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Video Game Music and Task Performance: Experiment and Review

Whitley Harrel

Video Game Music and Task Performance

Experiment and review

By
Whitley Harrel

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Dr. Brent King,
Thesis Advisor

Dr. Gavin Keulks,
Honors Program Director

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I would like to thank my friends, family, and advisor for their support during this project

Table of Contents

Abstract

This study was an examination of the impact video game music may have had on the performance of a difficult cognitive task. Participants listened to music selected from the video game "Legend of Zelda: Twilight Princess" while simultaneously playing the 2-back version of the N-back test. Participants were split into four groups, video game player listening to battle music, video game player and town music, non-player and boss music, and non-player and town music. The task was administered on a computer and results were measured by percent correct. Scores were analyzed with a two by two ANOVA with no significant difference found. This leads to the conclusion that video game music does not have an impact on the performance of a mentally difficult task.

Keywords: Video games, video game music, n-back test, task performance, cognitive task, memory

Video Game Music and Task Performance: Experiment

Introduction

The video game industry has rapidly expanded since its birth in the 1970's. More and more people are gaining access to these games every day, and as the industry grows, the interest in video game research grows as well. A substantial amount of research has been performed in the interest of video games and violence (DeCamp & Ferguson, 2017; Denson et al., 2020; Scott, 1995). The current study is an exploration of one of the unique features of video games, the music. Throughout any one game there will be many different pieces of music for the many different situations a player may encounter. At a simplified level, there are a few different types of music: battle, overworld, dungeon, and safe zone (Aska, 2017). This study will be comparing battle music and safe zone music because in gameplay the player is completing opposite actions. Battle music plays every time you engage in battle with an enemy, the music tends to be fast paced, inharmonious, and feature heavy drum lines to build tension (Grimshaw, 2011). Safe zone music plays in areas where it is not possible for the player to be attacked by enemies, the music tends to be a slower "walking" pace, with folk-like melodies to create a lighter mood (Aska, 2017).

The history of video games themselves has a significant impact on how the music sounds today. The constraints of early video game console technology determined the way the music sounded and players became used to and came to

expect the music of video games to sound a certain way (Collins, 2008; Aska, 2017). In early video game history, the music was simple sets of looping beeps but many modern video games are fully orchestrated (Collins, 2008). The music of modern games is usually developed by a professional music composer. The music selected for use in this study was composed, in part, by Kōji Kondō. Kōji Kondō is the composer for the original "Super Mario Bros." game. His music established many of the conventions of video game music (Belinkie, 1999). Music in a video game helps the player understand the space that they are in and the task in that space (Grimshaw, 2011). Video game music sounds the way it does because of early console constraints in technology and because players expect it to sound a certain way. The next component of video game music to be studied should be how this specific music can affect people. This study will explore that question by having participants, both video game players and non-video game players, complete a task while listening to battle music or safe zone music.

Human's responses and relationships with music has always been a popular area of study. It is well documented that music affects us, though the effects vary. One study found that business students calculating stock prices performed better while listening to fast-paced music rather than slow-paced or no music, they produced a higher quantity of calculations with the same quality as the other groups (Mayfield & Moss, 1989). In another study on a simple motor task of tracing lines, subjects performed more quickly in the fast-paced music

condition than in the slow, but metronome tones of the same tempo had no effect (Nittono, Tsuda, Akai, & Nakajima, 2000). Bonin and Smilek (2016) had participants complete a 2-back task, a cognitively challenging task, while listening to either harmonic music, inharmonic music, or no music. Those in the inharmonic group performed worse than the other two groups, leading the researchers to come to the conclusion that inharmonic music requires more brain power to process (Bonin, & Smilek, 2016). It has been shown that in an auditorily distracting environment music helps children with maintaining focus (Wolfe & Noguchi, 2009). The above studies show how the different components of music can impact our performance on a variety of tasks. Music, depending on its qualities, can help us focus, perform faster, and perform better.

A few studies have been performed in the specific area of video game music. One study has found that subjects playing a video game with the music turned on had a higher stress response as measured by cortisol levels in the saliva, compared to the group playing in silence (Hébert, Béland, Dionne-Fournelle, Crête, & Lupie, 2005). In another study, subjects playing in the music condition, rather than the silence condition, reported that they enjoyed the game more (Klimmt et al., 2018). These studies support that video game music has a physiological and subjective effect on players, but objective impact is still unexplored.

