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How Does the Effect of Background Music on the Performance of a Reading Comprehension Task Differ Across Musically 'Trained' and 'Untrained' Individuals?

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ABSTRACT

This study explored the effect of background music on the performance of musically trained and untrained individuals in a reading comprehension task. Three different musical genres (classical, jazz, and pop) and a silent condition were used. It was predicted that due to evidence of an overlap in systems used to process language and music in musicians (Patston & Tippett, 2011), background music would have a strong negative effect on musically trained participants' performance in the reading task, while musically untrained participants would be unaffected. The findings of the study support the hypothesis, with musically trained participants' scores decreasing by 10.63% during the music conditions, while untrained participants' scores were unaffected. It was also predicted that the strongest negative effect on performance would occur in the popular music condition, due to the presence of lyrics. This prediction was also supported, with musically trained individuals' performance decreasing by 15.9% during the popular music condition, although untrained individuals' performance was unaffected. These findings may have important implications, for musically trained individuals, as they suggest that background music can have a strong impact on the effectiveness of their learning and studying.

1. INTRODUCTION

There has been much debate surrounding the effect of background music on the performance of cognitive tasks. Studies have focussed on the effect of factors such as tempo, intensity, and musical genre, as well as the effects on individuals with certain personality traits such as introversion and extraversion (Cassidy & Macdonald, 2007; Furnham & Bradley, 1997). Factors such as the level of musical training of participants have also been explored, although they have received less attention.

There is evidence to suggest that there is a difference in the way in which musically trained and untrained individuals process music. Bever and Chiarello (1974), for example, found that musically trained participants were left hemisphere dominant and had an analytical approach to musical processing, in contrast with untrained participants, who were right hemisphere dominant and had a more holistic approach. This difference between musically trained and untrained individuals has been further explored by Patston and Tippett, who conducted a study comparing the effects of background music on the performance of musicians and non-musicians in a language task, in which participants had to identify grammatically incorrect sentences, and a visual task, in which they had to spot the difference between two shapes (2011). The study particularly focussed on music and language processing in the brain and the overlap of these systems in musicians (Patston & Tippett, 2011), as is suggested by previous research. Sluming et al.'s (2002) study, for instance, found that in orchestral musicians' brains the Broca's area, an important area for language, contained significantly increased gray matter density. In Patston and Tippett's experiment, participants were tested under three different conditions: instrumental background music, instrumental background music played incorrectly, and silence (2011). The results of the study confirmed their prediction that, 'Because of the evidence that in musicians, music and language processing share cognitive and neural resources…the performance of the musicians would be impaired on the language (but not the visuospatial) task in both music conditions' (Patston & Tippett, 2011, p. 175), with musicians completing significantly fewer items of the language task in the music conditions than in the silent condition. Non-musicians were, however, unaffected by background music and neither group's performance in the visual task was affected by background music (Patston & Tippett, 2011). According to Patston and Tippett, these results suggest that in musicians, music and language are not functionally independent and that, as a result, they struggle to process music and grammar simultaneously (2011).

The argument that musicians' performance in cognitive tasks is adversely affected by background music is further supported by Yang, McClelland, and Furnham (2016), whose study focussed primarily on musicians and whether there would be a greater negative effect on their performance in cognitive tasks when background music featured their own instrument. Participants each completed three tasks: an arithmetic test, a sentence-checking test, and the Wonderlic Personnel Test (Yang et al., 2016). Although no 'silent' condition was used for comparison, the results showed that participants' performance was significantly worse in the presence of background music featuring their own instrument in two out of three tasks and that on average, musicians tended to perform worse than non-musicians in the presence of background music, though this effect was not always statistically significant (Yang et al., 2016). The authors conclude that musicians' cognitive task performance is more negatively affected by background music than non-musicians, with an even greater effect when the music features their own instrument (Yang et al., 2016,).

