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The differentiated effects of lyrical and non-lyrical music on reading comprehension

Cameron Miller

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**THE DIFFERENTIATED EFFECTS OF LYRICAL AND NON-LYRICAL MUSIC
ON READING COMPREHENSION**

by
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A Thesis

Submitted to the
Department of Psychology
College of Science and Mathematics
In partial fulfillment of the requirement
For the degree of
Masters of Arts in School Psychology
at
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Thesis Chair: Roberta Dihoff, Ph.D.

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Abstract

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THE DIFFERENTIATED EFFECTS OF LYRICAL AND NON-LYRICAL MUSIC ON
READING COMPREHENSION

2013/14

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Master of Arts in School Psychology

The present study seeks to observe the effect of background music on reading comprehension, specifically searching for possible differences between effects brought on by different genres (i.e. classical and rock) and the presence of lyrics. Research on task performance in the presence of background sound is mixed, in part due to the large number of possible applications. An overview of existing research on this topic is presented, including articles on the relationship between music and cognitive ability, distractors and processing resources, and pre-existing studies on music and reading comprehension. University students participated in a randomized experiment, taking the Reading Comprehension portion of the Nelson Denny Reading Test in the presence of either (1) classical music with lyrics, (2) classical music without lyrics, (3) rock with lyrics, or (4) rock without lyrics. One-way analysis of variance revealed no significant main effect for both variables of genre and lyrics. A significant interaction was found between these two variables. Implications and possible explanations for these findings are discussed. Limitations of the present study and future improvements and directions are discussed.

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Chapter 1

Introduction

Students are constantly bombarded with information and stimuli in the age of new media. Never has it been so easy to read the news, watch videos, and listen to music, all without getting up from the computer. Students and teachers alike need to learn how to work and study efficiently and effectively despite constant distraction. Introductory research has begun to delve into the effect of background music on student's scholastic abilities, but it has yet to expand far enough to present practical applications. Some researchers have concluded that lyrical music is either distracting or cognitively impairing (Anderson & Fuller, 2010), but contradicting research implies that music assists in cognitive function such as reading comprehension in specific settings (Downing, Carlson, Hoffman, Gray, & Thompson, 2004). Since the next generation of learners will be acclimated and possibly dependent on constant stimulation, it is important to study the effects of music on scholastic ability. Research on this expansive topic will provide both students and teachers with further understanding of what helps or hinders individuals' ability to focus and retain information.

This line of research will move in the direction of determining how different types of background music impact students' scholastic ability. The specific focus of the current study is to test the impact of music with and without lyrics, and in the classical and rock genres on reading comprehension. I hypothesize that the control group without music would have different levels of comprehension than music groups, but the scores of the different music groups will also vary. I also hypothesize that lyrical music would have a greater negative impact on reading comprehension than non-lyrical music. Finally I

hypothesize that rock music would have a stronger negative impact on reading comprehension than classical music.

The present study will utilize the following operational definitions: the score a participant receives by completing 3 passages and 18 questions of the Nelson-Denny Reading Comprehension test will measure reading comprehension performance. Music selections will be defined by two different independent variables. There will be music selected in both genres of “rock” and “classical”, and there will be “lyrical” and “non-lyrical” versions of those songs, defined by the presence of lyrics in the song or lack thereof.

Limits apparent in the present study include a relatively small sample size, as the population used consists entirely of college students and therefore is not representative of the general education population. Additionally, a lack of sophisticated resources limits the study, as the sound system available for use may make standardization of music output difficult. It is assumed that participants used in this experiment are able to read at the level of an undergraduate student.

The present study aims to develop practical advice for students in our media saturated world, and comparing reading comprehension performance scores of different musical conditions will provide exploratory research for this specific goal. Using the Nelson-Denny reading test, reading comprehension scores will be measured across numerous musical conditions. In chapter two, a literature review will present previous research done and conclusions made regarding the effects of music on cognitive and scholastic ability.

Chapter 2

Literature Review

This review of related and relevant literature presents the dense body of research connecting music and scholastic ability. It addresses other tools used to assist teachers in the classroom, how music generally effects cognitive ability, the cognitive and neurological basis of distraction and processing resources, and the pre-existing literature addressing background music's affect on tasks including reading comprehension.

Music and Cognitive Ability

One of the most widely publicized connections between music and cognitive ability is that playing infants Mozart will make them smarter. While popular press fuels this cliché, the true “Mozart Effect” claims that classical music, specifically composed by Mozart, facilitates cognitive performance (Rauscher, Shaw, & Ky, 1993). Students taking an IQ test directly after listening to Mozart had significantly better scores than the previous day where they had taken it without the preceding music. While this study was relatively brief in comparison to related literature, it makes a very strong argument for the idea that music can be used to somehow benefit cognitive processes.

Research has built on the original concept of the Mozart Effect and the general idea that music impacts cognitive function. EEG readings of both classical and rock musicians first indicated cognitive changes during task performance for their specialized and preferred music genres, but also showed a universal and unique effect for classical music on the pre-attentive stage of processing (Caldwell & Riby, 2007). This study indicates a need for further understanding of the specific aspect of classical music that impacts the brain, and similar research should be focus on untrained musicians. One such

study tested the effect of Mozart on spatial and temporal reasoning tasks, with results that implied that listening to Mozart helps to activate task-related areas of the brain and shut down task-irrelevant parts of the brain (Jaušovec, Jaušovec, & Gerlič, 2006). This is in accordance with Rauscher et al.'s priming explanation for the Mozart Effect (1993).