Past studies have results that indicate music can affect performance on tasks and that video game music has an impact on players. The current study will explore the impact video game music has on the task performance of people who regularly play video games versus people who do not play video games. Boss battle music will play in one condition and town music will play in the other because they represent two of the basic types of video game music, battle and safe zone. Participants will be playing a working memory game called the 2-back. This activity should be neutrally difficult for both video game players and non-players.

Methods

Participants

Twenty-nine participants took part in this study. All participants were Western Oregon University students recruited through SONA. Because the experiment required both listening to music and selecting images on a computer screen, people with uncorrected hearing or sight were excluded in the selection process. All participants were over the age of eighteen.

Materials

Before the study began, participants were given an informed consent form, this can be found in Appendix A. The music played was either "Ganondorf Battle Second Half" or "Zora's Domain". Both of these pieces are from a video

game called *Legend of Zelda: Twilight Princess* and were composed by Toru Minegishi, Asuka Ohta, and Kōji Kondō. The game is for the Gamecube, Wii, and Wii U Nintendo systems. This music was selected for a few reasons. Nintendo has a large place in shaping video game music both in the past and today (Belinkie, 1999). *Legend of Zelda: Twilight Princess* is the second-best-selling game in the "Legend of Zelda" series with 8.48 million copies sold worldwide (Nunneley, 2018). It also received the award for "Best Original Soundtrack" from IGN Entertainment in 2006 during its original Gamecube release (IGN Entertainment, 2007). The music was played on an iPhone seven off of YouTube at ¾ volume. The N-back test was played online on the website "cognitivefun.net", the 2-back version was used.

Procedure

This study was experimental. The independent variables were which music piece was playing and video game experience, the dependent variable was the percent correct on the N-back test. As each participant entered the research room, they were greeted and asked to sit down. They were given one informed consent form to sign and one copy for them to keep, the researcher also verbally gave the information on the form, (the informed consent form and script can be found in appendix A and B). After the participant had read and signed the form they were asked to move in front of the computer, it was open on the n-back test game. They were instructed to use the mouse to select the "Click here for

demonstration button" and complete the interactive demonstration. They were allowed to ask any questions about how to play throughout the slideshow. After confirming that the participant felt they understood how to play they were then instructed to start the test when the researcher instructed them to. The participant was also told that music will be played while they are being tested but they were not told which music was going to be played. The piece that was played was determined by a coin flip for the first participant, for each participant thereafter the opposite piece was played. The researcher started the music then told the participant to start. The participant played for two minutes and then was asked to stop. The researcher then recorded the percent correct (calculated by the website) and asked the participant if they self-identify as a video game player, with the exclusion of mobile phone games. The participant was allowed to know their score if they would like, were debriefed, and allowed to ask any follow up questions.

Results

A two by two ANOVA was computed to examine the relationships between video game music track and video game experience on performance of a task. The mean was calculated for each group: video game player and boss battle music M=61.63(SD=17.29), video game player and town music M=50.67(SD=15.65), non-player and boss music M=53.85(SD=25.70), and non-

player and town music *M*=50.55(*SD*=20.57). No significance was found between any of the groups (video game experience*results, music*results, video game experience*music*results). The F test for participant video game experience was F(1,25).238, p=.630. The F test for music was F(1,25).774, p=.387. The F test for the interaction between video game experience and music was F(1,25)0.223, p=.643. A graph of the results can be found in appendix C.

Conclusion

Based on the results of this study video game music does not have an effect on task performance, no matter your experience with video games, though the results of this study may have been affected by many things. There was a small sample size of only twenty-nine. To be able to rely on the results of a study set up in the way this one was there would need to be at least twenty people in each group, in this study there were less than ten. With a small participant number the difference between groups must be very large to show significance. Because of the small sample size all participant scores were included during statistical analysis, including outliers and a few who completed the study in a noise polluted environment which may have affected their concentration, on both the task and the music. Raw data can be found in appendix D.

The 2-back test was chosen as the task because it was thought to be neutrally difficult for both video game players and non-players. All participants

were given the same instructions and a chance to ask questions, but many started the game with less understanding than others because of the difficulty of the game. This may have affected their score outside of any impact the music may have made. If this study were to be redesigned a simpler task may lead to more accurate results.

