Effect of Classical Background Music on Attention Level in Adolescents

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Abstract. Music consumption has been on the rise since the late 1990s. With more and more teens gaining access to a portable walkman or CD player, it can be observed that many choose to listen to music whilst studying or doing other attention-demanding work. This is mainly due to The Mozart effect, which suggests that listening to classical music (especially Mozart's pieces) can enhance performance in certain tasks. Some question whether listening to music can improve one's attention or is actually causing a distraction. It was hypothesized in this study that listening to classical background music improves participants' performances on mentally demanding tasks. High schoolers between the ages of 15 to 17 will each complete 2 reaction time tests, once with background music and the other without. The time it takes for each individual to complete one test will be recorded. The final data and result of the study support the hypothesis that listening to music whilst doing a mentally demanding task does, in fact, help with attention and reaction time. Although there are some limitations present such as sample size and sampling method, this could be a good opportunity to expand on the subject area through future research with different musical genres and other age groups.

Keywords: music · classical music · attention · reaction time · high schoolers

1 Introduction

According to a recent study, the consumption of music has been incessantly on the rise since 1999. Back then, the average was only 1 h and 48 min per day. That number has now increased to nearly 3 h per day for the average American [1]. Figure 1 shows a poster for the Walkman as it was first released by Sony.

"The Mozart Effect is a theory that suggests Mozart's music results in an improvement in spatial performance and a change in brain activity" [3]. This is why many people opt to play background music while participating in a mentally demanding task. As Jaušovec and Habe noted in their study, listening to Mozart's music improved the participant's performance in solving spatial rotation and performing numerical tasks [4]. They suggested that the musical intervention "increases the activity of specific brain areas and in that way facilitates the selection and "binding" together pertinent aspects of sensory stimulus into a perceived whole" [4]. Other studies concluded that the improvement in performance was not only for Mozart but also for other relaxing music [5, 6].

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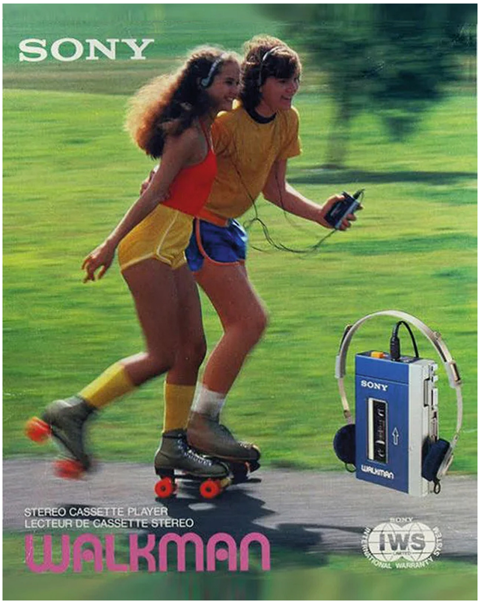

Fig. 1. Sony first introduced the Walkman in 1979 [2].

Similarly, the conductors of this study observed that the vast majority of their peers preferred to put on music whilst studying or doing homework. Although there were various studies in the past that explored the effect that listening to music while studying has on work efficiency, the studies concluded mixed results, and not many in particular were directed solely towards teenagers in high school, from grades 9 to 12 [1, 7, 8].

1.1 Goal of Study

With so many studies all with different views on the subject, few studies focused on high school students. Thus, this study aims to narrow the scope to only high schoolers from ages 15 to 17, in hopes of producing more accurate and less varied findings. This study will provide more insight into attention and efficiency for the researcher's peers as well as all high schoolers. They will be able to use the results as a basis for making future decisions as to whether or not to play music while studying. This research also strives to build upon past studies on the subject of music and attention and to inspire further research on this topic.

1.2 Hypothesis

It is hypothesized that listening to classical music (without lyrics) can improve teenagers' attention level whilst performing a mentally demanding task. The independent variable is whether or not the test is taken with musical intervention, and the dependent variable is the amount of time in seconds each participant takes to complete assigned tasks.

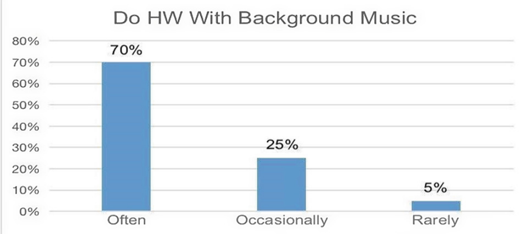

Fig. 2. The frequency of music consumption of the survey participants [Owner-drawn].