Ransdell and Gilroy's research in the effect of background music on writing produced results showing a significant negative impact on students' ability to write when they entered the music portion of the experiment (2001). Each student wrote in a silent condition, a vocal music condition, and an instrumental music condition. Participants with higher writing span and those with musical training were found to maintain a higher level of quality than other students in the music portion. While the researchers did differentiate between vocal (lyrical) and instrumental (non-lyrical) music in their conditions, they simply reported that there was no difference in the results of the two categories and no statistical data was given. One potential methodological issue informs the direction of present and future research, and also could explain this lack of difference. This study openly informed participants about the intention to observe the effect of the background music, which has the potential to influence the amount of focus and awareness placed on said music, which could skew the results in general and homogenize the lyrical and instrumental conditions.

One possible hypothesis regarding a positive effect for background music on performance implies a heightened state positive mood response, which in turn positively affects productivity (Lesiuk, 2005). Research into industrial implications of background music dates back to Newman, Hunt, and Rhodes experiment (1966) manipulating the presence of music in a skateboard factory and monitoring productivity. While they were

unable to find any significant correlation between music and productivity, they did find an increase in worker satisfaction. In Lesiuk's 2005 quasi-experimental field study, the researchers looked at four software companies, where divergent thinking rather than repetitive labor was needed for the job, and implemented a schedule of music-allowed and music-disallowed periods over the span of five weeks. State positive affect of employees dropped after music was taken away, and rose throughout time for those new to music in the workplace. This implied a decrease in positive affect after this stimulus was removed, but also a learning curve for those first being introduced to the concept of being productive in the presence of music. Lesiuk concluded that music did have a significant positive impact on quality of work, though slight (2005). While discussing this result, she justified the small effect by citing the highly trained workers' ability to persevere, however the significance of the results require replication.

Focusing on the inherent mood of the music (i.e. "calming" music or "aggressive" music) instead of the mood response of the listeners, conclusions of one study indicate that relaxing music elicited increased productivity and memory scores, alongside more altruistic behavior, whereas the opposite was observed by those in the arousing and aggressive music category (Hallam, Price, & Katsarou, 2002). Working with a small number of children that produced surprisingly definitive results, these researchers leave many questions unanswered, but also show the augmentative potential influence that music could have as an influence on students.

Distractors and Processing Resources

Netherlands researchers Pool, Koolstra, and Van Der Voort (2000; 2003) focused on the issue of commonplace media distractions in the modern world and their effects on students' abilities to complete homework. Specifically focusing on television programs running in the background, their focus on background stimulus hindering academic based cognitive abilities mirrors that of the current study. Taking into account factors such as episode novelty and audio/visual influences, the researchers' findings indicate that background television interferes with students' performance and completion time. Interestingly, however, they observed a lack of distraction effect in the audio-only category and concluded that the combination of audio and video is necessary to distract. While the focus of their study was on television as a whole, it seems inadvisable to discount the sufficiency and impact of audio-only stimulus as a distractor given existing literature.

In related research, a similar team ran another very similar experiment, this time looking at the interaction between background media stimulus and homework difficulty (Pool, Van Der Voort, Beentjes, Koolstra, 2000). Homework performance was hindered by the presence of television in the background, especially in the difficulty homework scenario, but music videos had no such significant effect. While the researchers conclude that music videos are harmless at least on paper-and-pencil assignments, they miss an interesting potential variable. This Dutch study was done with students in the Netherlands and with Dutch television in the background. Alternately, the music videos were English. A lesser familiarity with the English language could decrease the potential for processing interference between the assigned task and the unattended background music and lyrics.

Lyrics are a part of the whole that makes up music, but when looked at separately they are processed to some extent individually (Besson, Faita, Peretz, Bonnel, Requin, 1998). Measuring the event-related potentials of musicians hearing semantically incongruous lyrics and/or out of tune harmonies, these researchers found evidence that on-line processing of the semantic and harmonic aspects of lyrical music are independent of one another. This separation encourages further investigation into lyric-based distractors. It is crucial for research to delve into the impact of unattended language, the role lyrics may take in the present study, upon cognitive performance. In an experiment that would influence many further studies in this field, Salame and Baddeley performed a set of experiments that required subjects to complete serial memory tasks (1982). The list to memorize was presented close to or simultaneously with words, nonsense, noise, or silence, and results indicated that unattended speech significantly disrupted immediate memory. Based on their different conditions, Salame and Baddeley's interpretation of the data suggests that the disruption effect did not have a semantic component, but rather it occurred due to the simultaneous and incompatible phonemic processing of both the list and the distractor. Salame and Baddeley continued to work in this field in hopes of solving whether or not unattended speech interferes with serial recall through perception or memory (1986). Issuing rhyme and homophone judgment tests to subjects in the presence of unattended speech, the researchers found that the background stimulus had no effect on the subjects' performance and concluded that it is not a perceptual issue. Further analysis on its impact on memory, and especially that beyond working memory, is required.