Other studies challenge this conclusion. Darrow, Johnson, Agnew, Fuller, and Uchisaka's (2006) study, for instance, found that music majors processed significantly more items in a selective attention test in the presence of background music than without it. A significant difference was also found between music majors and non-music majors (Darrow et al., 2006). The authors suggest that their findings show that background music acts as a facilitator rather than a distractor, particularly for musically trained individuals (Darrow et al.,

2006). It should, however, be considered that participants were given the freedom to choose their own background music to use in the study, creating the risk of personal preference and familiarity with the music as potential confounding variables. This also meant that due to the wide range of musical genres selected, not enough data was collected for each individual genre to establish whether the effects of background music could be attributed to particular genres or their specific features.

The studies discussed above provide some useful insights, however, conflicting results and varying methodology across studies means that these findings cannot be generalised and that much further research is needed. The present study aimed to build on previous research by addressing some of the methodological limitations of past studies and focussing on an area which has been little explored in relation to the level of musical training an individual has received, namely, the effect of musical genre on the performance of a reading comprehension task.

The study compared the performance of musically trained and untrained participants of a reading comprehension task under three different background music conditions (classical, jazz, and popular music) and a silent condition. It was predicted that due to evidence which suggests that in musicians, there is an overlap in systems used to process language and music, there would be a strong negative effect of background music on musically trained participants' performance in the reading task, while untrained participants' performance would be unaffected. Due to evidence suggesting that musically trained individuals take a more analytical approach to musical processing, it was also thought that they would find it more difficult than untrained participants not to be distracted by certain details within the music. It was predicted that the strongest negative effect on performance would occur in the popular music condition, which comprised music with lyrics, placing an even greater demand on participants who would be required to process another 'language' element, in addition to the language processing required by the reading task.

2. METHOD

Design. The independent variable in this study was the presence or absence of background music and the musical genre of the background music used. The study used a repeated measures design, with each participant completing all four conditions: classical music, jazz music, popular music, and a silent condition. Each participant completed the conditions in a different, randomised order, to reduce order effects. The dependent variable was participants' performance on four different reading comprehension tasks, which all participants completed in the same order. For practical reasons, variables such as the volume of the music, as well as the type of headphones used to listen to the background music were not controlled.

Participants. A volunteer sample of 20 participants, 10 males and 10 females, was used in this study. All participants were undergraduate students between the ages of 18 and 23. Participants were classified as 'musically trained' if they had completed an A-level or equivalent qualification (such as Grade 8 theory) in music, as these qualifications require a high level of musicianship, exposure to, and engagement with music. 10 musically trained and 10 musically untrained participants were tested. Participants also completed the 'Musical Training' and 'Active Engagement' sub-scales of the Goldsmiths Musical Sophistication Index (Gold-MSI) (Müllensiefen, Gingras, Musil, & Stewart, 2014), which were considered the most relevant to the present study. Those classified as musically trained, scored, on average, 90.7 overall, whereas musically untrained participants scored 59.3 overall. The average 'Musical Training' score of musically trained participants was 41.4, while untrained participants scored 25.9. It was found, however, that some participants classified as 'untrained' scored higher than some classified as 'trained'. This may be due to the subjective nature of the Gold-MSI, which is based on self-report. It was decided, therefore, that participants would remain in the groups they had originally been assigned to, according to whether they had completed an A-level or equivalent qualification in music, as this was considered to be a more objective measure.

Materials/Stimuli. In order to increase the ecological validity of this study, it was decided that a reading comprehension task should be used, as the type of engagement required for this kind of task is similar to that required by many students in their everyday studying. The reading comprehension tasks were found on www.readworks.org (n.d.), a website providing tasks designed for use in schools to help improve reading comprehension skills. The tasks selected for the present study were designed for students in the 11th and 12th grades (UK year 12 and 13) and involved answering questions related to a text. Each text was between 1153 and 1274 words long and participants were required to answer 10 questions on each, seven of which were multiple choice and three of which required written answers. A small pilot study involving two participants was conducted to determine how much time participants should be given to complete the tests. The two participants completed the tasks in silence in either 10 or 12 minutes and were asked to provide verbal and written feedback on the difficulty of the tasks. Based on the performance of the participants and the feedback given, a time limit of 10.5 minutes for each task was selected.