2 Methodology

2.1 Initial Observational Survey

To examine the sample population in more detail, the research team started off by conducting an observational survey. The subjects were asked whether they prefer background music while studying. The people who claimed that they do are then asked whether they put on music often, occasionally, or rarely. Figure 2 shows a histogram of the survey results.

Out of the 40 students who stated that they do indeed listen to music, 70% (28) of the participants of the survey reported listening to music often when doing homework. 25% (10) responded to occasionally listening to music. Only 5% (2) of the responses rarely do so. These results propelled further examinations of the effect of music on attention and whether it poses as beneficial or distracting.

2.2 Participants

All participants of the study were high schoolers between the ages of fifteen to seventeen ($M = 15.88$). Sixty-five samples (31 males and 34 females) were collected using a convenience sample (friends and classmates of the author). The participants' informed consent was acquired before the experiment. Debriefing was also conducted afterward. Only participants without auditory or other relevant neurological disorders were included in this study.

2.3 Experimental Design

Each subject will complete a reaction time test twice, once while music is playing (the treatment) and once with no background noise (the control). The order of the control and the treatment test was counterbalanced across participants. The participants wore headphones for both occasions, one time to play music and the other time to minimize unwanted background noise. The participants will send in a final screenshot for both their trials and the final score in seconds will be recorded.

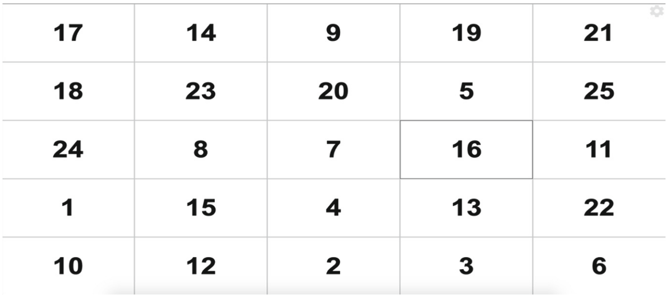

Fig. 3. The user interface of the Schulte Grid Test used in this experiment [9].

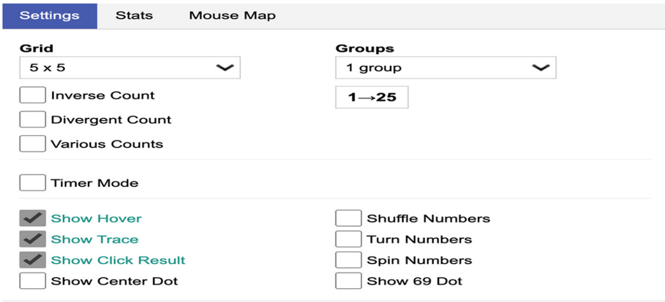

Fig. 4. The default settings of the Schulte Grid Test used in this experiment [9].

2.3.1 Behavioural Task

Participants were asked to complete a digital version of the Schulte Grid Test as shown in Fig. 3 [9]. The test was developed by German psychotherapist Walter Schulte as a psycho-diagnostic test in order to test the properties of attention. It is a matrix "of 5 × 5 randomly arranged numbers from 1 to 25" [9]. During the test, participants are required to click on the numbers in ascending order and say the numbers out loud simultaneously. The time that each participant spends finishing the test is recorded. If the participants make an incorrect click, they will be asked to continue from the number they missed while the timer is still running. Default settings were used as shown in Fig. 4.

Sample feedback from the test and a part of the data table are visualized in Fig. 5 and Table 1 respectively.

2.3.2 Musical Intervention

All participants will complete the Schulte Grid test under two auditory conditions: one having background classical music, and the other having no auditory stimuli. The chosen background music used was a classical music piece named "Gymnopedie No. 1" by composer Erik Satie. During the test, each participant will wear headphones, either playing the sound or serving as a noise-canceling mechanism. Each participant had the same music on the same volume to ensure that there was no bias between each sample.

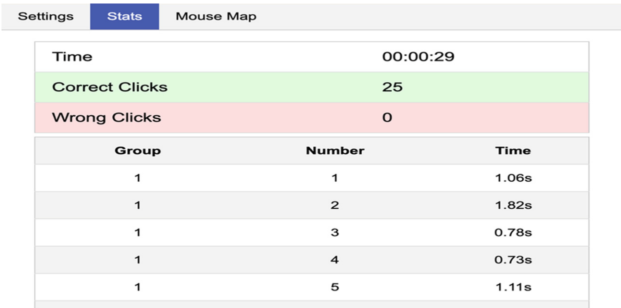

Fig. 5. A sample feedback from the Schulte Grid Test [8].