Continuing to use serial recall as a measure of cognitive performance, researchers investigated the involuntary divergence of attention by external stimuli (Lange, 2005). Distraction often is domain-specific, such that that an unrelated sound would negatively effect verbal processing more than spatial processing, and a changed visual cue would negatively effect spatial processing more than verbal processing (Lange, 2005). Researchers came to this conclusion while investigating a hypothesis based on Cowan's working memory model (2005; 2009), which creates different hierarchies that dictate the interplay of attention and memory. Predicting that distraction from an assigned memory task set would cause the items to lose their activation benefit and lead to memory impairment, Lange (2005) found not only disruption in standard serial recall tests but also in the spatial tests. Further study beyond serial recall and working memory are required for direct application to short and long term memory tasks.

Investigating age differences and Inhibition Deficit Theory, which states that as a person ages their inhibitory control over working memory decreases, researchers used prose and serial recall tasks to measure semantically related intrusion errors induced by irrelevant background speech (Bell, Buchner, Mund, 2008). Memory intrusions happened more frequently with older adults, aligning with Inhibition Deficit Theory. The most pertinent finding to the present study, however, was that background speech was found to be more intrusive than background speech presented in reverse. This finding implies that the aspect of background speech that is the detrimental to memory is its overlapping semantic processing, which is lost when incomprehensible backward speech is presented. This conclusion supports the findings of Oswald, Tremblay, and Jones (2000). In response to the large body of research in serial memory, these researchers attempted to

measure the impact of meaningful and meaningless irrelevant speech on comprehension. Finding that while both meaningful and meaningless background speech interfere with comprehension task performance, meaningful speech was significantly more impactful. Following the interference-by-content model (Jones & Tremblay, 2000), Oswald et al. (2000) conclude that the background meaningful speech must be semantically processed to some extent, limiting cognitive semantic capacity to process the semantic task at hand. These conclusions relate to predictions of the current study in that lyrics present in background music require semantic processing resources, which may limit those available for comprehension.

Sörqvist set up an experiment directly comparing the effect of background speech and general background sound, in this case aircraft noise, on prose memory (2010). Consistent with the hypothesis, speech was found to more negatively impact performance on the recall task. The author discusses briefly that the semanticity of background speech could be a key difference between the speech and the aircraft noise, referencing an interference-by-process view of auditory distraction, a perspective detailed and defended in Marsh, Hughes, and Jones studies (2008; 2009). Research by this team continues to highlight the idea that semantically processed auditory stimulus disrupts concurrent semantic memory tasks, but argues against previously mentioned interference-by-content models. These researchers conclude that the wealth of related research and their own results weighs in favor of the interference-by-process model, which states that the changing frequencies of auditory stimulus provide serial organizational information that interferes with the serial memory tasks, rather than the interference-by-content model that follows classical interference theory's disruption via passive structural similarity.

Continuing to look at specific group tendencies but moving past serial memory toward larger scale comprehension, researchers investigated the influence of gender on noise distraction and semantic memory (Boman, 2004). While noise distraction was found to impact young males and females similarly, relevant findings implied that irrelevant speech strongly and significantly impairs comprehension of novel text in episodic memory. One of this study's strengths is its focus on young subjects and its foray into longer-term memory, however it concludes that the results were not mediated by attention and fails to address possible other solutions such as lingual processing capacity.

In a unique interruption effect study using eye-tracking to monitor various aspects of reading progress, Cauchard, Cane, and Weger investigated distraction effects with silence, speech, and music each played in the background of a reading passage (2012). The researchers discuss how speech has been shown time and again to impair reading, but that the literature relating to background music has identified many more complicating variables and is inconclusive. While results showed significant impairment of reading time in during background speech, there was no observable effect for music. For reading comprehension, neither condition elicited a significant effect. The authors propose the lack of effect for music on comprehension is because of a ceiling effect, but another uninvestigated factor could be the lack of lyrics in the instrument-only music used. Concluding the interruption portion of their study, Cauchard et al. (2012) discuss reading comprehension and memory, suggesting that their results support Ericsson and Kintsch's Long-Term Working Memory model (1995), which states that processed reading information can be temporarily stored in and quickly accessed from long-term

memory. This framework would explain reading comprehension despite interruption-based disruption of short-term memory. Fully understanding the memory processes of reading comprehension, in addition to other scholastic skills, is crucial moving forward in understanding the connection between background music and academic ability.

Music and Reading Comprehension

Pre-existing investigation into the effect of music on reading comprehension has produced mixed conclusions. Anderson and Fuller (2010) measured reading comprehension of adolescents while listening to popular lyrical music and found it to definitively detract from their performance. While supporting the hypothesis that lyrics interfere with processing written word, this study fails to address the separate impacts of music's core ingredient, melodic sound, and the language that is frequently paired with it. Harmonic and lyrical processing have been found to be independent of each other (Besson, et al., 1998), and therefore looking at the effect of music on performance without lyrics has the potential for different results and application.