Interestingly, though there was no significant difference, there was a visual difference in the graph of scores. All groups scored around the same on average except for the video game player and boss music group, which scored about ten percent better than all other groups. This could indicate a trend and does reflect earlier research findings in calculations (Mayfield & Moss, 1989). If this is reflective of a trend it might mean that those who play video games have been conditioned to respond a certain way to boss battle music. Battle music may be able to positively impact concentration on tasks unrelated to video games for those who are video game players. The low sample size of the current study may have hampered the ability to examine the possible trends.

In the future this research would be vastly improved by a higher number of participants and an easier task. Although this study concluded that video game music and gaming history does not have an effect on task performance it is important that research in this area continues.

Reflection

Introduction

This section is a reflection of what it was like to do research as a student at Western Oregon University between 2018 to 2020.

Institutional Review Board

An important part of working on this project was submitting it to the Institutional Review Board (IRB). Every institute that performs research has an IRB. It is their job to check all research proposals and make sure they are ethical. On Western Oregon's IRB there are five members who are part of the college of liberal arts and sciences, five members of the college of education, one member of the research institute, and four members of the community. Before I could submit my proposal, I completed research ethics training through the Citi Program, this is the contracted provider for all researcher training at Western Oregon University. My certificate of completion can be found in appendix D. My study fit under exemption and so it was reviewed not by the full board, but rather only a portion of it. Because I needed to pass the IRB, I spent time carefully considering both the method and the wording of the informed consent document. Both of those things are important for the participants safety and understanding of the study. Additionally, I developed an IRB approved script for participants, so that they all received the same information.

Research Participation System

Here at Western Oregon University, if you are performing research as a student, participants are recruited through a research participation system. The system WOU uses is called Sona. The use of a research participation system has a profound effect on the participant pool. To begin research first you must set up your study on Sona. I titled the study, added a description, added participant disqualifications (under 18, uncorrected sight or hearing), and listed the time and location of the participation slots. It took participants about fifteen minutes to complete my study, so they were awarded one credit within the system. Participants were limited to those who are students at WOU and only to students who were currently taking psychology classes. At the time of my active gathering of data, psychology students in courses 201 and 202 were assigned to earn SONA credits or complete an alternative research-based assignment. For the other psychology courses, it was up to the professor to decide if Sona participation was assigned, worth extra credit, or not a part of the class. The decisions made around who receives Sona accounts, and therefore who can be a participant, are made by the WOU Psychology Department.

I was not the only person attempting a research study at the time. There are many other student and professor research projects happening at all times of the year. My project had to vie for the attention of a limited number of participants. Anecdotally, students informed me that they also look for the

quickest and easiest to complete studies. While in conversation with other researchers it was easy to tell that research projects that could be completed online attract the most participants. If a study could not be completed online then it was required for student researchers to gather data in study rooms in the Hamersley Library. I attempted to select research times when participants would likely be available, however I had to work around both my school schedule and work schedule. Also, SONA alphabetized the list of studies by the title of the studies. Researchers have discovered this and in conversation, made it clear that they were manipulating their titles to show early in the list. All of these conditions resulted in the smaller than ideal and limited sample of the Western Oregon University population that was represented in my study. The research participation system allowed me to gather participants in an ethical way, but it also had a large influence on the size and demographics of my study.

COVID-19

The COVID-19 outbreak had a significant impact on my study. In response to the outbreak, Governor Kate Brown ordered all Oregonians to stay home as much as possible, closing many businesses, workplaces, and schools (VanderHart, 2020). On March 19, 2020, Western Oregon University officially announced that spring term would be offered completely remotely with most offices being closed around campus (Fuller, 2020). This meant that I was no longer able to gather research in the way that I had designed my method. If I

were to change the way I gathered research that would have impacted any data gathered. Also, if I had decided to make any change to my method, I would need to file a change request to the IRB. I already had an issue where some of the participants were tested in different environments, a few participants' data was gathered in a classroom rather than a study room. To change the way in which the research is gathered would have a large enough impact that the data would be invalid, which is in addition to the low number of participants, would have seriously undermined the core of the research project and the work that had already been completed. This led me to the decision to cease the recruitment of participants for the study.

Conclusion

The place and time at which my study was conducted had a large impact on the results of the study. In an ideal situation I would have a much larger sample size and devise a way to complete the experiment online. This would give my study a longer reach and a more reliable outcome; allowing me to have an impact in the growing field of video game research.

