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## The Effects of Music on Concentration

### Logan Rizzo<sup>9</sup>

This study covered the origins of music and discussed the various implementations of music into our everyday society. We still do not quite understand how one comes to have a preference for music, although through research we have made some really good estimates regarding how one chooses a favorite. Researchers have proposed the ideas that music preference is chosen based on context as well as overall mood of the listener, but suggest maybe there is a more in depth reason. Using the idea of musical preference, we have studied performance on a variety of tasks including, but not limited to; exercise, reaction time, and pain reduction. Music has been shown to improve the ability of athletes during exercise, decrease reaction time to unexpected stimuli, and nullify chronic and acute pain. Concentration during a task relies heavily on ones surroundings and the state of mind of the individual; and by listening to music, he/she will be able to overcome numerous obstacles.

The earliest estimated incidence of music is dated back at least 35,000 years ago, and since then we still do not understand it completely (Schafer & Sedlmeier, 2010). What is it about music that captures our deepest emotions? Around 500 B.C., Pythagoras searched for an answer to this. His conclusion was that human variance of musical appreciation is related to the number of chords produced (as cited in Schafer & Sedlmeier, 2010). Many attempts have been made in regards to figuring out the connection between music and preference; however, many of these attempts have been made without evidence. Two theories stand as to why we prefer one type of music over another. LeBlanc stated that music is based on character and input of chords and harmonics and Hargreaves claimed that preference is based on context and mood of the listener (LeBlanc as cited in Schafer & Sedlmeier, 2010). Music has been sought after for many different

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reasons varying from pain relief, increased reaction time, relaxation methods, as well as increasing performance in sports and exercise.

Audioanalgesia is the term that has been used to describe the practice of music in pain relief. Perlini and Viita (1996) did a study in which they purposefully caused pain in participants and informed them that they would be listening to music to see if it relieved their pain. The participants were introduced to a variety of songs and were told to select one in particular based on its name under the assumption that this song would be what they listened to. In some scenarios, participants got to listen to the song they selected; while in others, the researchers avoided the selected song and played something completely different (Perlini & Viita, 1996). The results showed that when the requested music was played, participants experienced a less intense pain than those who received a different song than what they had originally requested (Perlini & Viita, 1996). Not only during administration of the music was this effect noted; during a brief interview, some participants that were expecting their requested song reported less pain than their counterparts who anticipated they were going to receive something different. Perlini and Viita (1996) were convinced the reasoning behind this was linear; the expectancy of preferred music led to feelings of control in the situation, and in turn these feelings of control led to an altered perception of anticipated pain. If music altered our perception of a situation, perhaps it also plays a similar role in a variety of other fields.

Hirokawa (2004) performed a similar study to that of Perlini and Viita (1996) but rather than inflicting pain on his participants, he questioned older adults on their arousal and requested they read a passage and recall a few words. Prior to the readings, he had the participant fill out an Activation-Deactivation Adjective Check List, or AD ACL, which determined their tiredness level, calmness level, and tension level. After the participants completed the check list, they were

exposed to one of three conditions: a) silence b) preferred music or c) an audio relaxation recording (Hirokawa, 2004). Following each trial, another AD ACL was filled out to determine their tiredness, calmness, and tension post-trial. In regards to calmness, music was the only one to decrease following the experiment; tension was reduced the most following silence, and reduced the least when listening to relaxation recording (Hirokawa, 2004). In regards to tiredness, Hirokawa's (2004) results showed that silence made the participant more tired than any other trial. Relaxation recordings were slightly below silence in degree of tiredness, whereas with music there was little to no increase in tiredness levels. People often listen to music when driving if they are tired, but it has always been unclear why.

In a study done by Turner, Fernandez, and Nelson (1996), music volume was matched up with reaction time to determine if music inhibited people's response time. There was a control based on the participant's most comfortable volume and this varied for each participant. There were then two trial conditions that were a) plus or minus 10 decibels (dBA) of the control volume and b) silence. They found the average comfort level of the participants was around 70 dBA, and coincidentally this was the optimal level for reaction time while increasing or decreasing the volume increased the time it took to react (Turner et al., 1996).