Peter Chou conducted a study in Taiwan seeking to investigate the impact of background music on concentration, given the widespread use of new music technologies by students (2010). Using slower classical music and hip-hop respectively in the two experimental groups, the results of reading comprehension tests showed that students' performance in the hip-hop condition was significantly lower. Chou claims that his results are directly related to and in support of the limited attention capacity theory of Kahneman's model of attention (1973). This theory proposes that concurrent cognitive activities compete for processing resources, and applied to this situation a limited mental capacity would therefore detract from performance. Looking through the lens of this

specific model is unique in this body of related research, but does little to identify what differentiates its method and results from other similar studies with different conclusions. Again, the effect of lyrics is left unattended, which especially seems to be a large error in this case since those in the hip-hop condition, which has lyrics, did perform worse than those in the classical condition, which had a combination of lyric and lyricless music.

Investigating individual predispositions to distraction in this area of research allows for a better understanding of how to guide each individual student. Individuals with low working memory capacity have been shown to be more negatively impacted by background speech and score lower on reading comprehension tests in the presence of such speech (Sörqvist, Halin, & Hygge, 2010). While the background speech inhibited the performance of all participants in this study, it was more dramatic for those with low working memory capacity and also a weaker immediate suppression mechanism, as determined by the Carretti, Cornoldi, and Pelegrina Number updating task (2007). This task highlights the immediate suppression mechanism by requiring memorization of only some presented numbers, whereas others must be suppressed; non-required number recall implies lower immediate suppression ability. Sörqvist, et al. determined that this task resembles that of the reading comprehension with background speech test (2010). Lyrics, processed semantically, would similarly interfere and interact with working memory capacity and the immediate suppression mechanism.

One perspective on individual traits that effect music's impact on comprehension pertains to Eysenck's theory that extraverts and introverts seek higher and lower levels of external stimulus respectively in order to maintain the personally optimum level of arousal (1967). This position has led researchers to investigate the impact of personality

as a variable in the interaction of music, an external stimulus, and performance. Recent research into the differential effects of background music and noise on introverts and extroverts indicated that both music and noise negatively impact performance of both groups in reading comprehension, prose recall, and arithmetic tasks, but more so for introverts (Furnham & Strbac, 2002). Furnham and Strbac's study impressively used unreleased music that would control for the effect of familiarity, but it only used "garage music" with lyrics, a generally more raucous and noisy type of music. Contradictory findings in research since the previously mentioned study failed to find significant effects between auditory interference or personality in cognitive performance, however it did find that extraverts performed better on creativity measures than introverts did in the presence of music (Chamoro-Premuzic, Swami, Terrado, & Furnham, 2009). While this study utilized a number of different genres, it failed to take this into account in the analysis, including reference to the potential impact of lyrical interference. Another finding that could account for extraverts' higher tolerance of background music is a significant positive correlation found between extraversion score and reports of listening to music while studying at home (Furnham, Trew, & Sneade, 1999).

Another related study focusing on the influence of extraversion soon after Chamoro-Premuzic et al.'s 2009 study used numerous different tests to conclude that in general, a silence condition led to the highest cognitive performance score, followed by music, and finally noise (Dobbs, Furnham, & McClelland, 2011). They found that extraversion had little to no effect on scores in the silence condition, and a significant positive effect in a noise condition. A music condition led to less of a clear-cut conclusion. IQ was also found to have a correlation with the other tests, and was

controlled for. In their discussion, Dobbs et al. (2011) make apt generalizations regarding this focus of researching, pointing out that there are a wide range of factors that impact cognitive ability in the presence of background music such as musical environment, psychological factors, sociological factors, the nature of the task, and the nature of the distraction. Given this large number of variables, each study has loose ends and confounding variables that can be argued. Such variable issues in the case of this study were that they only used fast vocal music and only tested girls. Various other researchers have replicated the results of these personality-based studies, including Ylias and Heaven's 2003 study that in addition to extraversion measured and compared the personality traits neuroticism, agreeableness, conscientiousness, and openness to experience. Previous findings for extraversion were corroborated, with high scores positively influencing performance in the distraction condition but not in the silence condition, but no such effect or interaction was found for the other traits.

Doyle and Furnham (2012) investigated a hypothesis that participants' level of creativity could possibly impact performance on reading comprehension in the presence of background music. Based on an assumption that creative and non-creative individuals shared numerous qualities of extraverts and introverts respectively, these researchers believed that previous results found by Furnham and Strbac (2002), and Chamoro-Premuzic et al. (2009) would be replicated. While there was an apparent trend for higher scores of creative individuals, no significant difference was found. The authors proposed numerous explanations for the lack of significant effect, including the task being insufficiently complex and lacking the potential for a sizable advantage or disadvantage. Assuming that creativity and extraversion are entirely the same and should be dictated by

the same effects seems to discount the potential for an important unshared trait that itself interacts with background music and reading comprehension. Further investigation into the differences between these traits and its impact on this topic could prove to be valuable.

Investigating the variables of music tempo and volume in relation to reading comprehension, Thompson, Schellenberg, and Letnic (2011) found that fast and loud music is more likely to negatively impact reading comprehension than other combinations of tempo and volume. Using only classical music the study circumvents the complicating factor of lyrics, but also limits itself to a single genre, which has been speculated could involve a preferential effect (Kämpfe, Sedlmeier, & Renkewitz, 2010). The researchers also found that of their participants, those with musical training achieved higher comprehension scores, also discussed in Kämpfe et al.'s meta-analysis.