For the classical music condition, the second movement of Antonín Dvořák's *Cello Concerto in B minor, Op. 104, B. 191* was used. This piece was considered a good representation of the classical music genre for several reasons. Not only is its composer popular within classical music, but also, being a concerto, the piece employs a full orchestra, which is a common type of instrumentation within the classical genre. Additionally, the movement features variations in expression, tempo, dynamics, tonality, and texture, which enabled participants to be exposed to a wide range of typical features of the genre. The jazz music condition used two pieces from the album *Saturday Night- Miles Davis in Person at the Blackhawk, San Francisco*: *I Thought About You* and *Someday My Prince Will Come*. These pieces were also selected due to the popularity of their composer within jazz music and the use of typical jazz instrumentation (trumpet, saxophone, piano, double-bass, and drumkit), as well as the use of a wide variety of features typical of the genre, including improvisational solos on several different instruments, a variety of dynamic levels, tempos, and playing techniques. The popular music condition employed three different songs: Drake's *God's Plan*, Ed Sheeran's *Perfect*,

and Sigrid's *Strangers*. As with both the classical and jazz conditions, an effort to expose the participants to as many of the features associated with the genre as possible within the given time was made. As a result, each song chosen represented a different sub-genre within the popular music genre (R&B, folk-pop, and synth-pop). As popular music is, by definition, usually familiar to listeners, these songs were intended to be recognisable to most of the participants. It was, therefore, ensured that all three songs featured within the top 60 of the UK official charts (n.d.) at the time of conducting the experiment. Silences between songs were removed so that the background music was continuous.

Procedure. Participants were briefed about the aims of the study, which took place in various silent study areas to make the situation as naturalistic as possible. They began by filling out the Gold-MSI questionnaire and were then allowed 10.5 minutes to complete each reading comprehension task. During the music conditions, background music was played for the entire 10.5 minutes of completing each task. In between tasks, participants were given two minutes to complete a short questionnaire, in which they were asked to rate how distracting they found the music, their level of familiarity with it, and how enjoyable they found it. They were also asked to identify any specific features of the music they may have found distracting. This questionnaire was given at the end of each condition except for the silent condition, after which participants simply had a two-minute silent break. After completing all the tasks, participants completed one final questionnaire, enquiring about how often they would normally listen to background music while studying and what musical genre they used most. Participants were then debriefed and given the opportunity to ask any questions.

3. RESULTS

As shown in Figure 1, just two musically trained participants performed better in the presence of background music, compared with four untrained participants (see Figure 2).