Table 1. A sample of the data table [Owner-drawn].

Age	Music - time(s)	No music - time(s)
16 years	33	36
17 years	25	24
15 years	21	27
16 years	27	30

3 Results and Analysis

Two sets of data were collected, one set for the control tests, and the other set for the times of the treatment tests. The software R-studios was used to run a Shapiro-Wilk normality test on each set of data to determine whether the data is normally distributed. It was published in 1965 by Samuel Sanford Shapiro and Martin Wilk and is a common test used to test whether the data set fits a normal curve. “It does so by ordering and standardizing the sample (standardizing refers to converting the data to a distribution with mean and standard deviation)” [10, 11]. The null hypothesis states that the data set is normally distributed, while the alternative hypothesis states that the variable is not normally distributed.

The p-value for the treatment group is 0.05076 which is greater than 0.05 thus fitting the normal curve. However, the p-value for the control group is 0.0255 which happens to be less than 0.05 not qualifying for normal distribution. Due to the fact that the latter p-value is less than 0.05, it is not possible to run a t-test for it is only used for data sets with normal distribution. Instead, a Paired Wilcoxon Test will be conducted to show the values for the skewed data. The code is shown in Fig. 6.

Figure 7 shows the boxplot created to represent the two sets of data. Table 2 demonstrates the statistical values for both data sets (music and no music).

```
> wilcox.test(R_Attention$With, R_Attention$Without, paired
=TRUE)

        Wilcoxon signed rank test with continuity
        correction

data:  R_Attention$With and R_Attention$Without
V = 461, p-value = 0.0008068
alternative hypothesis: true location shift is not equal to
 0
```

Fig. 6. Code for Paired Wilcoxon Test [Owner-drawn].

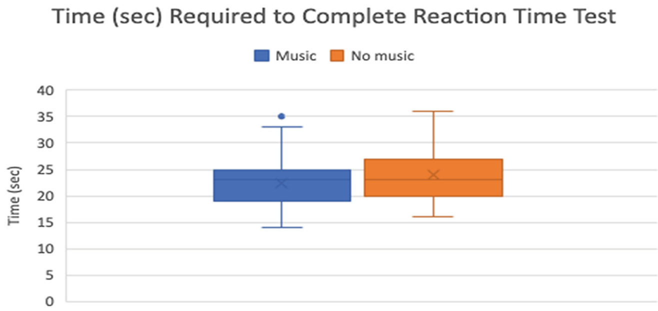

Fig. 7. Time (sec) Required to Complete Reaction Time Test [Owner-drawn].

Table 2. Statistical values for the collected samples of Music and No music [Owner-drawn].

	Music	No Music
Population Size	65 people	65 people
Mean	22.446 s	23.923 s
Median	23 s	23 s
Minimum	14 s	16 s
Maximum	35 s	36 s
Interquartile range	6 s	7 s
Outlier	35 s	none

4 Conclusion

Looking at the statistical values and plots, the overall conclusion supports the initial hypothesis. It was initially stated that listening to classical music in the background can increase a high schooler's performance on an attention-demanding task. The data collected from this experiment matches the anticipated results. The group with music has a mean time of 22.6462 s and the group without music took an average of 23.9231 s. The mean and interquartile range values of the collected samples were taken into consideration to conclude that, on average, the treatment group showed higher efficiency in completing the given task.

Although different bias-eliminating mechanisms were implicated, such as counter-balancing the order of the control and treatment tests among the participants. There is likely still bias in the results. This might be a result of the sample being a convenience sample. Another reason might be the limited sample size. These reasons cause it to be difficult for the researchers to generalize the findings to a broader population of all high school students around the world.

There are a lot of details within this subject that can potentially make way for future research. This study explored the positive effects of classical music. However, there is a wide variety in the genre of music listened to when studying. Other studies may compare the impacts of different musical genres, such as pop music, r&b, or rap music. There is also a connection between music therapy and mental disorders. If music is beneficial for concentration in the general population, there could be potential to study its effects in individuals with attention disorders. Other potential future directions may include limiting the population to younger children or even older seniors.

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