The potential for teachers to utilize music as a classroom tool and make practical use of trends in this area research has garnered some attention, but warrants more. In a novel study connecting the effect of background music on memory in a history lesson presented through a “virtual reality” computer center, researchers found evidence that background music significantly and positively impacted performance (Fassbender, Richards, Bilgin, Thompson, Heiden, 2012). The results were inconsistent through the different scenarios used by the experimenter, but this could possibly be explained by the distracting effect of the novel technology used. A second interesting pilot study had third-grade students utilize a vibroacoustic chair for reading and other scholastic tasks over the course of 6 months (Downing et al., 2004). While there were a number of procedural and theoretical limitations of the study, it did show a significant improvement for students in

sight-word recognition and comprehension. Even though there was no control group, normal maturation was not factor in, and students utilized the chair as they pleased and for however long they wanted, the marked improvement is intriguing and shows the direction that the practical application of the present research could go.

Understanding the impact of background music on reading comprehension offers a variety of benefits to education and psychology, ranging from the practical application of classroom tools to the theoretical understanding of musical processing in the brain. This area of research has been going on for some time, but mixed results allude to an inconclusive direction rather than a lack of effect. By understanding the complexities of music, cognitive output, and the interaction between things like lyrics, reading, writing, etc., research can be led in a more beneficial direction that differentiates between the varying facets of cognitive ability and musical processing. The present study will add to the collection of well-directed research and will provide further evidence for comprehensive understanding of this important topic.

Chapter 3

Methods

Subjects

Seventy- two American undergraduate students involved in the university research pool participated in the study. Access to, recruitment, and selection of subjects was done through the pre-defined rules of the subject pool. These students, who are offered psychology course extra credit in exchange for participation, receive participation opportunities and sign up independently. Participants were split as evenly as possible given fluctuating sign-ups and no-shows into the four test groups – Classical Lyrical (n=13), Classical Non-Lyrical (n=17), Rock Lyrical (n=11), and Rock Non-Lyrical (n=18). There was a fifth control group as well (n=13). Participants were given the Rotter Locus of Control scale (Rotter I-E Scale) to determine level of extraversion or introversion (56 external locus of control and 16 internal locus of control) (Rotter, 1966).

Variables

The Rotter Internal-External Locus of Control Scale (I-E Scale) was used as a personality measure for participants. The reliability of this 29-item, forced choice test can be shown best through its internal consistency stability, shown in table 6.2 of Rotter's *Generalized Expectancies for Internal Versus External Control of Reinforcement* (1966). Reliability has also been displayed through a test-retest model, also found in table 6.2, where scores after one month seem "quite consistent in two different samples," although r-values are smaller after two months (Rotter, 1966). To demonstrate validity, correlations were examined between this scale and the Marlow-Crowne Social Desirability Scale, and ranged from -.12 and -.41. This data can be seen on table 6.2, in

addition to the correlations with intellectual measures, which ranged from -.22 to .03. Table 6.3 displays means and standard deviations between various populations, and continue to support the validity of the exam by showing generally minimal differences. Procurement of this scale came from contacting Dr. Rotter's office and agreeing to the following stipulations: 1) collect all copies of the scale from participants, 2) do not publish the scale anywhere, other than in your dissertation/thesis/research results, 3) use the scale for research purposes only, 4) get assistance from someone with previous experience administering and interpreting personality scales if you have none yourself.

The first three passages (18 questions) of the Nelson-Denny Reading Test's Reading Comprehension section was used to measure the dependent variable in the present study – reading comprehension score (Brown, Fishco, & Hanna, 1993). The reliability of this portion of the exam is best demonstrated by the alternate forms method, where the same student was administered both Form G and H of the exam within a three-week period ($r=0.81$). For the present study, Form H was used. To address validity, an extensive balanced treatment review panel surveyed the test to ensure that reading was being measured fairly across varied populations. Questions have, however, been raised about the test's validity regarding modern materials (Murray-Ward, 1998). This scale was purchased through Riverside Publishing.

Procedures

Participants entered the testing area, signed in for the purposes of receiving credit through the Rowan Subject Pool system, and read the alternate consent page attached to the sign-in sheet. Subjects were tested at the same time and in groups of no larger than ten. After sitting at pre-assigned desks, participants were informed that they could opt out

before, during, and after the experiment for any reason. Given no further questions, participants moved on to complete the Rotter I-E Scale. They were allotted 15 minutes to complete the scale, however informed that the study would move forward when everyone was complete. After indicating completion to the experimenter, they were given 3 reading passages and questions from the Reading Comprehension portion of the Nelson-Denny Reading Test's Form H. Participants were informed that they had 15 minutes to complete this portion, and that the entire time must pass before moving on, so there was no need to rush. The experimenter began playback of the music through small speakers placed in the room at the same time participants began the test.