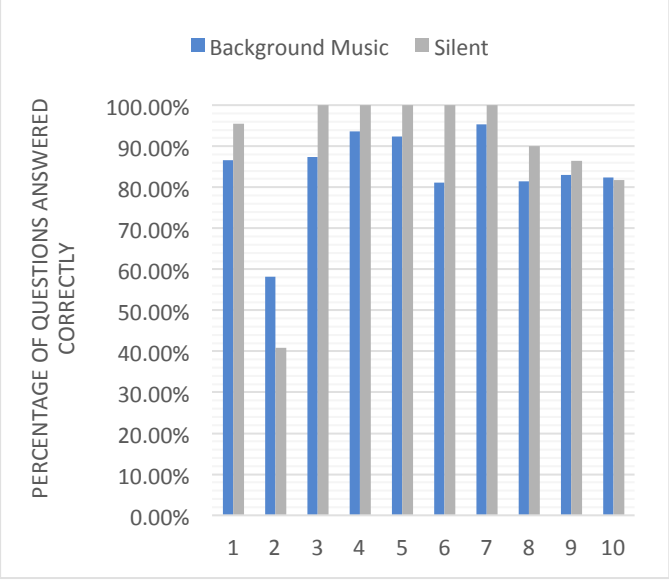

Figure 1. Performance of musically trained participants

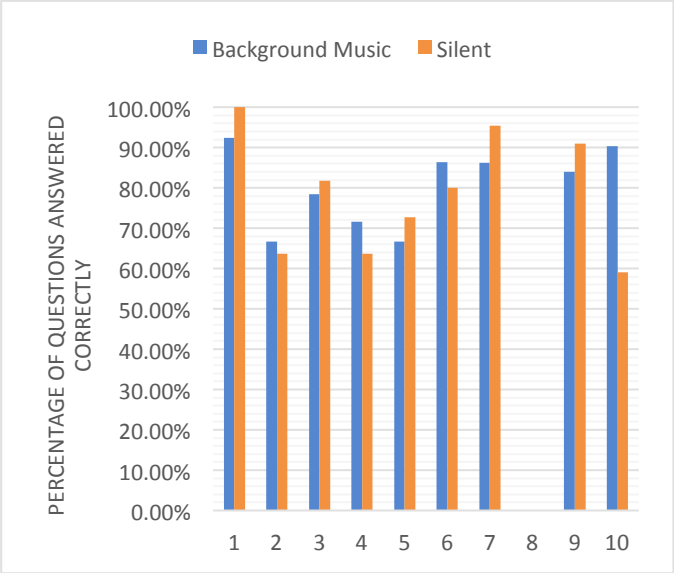

Figure 2. Performance of musically untrained participants

On average, musically trained participants answered 89.45% of questions correctly in the silent condition, compared with 78.82% in the background music conditions, resulting in a 10.63% decrease in performance during the music conditions. Untrained participants answered 78.59% of questions correctly in the silent condition, compared with 80.3% in the background music conditions, resulting in a small increase in performance of 1.71% during the music conditions. In the classical music condition, musically trained participants' performance decreased by 10.59% when compared to their performance in the silent condition, whereas untrained participants' performance increased by 3.38%. In the jazz music condition, musically trained participants' performance decreased by 5.4%, while untrained participants' performance increased by 1.81%. In the popular music condition, musically trained individuals' performance decreased by 15.9% while untrained participants' performance decreased by just .05% (see Figures 3 and 4). It was decided that one musically untrained participant's scores should be excluded as an anomaly from the results, due to scoring much lower than all other participants in most conditions and leaving a written comment stating that their performance in the tasks had been affected by their level of interest in certain topics discussed in the texts used as part of the reading comprehension. No strong correlations were found between participants' performance in any of the music conditions and their overall score in the Gold-MSI (with a correlation of r = -.07 between Gold-MSI and classical condition scores, r = .03 for the jazz condition scores, and r = .08 for the popular condition scores) or their scores in the 'Musical Training' (with a correlation of r = .05 between 'Musical Training' and classical condition scores, r = .12 for the jazz condition scores, and r = .14 for the popular condition scores) and 'Active Engagement' sub-scales (with a correlation of r = -.19 between 'Active Engagement' and classical condition scores, r = -.07 for the jazz condition scores, and r = .02 for the popular condition scores).