Appendix A

Informed Consent

Western Oregon University and the Department of Psychology support the practice of protecting research participants' rights. Accordingly, this project was reviewed and approved by a WOU faculty member and Institutional Review Board. The information in this consent form is provided so that you can decide whether you wish to participate in our study. It is important that you understand that your participation is considered voluntary. This means that even if you agree to participate you are free to withdraw from the study at any time, without penalty.

This study is an investigation on the effect that video game music has on the performance of a task. For this study you will be asked to listen to a piece of music and play a memory game on the computer. The test is to see how correctly you can complete a difficult task while listening to the music.

This study poses no known risks to your health and your name will not be associated with the findings. For participation in this research project, you will receive extra credit through SONA. Upon completion of your participation in this session, you will be provided with a brief explanation of the questions this study addresses. All data will be collected in a password protected computer. Data will be presented in aggregate form if the study becomes published or presented in public forum. If you have any questions not addressed by this consent form, please do not hesitate to ask. You will receive a copy of this form, which you should keep for your records. We thank you for your time and effort.

Investigator 1: Whitley Harrel, email: wharrel16@mail.wou.edu

Faculty Advisor: Brent King, Ph.D.
kingb@wou.edu
503.838.9262

IRB contact information: irb@mail.wou.edu
503.838.9200

CONSENT STATEMENT:

I have read the above comments and agree to participate in this experiment. I understand that if I have any questions or concerns regarding this project I can contact the the primary investigator Whitley Harrel, advising faculty Dr. King, or the IRB directly.

Please sign your full name and date this document if you agree to participate in this study:

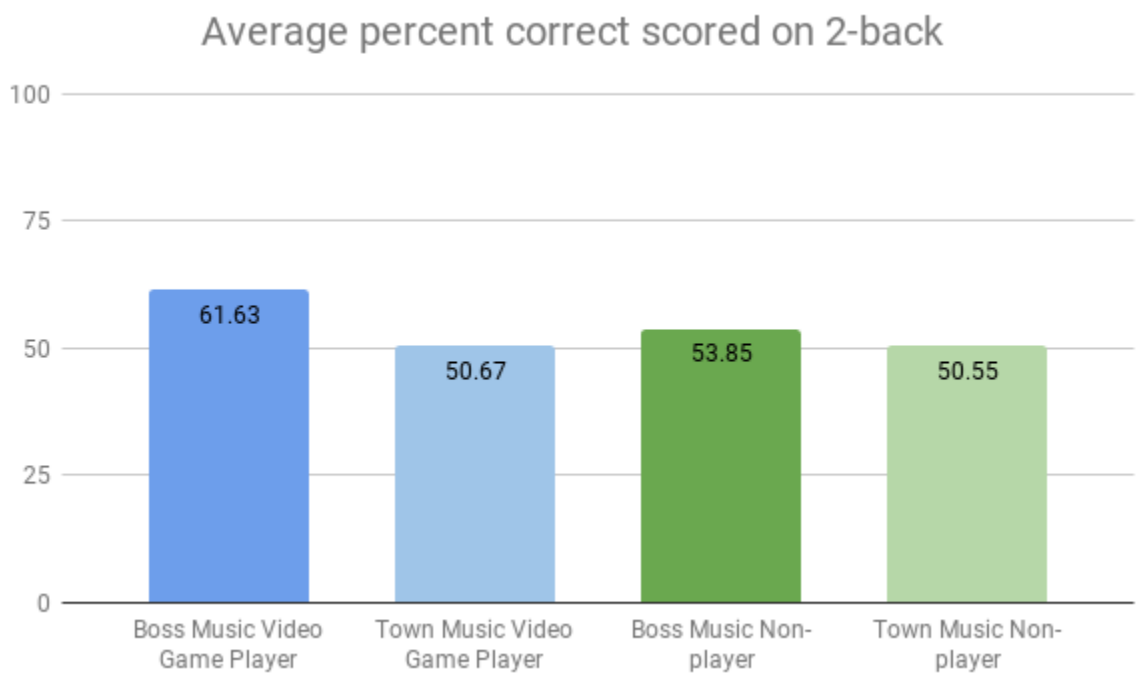
_____

Appendix B

Script begins after participant takes their seat:

Hello, thank you for participating in my study today. Here is the informed consent form, one for you to sign for my records and one for your records as well. It has my information if you would like a follow up on the study. It also contains my advisor's information, you may contact him if you feel I have acted inappropriate in any way or have any other concerns. Please take the time to read through it before signing but I will also give you the information now. In this study you will be listening to music and playing a memory game. This study has been reviewed and passed by the Institutional Review Board and it will not cause you harm. But your participation is voluntary and if you wish to stop at any time you can. You will still receive Sona credit even if you do not complete the study.