This can be explained by the cue-utilization theory which we can relate to driving. While listening at a low volume we can pick up on all the sounds surrounding us, relevant and irrelevant (e.g., sirens, or animals). As the volume increases, we are less likely to hear the quieter sounds (animals) and only pick up on the more relevant ones (sirens). However, if the volume is too high then we tend to miss some of the relevant information all together (sirens), and therefore we are more likely to react slowly to these objects when they appear in our visual field (Easterbrook as cited in Turner et al., 1996). Reaction time is heavily based on focus, but one has

to wonder how music plays a role when focusing on something requiring physical exertion as well.

When someone goes to the gym, it is not uncommon to see him/her with a pair of headphones in. Is this actually helping his/her performance, or is it just a means of tuning everything else out, or both? Karageorghis and Terry (1997) concluded that it depends on the type of exercise involved. If the exercises were “submaximal,” or considered a routine exercise, then listening to music actually diverts your attention from your muscles and diminishes the feelings of fatigue. However, if the exercises were considered “extensive” (i.e., heavier weights, faster speeds, longer times) then there is no way for your body to divert its attention to anything but your muscles, and therefore has no effect on feelings of fatigue (Karageorghis & Terry, 1997). During the experiment, Karageorghis and Terry (1997) tested the effects of different types of music and found that slower types and even faster modern rock significantly lowered the participants’ heart rate and allowed them to perform better.

The present study was designed to see if a participant’s preferred type of music increases their performance on a concentration task more than the relaxing, slow/classical type of music.

## **Method**

### **Participants**

Participants were recruited using the Lindenwood University Participant Pool (LPP), a department of the University that allows Lindenwood students to participate in student experiments. There were a total of 19 participants, and 3 of those had to be discarded due to being hard of hearing (N=16). A majority of the participants were male, accounting for 68.75% of the participants. Out of the 16 remaining participants, 3 were familiar with, or have played the game *Fall Down* in the past. On a scale of 1 to 10, participants were asked whether or not they

listened to music while studying; I concluded that answers at or above five would be considered a “yes,” and below a five considered a “no.” Using this system, 9 out of 16 participants used music while concentrating; however, I found it interesting that 6 out of those initial 9 found background noises distracting greater than 50% of the time. When asked their favorite type of music 25% preferred Rock, 18.75% preferred Country, 12.5% preferred Classical, and 43.75% preferred Other. Participants were given bonus points through the LPP as compensation for participating in the study.

### **Materials**

The setting for this experiment was any quiet room with minimal distracters (no TVs, no other people aside from myself and the participant, and no loud noises) on the Lindenwood campus. Specifically, I used a room with two chairs, and one desk to comfortably sit myself and my participants on the first floor of Young Hall on Lindenwood’s campus. The participants were given a Sony Vaio laptop with the game *Fall Down* (Hit Free Games, 2013) installed onto it, as well as a pair of *Razer* noise cancelling, over-the-ear headphones to ensure no other noises were being heard. The Classical, Rock, and Country songs used in this study were: *The Marriage of Figaro* by Mozart (Mozart, 1786), *The Dirt Whispered* by Rise Against (McIlrath, 2008), and *Tennessee Flat Top Box* by Johnny Cash (Cash, 1964) respectively. These particular songs were used for their highly different musical qualities and a relatively similar length. Another deciding factor for these songs was that I was able to find instrumental versions, which meant that I could exclude lyrics as a factor.

### **Procedure**

*Fall Down* is a game that is played on a computer by guiding a falling ball through a series of holes in the ground without allowing the ball to be pressed to the top of the screen (Hit

Free Games, 2013). Ideally, I wanted to find something that didn't require much skill, and one that specifically required concentration. The idea here is that the more you concentrate (potentiated by music), the better your performance will be in the game. In my search, I identified this particular game to be a good tool for this experiment. Particularly because *Fall Down* already has a standardized scoring system which provides reliable measurements and is based solely on concentration rather than skill (Hit Free Games, 2013). Utilizing the data collected, there was no significant correlation between familiarity and general scores, all values were at least  $p > 0.300$ .