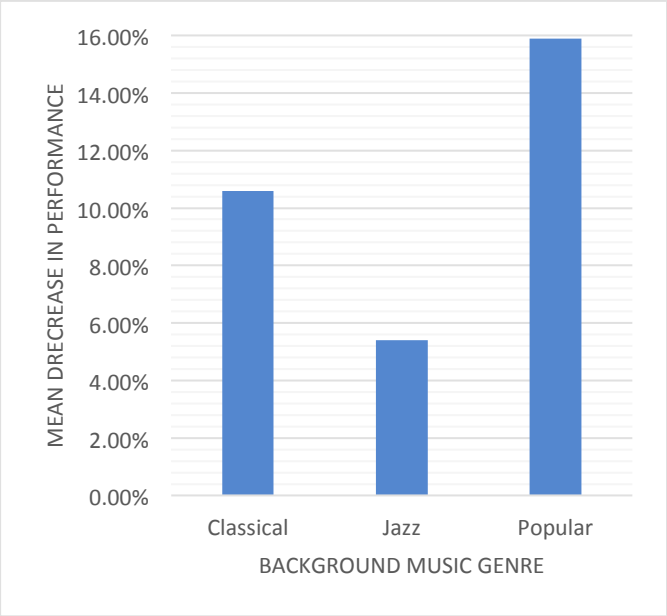

Figure 3. Mean decrease in performance of musically trained participants

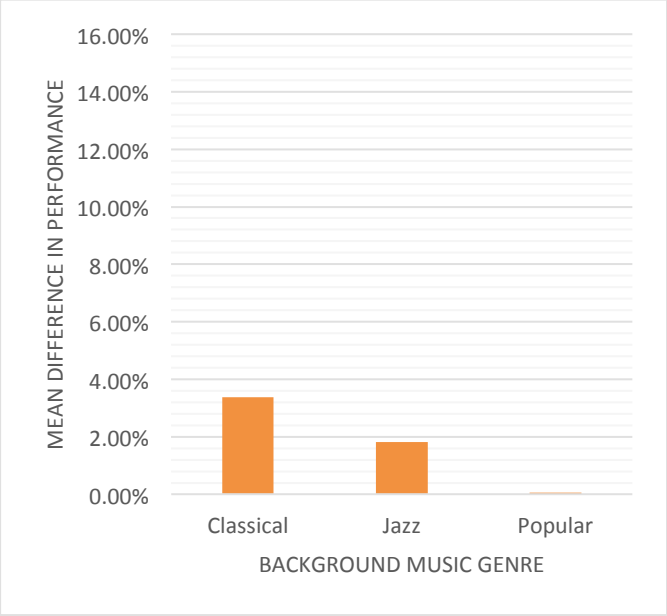

Figure 4. Mean difference in performance of musically untrained participants

There was also no strong correlation (r = -.03) found between their mean performance in the music conditions and the time they normally spent listening to background music while studying. No strong correlations were found between participants' performance in any of the music conditions and their own ratings on distractibility (with a correlation of r = -.14 between distractibility ratings and classical condition scores, r = -.05 for the jazz condition scores, and r = -.31 for the popular condition scores), familiarity (with a correlation of r = .19 between familiarity ratings and classical condition scores, r = -.44 for the jazz condition scores, and r = -.08 for the popular condition scores), and enjoyability (with a correlation of r = -.19 between enjoyability ratings and classical condition scores, r = -.02 for the jazz condition scores, and r = -.15 for the popular condition scores).

4. DISCUSSION

The results of this study support the hypothesis that background music would have a strong negative effect on the reading comprehension performance of musically trained participants, whilst musically untrained participants' performance would remain unaffected by the background music. It should, however, be noted that there was no correlation found between participants' performance in the music conditions and their overall score in the Gold-MSI, which seems to contradict the hypothesis. This may, however, be due to the fact that the Gold-MSI relies on self-report and is a more subjective measure than the A-level or equivalent qualification used in this study to classify participants as musically 'trained'.

The results also support the second part of the hypothesis, that the strongest negative effect on performance occurs when listening to popular music. Performance of musically trained participants was negatively affected in the popular music condition, while untrained participants showed almost no decrease in performance. There are several possible factors which may have contributed to the distractibility of this musical genre for musically trained individuals. Many participants commented on the prominent beat of the first song as a distracting feature. This supports Tze and Chou's (2010) findings which suggest that music of a higher intensity such as hip-hop music with a fast tempo and heavy bass beats is more distracting and has a greater effect on task performance and concentration than music of a lower intensity, such as light classical music. As predicted, the use of lyrics also seemed to have a strong impact on levels of distraction, with 18/20 participants commenting that they found the use of lyrics or vocals distracting. This is supported by previous research into the distracting effects of lyrical background music including Koolidge and Holmes' (2018) study, which found that young children performed significantly better in a spatial-cognitive task (completing a puzzle) in the presence of background music without lyrics than music with lyrics. Darrow et al.'s (2006) study, which found that music majors listening to instrumental background music completed significantly more items in a selective attention task than those listening to lyrical background music, also supports the presence of lyrics as impacting on levels of distraction during cognitive task performance. Many participants in the present study commented that they were familiar with the songs and felt the urge to sing along, which may suggest that familiarity with and past experiences of performing the music may lead to an urge to participate in the music and increased levels of distraction.