Appendix C


Average percent correct scored on 2-back
100
75
50
25
0
61.63
50.67
53.85
50.55
Boss Music Video Game Player
Town Music Video Game Player
Boss Music Non-player
Town Music Non-player

Appendix D

Video Game		Control	
Boss	Town	Boss	Town
51.61	33.33	58.62	15
90	43.48	26.92	20
51.61	44.78	6.9	67.65
48.15	57.89	76.92	54.17
62.5	73.91	66.67	71.43
72.73		73.33	43.75
		76	67.86
		30.56	59.09
		68.75	56

Appendix E

Completion Date 06-Feb-2019
Expiration Date 05-Feb-2022
Record ID 30393514

This is to certify that:

Whitley Harrel

Has completed the following CITI Program course:

Not valid for renewal of certification through CME. Do not use for TransCelerate mutual recognition (see Completion Report).

Group 1: All WOU Researchers (Curriculum Group)
Group 1: All WOU Researchers (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Western Oregon University

Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w69dacb5d-858a-4624-bfc5-aa1f18841714-30393514

Bibliography

Aska, A. (2017). *Introduction to the study of video game music*. Lulu.

Belinkie, M. (1999). Video game music: not just kid stuff. Retrieved from https://www.vgmusic.com/information/vgpaper.html

Bonin, T., & Smilek, D. (2016). Inharmonic music elicits more negative affect and interferes more with a concurrent cognitive task than does harmonic music. *Attention, Perception, & Psychophysics*, *78*(3), 946–959.

Collins, K. (2008). *Game sound an introduction to the history, and practice of video game music and sound design*. Cambridge: MIT Press

DeCamp, W., & Ferguson, C. J. (2017). The impact of degree of exposure to violent video games, family background, and other factors on youth violence. *Journal of Youth and Adolescence*, *46*(2), 388–400.

Denson, T. F., Dixson, B. J. W., Tibubos, A. N., Zhang, E., Harmon-Jones, E., & Kasumovic, M. M. (2020). Violent video game play, gender, and trait aggression influence subjective fighting ability, perceptions of men's toughness, and anger facial recognition. Computers in Human Behavior, 104.

Fuller, R. (2020). Coronavirus: WOU Homepage. Retrieved from https://wou.edu/coronavirus/

Grimshaw, M. (2011). *Game sound technology and player interaction: concepts and developments*. Hershey, PA: Information Science Reference.

Hébert, S., Béland, R., Dionne-Fournelle, O., Crête, M., & Lupien, S. J. (2005). Physiological stress response to video-game playing: The contribution of built-in music. *Life Sciences*, *76*(20), 2371–2380.

IGN Entertainment. (2007). Best of 2006. Retrieved from https://web.archive.org/web/20070110101449/http://bestof.ign.com/2006/cube/23.html

Klimmt, C., Possler, D., May, N., Auge, H., Wanjek, L., & Wolf, A.-L. (2018). Effects of soundtrack music on the video game experience. *Media Psychology*.

Mayfield, C., & Moss, S. (1989). Effect of music tempo on task performance. Psychological Reports, 65(3, Pt 2), 1283–1290

Nittono, H., Tsuda, A., Akai, S., & Nakajima, Y. (2000). Tempo of background sound and performance speed. *Perceptual and Motor Skills*, *90*(3,Pt2), 1122.

Nunneley, S. (2018). Switch sales are over 17M units, Breath of the Wild best-selling Zelda title. Retrieved from https://www.vg247.com/2018/04/26/switch-sales-over-17m-units-breath-of-the-wild/

Research Ethics and Compliance Training. (n.d.). Retrieved from https://about.citiprogram.org/en/homepage/

Scott, D. (1995). The effect of video games on feelings of aggression. *The Journal of Psychology: Interdisciplinary and Applied*, *129*(2), 121–132.

VanderHart, D. (2020) Gov. Kate Brown Issues Order Directing Oregonians To 'Stay Home'. Retrieved from ttps://www.opb.org/news/article/oregon-stay-at-home-order-coronavirus-covid-19-kate-brown/

Wolfe, D. E., & Noguchi, L. K. (2009). The use of music with young children to improve sustained attention during a vigilance task in the presence of auditory distractions. *Journal of Music Therapy*, *46*(1), 69–82.