Participants were given two copies of the informed consent (see Appendix A) and a copy of the demographic questionnaire (see Appendix B). The questionnaire asked participants to rank the different music styles (classical, rock, country, or none) in order of their personal preference. The experiment consisted of four trials, a control, and three experimental trials. Since this experiment was designed to look at the effects of different types of music on concentration and reactions I had to create a control to determine baseline performance. In the control condition, participants were exposed to no music at all, categorized as "other." In order to assure that the participants did not get distracted by external sounds, they were given noise cancelling headphones to drown out any background noises. The three experimental conditions involved exposing participants to classical, country, and rock – considered to be very different genres – music while playing the game *Fall Down*. Different genres of music vary on their tempo as well as content. Since lyrics were removed, these were categorized based on tempo; rock having the fastest tempo, country having moderate tempo, and classical having the slowest. Prior to the participants starting the game, they were introduced to each song in order to familiarize themselves with it so as to reduce any further distractions throughout the study.

Following the introduction of the songs, participants started to play the game. In an attempt to reduce the effect of order, I counterbalanced the conditions by alternating genre preferences with play order. For example, if the participant's favorite genre was country, only the country order was affected while the other three genres remained in their respective order. I created four orders for playing the songs, each of which changed positions based on the participant's first preference. Each category cycled through these four play orders independently of one another. After the participants played a game under one of the conditions, their scores were recorded. This process was repeated for all the remaining conditions. Following completion of the four conditions, the participants were given a feedback letter (see Appendix C) and asked if they had any questions in regards to the study, access to the study, or the process in general.

### **Results**

My primary hypothesis stated that when a person played the game with their most preferred type of music, than his/her score would be greatest following the preferred condition. Using my data I performed a repeated measures Analysis of Variance (ANOVA) and tested for significance. The results did not reveal a statistically significant main effect of music,  $F(3,45) = 0.102$ ,  $p = 0.942$ . My secondary hypothesis claimed that if the first music preference fails to produce greater results, then Classical music will be the leading producer for results due to its innate relaxing qualities. Using the same group of participants, but a separate category for data, I ran another ANOVA; the results were very similar to my first hypothesis where my F value was calculated at 0.169, and  $p > 0.05$  ( $p = 0.905$ ). I failed to reject the null hypothesis on both my hypotheses.



### Discussion

I found that there was no statistical correlation between preference order, and performance on a concentration task. I also found that there was no statistical correlation showing that Classical music produced better results than any other genre of music. However, I did find a measurable difference among the raw scores of the Classical category that indicated that it produced higher overall scores. Since I failed to reject the null hypothesis, I came to the conclusion that it is because the participant was too distracted by the music. If I hear my favorite song on the radio, I immediately focus in on the song, rather than the task at hand. Perhaps, this was the reason for the mixed results, and the same reason that the third preference actually had the highest average of the four conditions. If a song playing is one that is not preferred then perhaps one is more likely to ignore it and put their attention elsewhere.

In the future this study could be improved upon by granting a wider range of musical preferences. For example, rather than supplying an alternative music preference for the “other” category, I chose to use it as my control and not use any form of music. Considering that 43.75% of my participants rated “other” as their favorite preference, I may have found evidence supporting my hypothesis had I provided a corresponding type of music. I also feel that a greater sample size would have produced better results, particularly because during my study I noted that some people followed their music preference exactly. By this I mean that some people’s scores on the game correlated exactly with their music preference (i.e., their first preference equated to the highest score and their last preference equated to their lowest score). If I had a larger sample size perhaps these findings would have been more representative and produced significance in my data. Another alternative for studying the effects of music preference on concentration would be finding a different task as means of concentrating. I say this because

there were times during the study where the game play was slowed by the internet connection and could have potentially decreased the participant's scores.

If I were to do this experiment again, I would choose a game that is stored directly to the computer and does not require an internet connection. The game *Snake* requires no internet connection, has a standardized scale, and requires minimal skill. This would make a suitable alternative because there could be no interruption and the only object that moves is the object you are controlling. Another alternative would be the board game *Operation* because there is no external factors that play into this game (e.g., internet connection, unfamiliarity with the computer). However, using this method I would have to use a different standard of measurement, and time would replace overall score.