The classical background music had a strong negative effect on musically trained participants, while the scores of untrained individuals were almost unaffected. Interestingly, despite the genre's high level of distractibility for musically trained individuals, 5/10 participants in both groups mentioned using classical or piano music as background music while studying, suggesting that this genre may be generally perceived as the least distracting. A possible

explanation for the increased levels of distraction amongst musically trained participants may be that they often experience a much higher level of exposure to the classical music genre than untrained participants. It is possible that familiarity with the genre may have impacted on its distractibility for musically trained individuals. As previously suggested, the urge to participate in performance, perhaps triggered by familiarity with the genre or past experiences of performing a specific piece of music or music of the same genre, may also have an effect on distractibility. This is illustrated in the comments of one of the musically trained participants, explaining that they 'wanted to conduct along to the music'. Although comments made by the participants in the present study suggest that familiarity with a musical genre or specific piece may lead to increased levels of distraction, this is not supported by recent research. Chew, Yu, Chua, and Gan's (2016) study found that there was a significant increase in participants' performance in a word memory test during a familiar background music condition, when compared with an unfamiliar background music condition. Familiarity of the background music was not, however, found to have had a significant effect on performance in arithmetic or reading comprehension scores (Chew et al., 2016). It is clear that further research into the effect of the familiarity of background music on cognitive task performance is needed.

Another possible explanation for the strong negative effect of background music on the reading comprehension performance of musically trained individuals may be their analytical approach to musical processing, as identified by Bever and Chiarello (1974). It was expected that musically trained participants would, therefore, be able to identify specific details and features of the music which may have contributed to its distractibility more readily than untrained participants. Several participants from both groups were, however, able to identify and describe in some detail, several specific musical elements which they found distracting, mentioning features such as sudden dynamic contrast, syncopation, crescendos, rhythmical, harmonic, and melodic interest, instrumentation, virtuosity, variations in texture, and tempo.

Although, overall, the results of the present study support the argument that a higher level of musical training impacts negatively on the ability of individuals to perform a reading task, there are several limitations which must also be considered. Firstly, the use of repeated measures may have been problematic in this study due to possible order effects, which are also more likely to have occurred due to the length of the experiment (approximately one hour). Although efforts were made to reduce the impact of order effects by presenting the stimuli to each participant in a different order, all participants completed the different reading comprehension tasks in the same order. As this study involved only 20 participants, it was impossible to fully counterbalance the conditions and it is, therefore, recommended that future research employs a larger sample size to allow for a fully counterbalanced design.

Other limitations are linked to the choice of test used in this study. Although a pilot study was conducted to ensure the right level of difficulty of the task, the sample was extremely small, involving only two participants. It is, therefore, possible that the tasks were not of the right difficulty which may have influenced findings. Another limitation is that the level of interest in or knowledge of the topics discussed in the texts used in the different reading tasks may have had a greater effect on participants' concentration levels than the different experimental conditions. In future, it may be useful to devise a new test which is not specifically focussed on one topic.

Future research should also control for factors such as volume, as previous studies suggest that this may be a factor affecting levels of distraction. Thompson, Schellenberg, and Letnic (2011), for instance, found that fast and loud music was significantly more disruptive to a reading comprehension task than slow, soft music. It may be difficult to control for factors such as tempo and dynamics, as these may often change within pieces of music; however, efforts should be made to ensure that all pieces are played at a similar average volume.

Finally, one should consider the difficulty of attempting to represent an entire musical genre within a 10.5-minute excerpt. Within each genre used in the present study there are many sub-genres which often differ tremendously from one another in terms of their musical features. In future, it may be useful to repeat this study using several excerpts from different sub-genres within the same overall musical genre.

The findings discussed in this report have shown that the use of background music can have a detrimental effect on the reading comprehension performance of musically trained individuals. The genre of background music used can also affect performance, particularly of those with musical training. These findings may have important implications for musically trained individuals, as they suggest that background music can have a strong impact on the effectiveness of their learning and studying.

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