Having been split into four experimental groups and the control group beforehand, the music was specifically chosen for their group. There were 4 different experimental groups: Classical Lyrical, Classical Non-Lyrical, Rock Lyrical, and Rock Non-Lyrical. Songs were chosen for these experimental groups based on presence of English lyrics and availability of non-lyrical versions. In order of presentation, songs included in the Classical groups were: "Hallelujah Chorus" from George Frideric Handel's *Messiah* (1741/1988), "I Have a Song to Sing" from W.S. Gilbert and Arthur Sullivan's *The Yeomen of the Guard* (1888/2009), "The Sun Whose Rays Are All Ablaze" from Gilbert and Sullivan's *The Mikado* (1885/2009), "He That Dwelleth... Thou Shalt Break Them" from Handel's *Messiah* (1741/2009), and "In Native Worth" from Franz Haydn's *The Creation* (1796/2009). Songs included in the Rock groups were: "Monkey Wrench" by the Foo Fighters (Grohl, 1997), "Pompeii" by Bastille (Smith, 2013), "Glass of Water" by Coldplay (Berryman, Buckland, Champion, & Martin, 2008), and "Are You Gonna Be My Girl" by Jet (Cester & Muncey, 2003).

After completion of all three tests, the participants were debriefed and given the opportunity to ask questions or opt out. Music was chosen in the hopes of avoiding familiarity, as it is well documented that episodic memory could be activated by familiar music, thus introducing a confounding variable into the experiment (Eschrich, Munte, & Altenmuller, 2008). Participants were then dismissed.

Statistical Analysis

A two-way between-subjects Analysis of Variance (ANOVA) test was used to analyze the data. The Nelson-Denny Reading Comprehension test is scored between 0 and 18, with a higher score indicating more correct answers given, and greater test performance. The Rotter I-E Scale presents participants with a score between 0 and 23, with a lower score indicating a more internal locus of control and a higher score indicating a more external locus of control. According to Barbara Engler's *Personality Theories*, a score of 8.5 is the mean score, and scores above can be interpreted as indicative of an external locus of control, while scores below can be interpreted as indicative of an internal locus of control (2013).

The present study aims to add momentum to a growing body of research that will help illuminate the best uses of music in the modern scholastic world. Music and other ever-present types of media saturate the background of our society, and understanding how these new realities impact our performance will allow us to more efficiently function within changing cultural norms today and tomorrow. Participants took reading comprehension tests in the presence of various different background music conditions, and the mean scores were compared. The first hypothesis for this study states that the mean scores of the silent control condition and the music conditions will be different, and

that within those music conditions the means scores will differ as well. The second hypothesis predicts that participants in the non-lyrical conditions will perform better than those in the lyrical conditions. Finally, the third hypothesis anticipates that participants in the classical music conditions will perform better than those in the rock conditions.

Chapter 4

Results

Given that the groupings of Internal and External Locus of Control are below and above 8.5 respectively, 56 participants were found to have External Loci of Control and 16 students were found to have Internal Loci of Control. Given this uneven distribution, this personality variable could not be factored into further the statistical analysis of Reading Comprehension and Music.

Mean reading comprehension test performances for the different experimental conditions are illustrated by descriptive statistics. Results from the descriptive statistics procedures are included in Table 1. The mean score for participants in the control groups was 15.077 ($SD = 2.14$). The mean score for participants in the Classical, Lyrical groups was 13.154 ($SD = 2.30$). The mean score for participants in the Classical, Non-Lyrical groups was 15.294 ($SD = 1.21$). The mean score for participants in the Rock, Lyrical groups was 14.182 ($SD = 2.40$). The mean score for participants in the Rock, Non-Lyrical groups was 14.111 ($SD = 2.04$). Figure 1 illustrates the trends found in the descriptive statistics of the sample population.

Table 1

Descriptive Statistics: Sample Population

Genre	Lyrics	N	Mean	SD
Control	Control	13	15.077	2.139
Classical	Lyrical	13	13.154	2.304
	Non-Lyrical	17	15.294	1.212
Rock	Lyrical	11	14.182	2.400
	Non-Lyrical	18	14.111	2.042

Note. Scores range from 0-18. A higher score indicates more items answered correctly.