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Appendix A  
Informed Consent

**INFORMED CONSENT FOR PARTICIPATION IN RESEARCH ACTIVITIES**

The Effects of Music on Concentration

Principal Investigator: Logan Rizzo

Participant \_\_\_\_\_ Contact info \_\_\_\_\_

You are invited to participate in a research study conducted by Logan Rizzo under the guidance of Dr. Michiko Nohara-LeClair. The purpose of this research is to determine whether listening to a certain type of music (i.e., rock, country, and classical) has any effect on performance while playing a game. Your participation will involve a) filling out a brief survey regarding music preferences and concentration practices and b) playing multiple games of "Fall Down" while listening to three different types of music and one with no music; *The Marriage of Figaro* by Mozart (classical), the instrumentals of *The Dirt Whispered* by Rise Against (rock), and the instrumentals to *Tennessee Flat Top Box* by Johnny Cash (country). This study should take approximately 15 – 20 minutes of your time. Your participation in this study is strictly voluntary. The information necessary in order to receive your extra credit will be given to you upon completion of or withdrawal from the study. There are no anticipated risks associated with this research and there are no direct benefits for you participation. However, your participation will contribute to the knowledge about the effects of music on our concentration skills and may help society as a whole. Your participation is voluntary and you may choose not to participate in this research study or to withdraw your consent at any time. You may choose not to answer any questions that you do not want to answer. You will NOT be penalized in any way should you choose not to participate or to withdraw. As part of this effort, your identity will not be revealed in any publication or presentation that may result from this study and the information collected will remain in the possession of the investigator in a safe location until the end of the study at which point it will be destroyed. If you have any questions or concerns regarding this study, or if any problems arise, you may call the XXX or the Supervising Faculty, Dr. Michiko Nohara-LeClair at 636-949-4371. You may also ask questions of or state concerns regarding your participation to the Lindenwood Institutional Review Board (IRB) through contacting Dr. Jann Weitzel, Vice President for Academic Affairs at 636-949-4846.

**I have read this consent form and have been given the opportunity to ask questions. I will also be given a copy of this consent form for my records. I consent to my participation in the research described above.**

I wish to receive the final results via e-mail at the e-mail address indicated above.

\_\_\_\_\_  
Participant's Signature                      Date

\_\_\_\_\_  
Participant's Printed Name

\_\_\_\_\_  
Signature of Principal Investigator    Date

\_\_\_\_\_  
Investigator Printed Name

Appendix B  
Questionnaire/Demographic Survey  
Music and Concentration Questionnaire

1) Gender:

Male     Female     Prefer not to share

2) Please rate the following types of music in order of favorite (1) to least favorite (4).

Rock     Country     Classical     Other

3) How often do you listen to music while trying to concentrate? (1 = never, 10 = all the time)

1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 ---- 8 ---- 9 ---- 10

4) Is there a certain type of music that you primarily listen to while trying to concentrate? If you said "never" to the previous question, skip and go to Question 5.

Yes, \_\_\_\_\_ (please list type of music)  
 No.

5) How much do background noises distract you? (1 = not at all, 10 = always)

1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 ---- 8 ---- 9 ---- 10

6) How familiar are you with the game *Fall Down*? (1 = not at all, 10 = very familiar)

1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 ---- 8 ---- 9 ---- 10

7) Are you, or would you consider yourself hard of hearing?

Yes  
 No.

**Scores:**            **Rock**            **Classical**            **None**            **Country**

Appendix C  
Feedback Letter

Thank you for your participation in my study. The study was designed to test whether a person's favorite type of music would yield the best results during a concentration task. My prediction here was that if a person's favorite type of music was Rock, then their score during the Rock condition of the experiment would be highest. If the findings support my hypothesis perhaps we can apply the study to our personal lives and better our concentration at home, school, or even work. If you have any questions or concerns following the research, please feel free to contact me at 636.627.9114 or LPR428@gmail.com.

Thank you!

Logan Rizzo