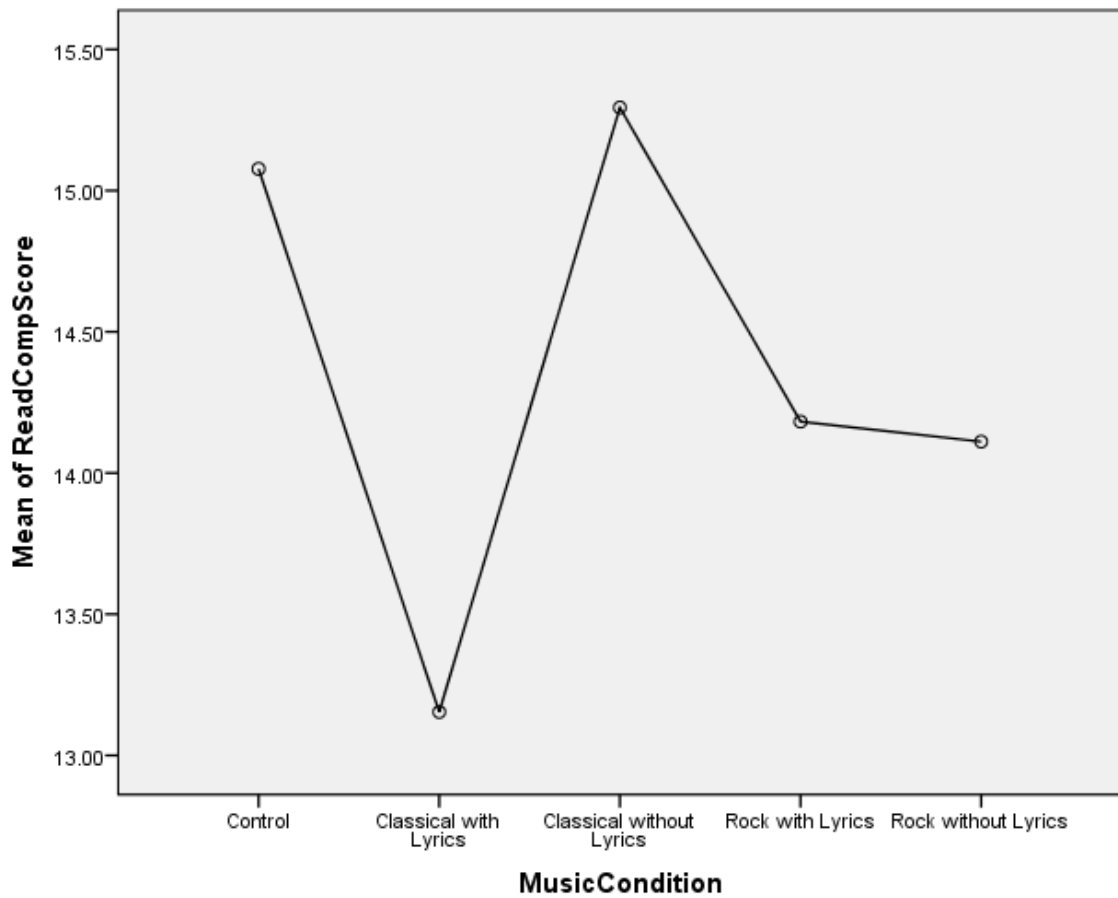


Figure 1. Comparing means of Reading Comprehension Scores Across Experimental Conditions

A two-way ANOVA compared the relationships between independent variables, (1) presence of lyrics (“lyrics”) and (2) music genre (“genre”), and the dependent variable, performance on the reading comprehension test (“reading comprehension”). No significant main effects were found for either independent variable, however the relationship between “lyrics” and “reading comprehension” was close to significant. A significant relationship was found in the interaction effect between the presence of lyrics and genre ($p < .05$). Results from this ANOVA are included in Table 2.

Table 2

Variance of “Reading Comprehension” according to “Lyrics” and “Genre”

Factor	<i>df</i>	<i>F</i>	<i>p</i>
Genre	1	0.022	.882
Lyrics	1	3.948	.051
Genre x Lyrics	1	4.506	.037*

Note. * = $p \leq .05$

The first of three hypotheses claimed that the control group without music would have different levels of comprehension than music groups, but the scores of the different music groups would vary. Collected data supports this hypothesis as the mean score of the control group ($M = 15.08$) is greater than three of the four experimental groups, beating ‘classical with lyrics’ ($M = 13.15$), ‘rock with lyrics’ ($M = 14.18$), and ‘rock without lyrics’ ($M = 14.11$). The second hypothesis was that lyrical music, regardless of genre, would have a greater negative impact on reading comprehension than non-lyrical music. This hypothesis cannot be confirmed, as the effect was not found to be significant ($p = .051$). The third hypothesis of the present study stated that rock music would have a

stronger negative impact on reading comprehension than classical music, which the present study does not confirm ($p = .882$).

While Locus of Control data was not usable, there are a plethora of other interesting results that warrant discussion. The collected data give support to one hypothesis, as the control group did see higher scores than three of the four other conditions. While the other two hypotheses were not supported, a p -value of 0.51 for the effect of lyrics and a significant interaction between lyrics and genre deserve analysis and consideration. The following section of the present study will discuss these findings and consider avenues for further investigation.

Chapter 5

Discussion

Conclusions

Analysis of variance used on the data collected presents interesting findings that corroborates some previous research and raises questions about others, while providing information that can be used to answer questions raised by the hypotheses of the present study. As indicated by the first hypothesis, a difference between the mean scores of the control and music conditions was expected as the silence of the control condition lacks the potentially distracting background sound that may impair either concentration or processing capacity. What was not expected, however, was that the ‘classical without lyrics’ condition would have a slightly higher mean score. This interesting dynamic suggests the possibility that non-lyrical classical music may uniquely not hinder reading comprehension or may even enhance it. Mean differences between the control and experimental groups relate to the findings of Anderson and Fuller, who found that the presence of popular music in the background of a reading comprehension test significantly and detrimentally affected scores of students as compared to those in a control group without music (2010). Lack of a significant main effect and a higher score in the ‘classical without lyrics’ group hinder the present study’s ability to fully corroborate Anderson and Fuller’s (2010) conclusions, but similarities between both methodology and results indicate that literature on this topic is growing. Further research is, of course, needed in order to develop solid strategies for students to utilize.

While the second hypothesis that predicted higher overall scores for the non-lyrical conditions cannot be confirmed, as the effect was not found to be significant ($p =$

.051), the p -value's proximity to significance indicates that the relationship between lyrics in music and reading comprehension requires further investigation. The presence of lyrics may very well have an impact on processing and comprehension capabilities, and a larger population size may have led to a difference p -value. If lyrics do end up having an impact on reading comprehension, this effect may best be explained by interference created by overlapping semantic processing, as detailed in research such as Bell, Buchner, and Mund's 2008 study, Oswald, Tremblay, and Jones' 2000 study, or Lange's 2005 study. These studies point toward the conclusion that, through an interference-by-content model, meaningful language presented in the background limits cognitive semantic capacity and therefore inhibits the processing of other semantic tasks. In the context of the present study, the presence of lyrics, which are language-based and require semantic processing, may interfere with subjects' ability to process and comprehend the reading task at hand.

Given the data collected through this experiment it seems that genre, at least between classical and rock, does not have a substantial impact on a subject's ability to comprehend written word. This finding is particularly interesting when compared to Chou's 2010 study, which saw the genre of hip-hop's mean score on a reading comprehension performance test sit substantially lower than that of the classical condition. A limitation of Chou's study, however, was that it did not take lyrics into account. Given that hip-hop tends to rely more heavily on lyrics than classical music, the study may possess a confounding variable in its varied lyrical presence that may explain the main effect for genre found in that study. Regardless, it seems that further

investigation is needed to compare the effects of the innumerable different genres and hybrids that exist within the scope of music.

While no hypothesis predicted the significance of this interaction, it is very intriguing to see the significance in the interaction between Genre and Lyrics ($p = .037$). According to this data, the impact of rock music was consistent across the lyrical conditions, but with the classical music, the presence of lyrics significantly affected the impact the genre had on test performance. It is hard to identify a definite cause of this. Lyrical classical music is generally foreign to most students. While movies, commercials, and other assorted popular media that heavily utilize instrument-focused classical music provide the general population exposure to non-lyrical classical, classical with lyrics is much less present in mainstream America. The unique vocal quality of harsh vibrato and high pitches used in this less exposed classical music may be jarring to students unfamiliar with this sound. Further research is needed to explore this interesting interaction.

Limitations

There are a number of limitations that should be noted and taken into account during future attempts to expand upon this present research. First, it was not possible to secure one room to use throughout all sessions so the individual sessions were spread across 4 different rooms. While this environmental variable could be confounding in and of itself, it also created problems with standardizing volume across conditions. Despite having a set volume through the computer, different sized rooms and subjects' positioning within those rooms affected the perceived volume for each individual. In the future, it may be advisable to have each subject listen through headphones. That each

song was different, within and across conditions, also created difficulty in maintaining volume consistency.

A larger population size would enhance the study for many reasons. Since the control was independent of the 4 experimental groups, it was difficult to factor the control into analysis. Had that population size been larger, approximately the size of the other groups combined, comparison between the control and a general “music” condition could have assisted in addressing the general question, “Are students better off reading without music in the background?” A larger population size may have also helped fix the sample population’s heavy skew toward external locus of control, allowing analysis of the extraversion variable. If university students are the available population, choosing a more direct route to measuring extraversion, rather than utilizing the Rotter scale and translating from locus of control to extraversion, may be advisable. Finally, future researchers should measure and control for cognitive ability, and familiarity or preference. Students’ pre-existing cognitive ability could impact the mean performance scores, and related literature has implicated song familiarity as an important factor that can lead to lower scores (Furnham and Strbac, 2002).

Future Directions

Future research should prioritize and focus on the role of lyrics in the interplay of music and academic performance. A study with a large sample population should confirm or deny the impact that lyrics could have on concurrent reading comprehension, as the *p*-value of .051 for the main effect of lyrics found in the present study does not lead to a definitive conclusion. Further research can then break down the general concept of “lyrics” into its component parts and develop a full understanding of the subject and its

effects. As shown by having a main effect near significance, and by being implicated in the interaction between itself and genre, lyrics are a complex aspect of music. As more research explores this language-based ingredient, specific recommendations can be made regarding to how its presence effects reading comprehension and other academic performance.

Limitations found in the present study also create an outline for researchers to consider in future studies. Volume consistency is paramount, and headphones may be the only ways to ensure that it is achieved. If music is played throughout a room, a consistent location with “surround sound” capabilities may be necessary in order to avoid individual participants perceiving the music at different volumes. Three other factors that also need to be adequately considered in the future include pre-existing academic ability, music familiarity, and level of extroversion. Existing literature suggests that each of these variables can play an important role in a students’ susceptibility to background musical distraction, and they should be given consideration.

Ultimately the goal in this type of research should be to develop definitive and practical advice for students trying to study in today’s media-saturated world. Looking more deeply at the effect of lyrics, and the interactions attached to it, can help guide students toward efficient and effective studying in the modern age.

Closing Thoughts

This study may provide practical guidance to inform university students’ study habits, and it can provide a jumping-off point for further research that can seek to maximize students’ ability to effectively read and perform in school. Differences in this data may suggest that background music in general lessens reading comprehension, but

further study is needed to specifically confirm this. If a student is going to listen to music while reading, analysis of collected data implies that genre, at least between classical and rock, should not have significantly different impacts. Further study is also needed to explore this, but non-lyrical music may be generally less invasive than lyrical. Finally, when choosing classical music to listen to, choosing non-lyrical selections is preferable to lyrical, whereas it should not matter with rock. Because of the nature of film, television, and video game scores, there is a plethora of lyric-free classical music available to students through soundtracks. Today's students are constantly bombarded with stimulus from new forms of media, and having an understanding of this concept from all angles can allow a better understanding of how to work efficiently in the 21st century.

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