



The Effect of Soft Background Music Without Lyrics on Attention Level of High School Students

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Abstract. Previous studies don't have conclusive ideas on the effect of background music on human attention. Given many high school students study with background music nowadays, this study aims to analyze the effect of soft background music without lyrics on high school students' attention level. 65 high school students, aged 15–17 years old, were involved in this study. 31 males and 34 females participated in this study. By using the Schulte Grid as the attention test, researchers examined participants' performance with and without the background music to see whether there was a significant difference or not. The comparison results revealed that soft background music without lyrics has positive effects on attention. The findings suggest that listening soft background music while studying improves high school students' attention level and thus increases their learning efficiency.

Keywords: Schulte Grid · Attention level · classical music without lyrics · clicking time · clicking accuracy

1 Introduction

Numerous investigations have studied the effect of different kinds of background music on human attention. Some studies analyze the relationship between lyrics in background music and attention level, indicating that lyrics in background music negatively affected worker attention performance [1]; whereas, other studies analyze the effect of background music on attention performance of younger and older adults, indicating that relaxing background music can impair visuo-spatial attentional control performance [2]. Over the years, there is no general agreement on the effect of background music on human attention. Many studies suggest that background music interferes with attention and decreases productivity, while others suggest that it has a positive effect on increasing attention level and raising efficiency [3].

Though the effect of background music on attention hasn't been conclusive yet, a great number of high school students consider that background music improves their performance during studying, enhancing their attention level. According to the survey that researchers in this study did in their high schools, a questionnaire was provided to investigate the students' frequency of studying with background music. 40 high school

students from the age of 15 to 17 years old provided their answers. Among the 40 students, 27 students (67.5% participants) usually studied with background music, 8 students (20% participants) rarely studied with background music, and 5 students (12.5% participants) answered that they studied with background music occasionally. The result of the survey shows that a large proportion of high school students have the habit of studying with background music. Indeed, It's a common phenomenon that many high school students nowadays wear earphones with background music inside while doing school work. However, few studies analyze background music on the attention level of high school students.

In this study, researchers mainly focused on high school students from the age of 15 to 17 years old, exploring how soft background music without lyrics affects their attention performance. The study aimed to analyze the relationship between soft background music without lyrics and high school students' attention level. Based on the results researchers concluded in this study, high school students are able to better understand the effect of background music on human attention and use background music reasonably to improve their learning performance and efficiency.

Researchers hypothesized that soft background music without lyrics has a positive effect on high school students' attention level. The independent variable is the soft background music without lyrics. The dependent variables are the total time each participant used to finish the attention test and their clicking accuracy which indicate participants' attention level.

2 Methodology

2.1 Participants

65 voluntary students (31 males and 34 females) participated in this experiment. All participants were high school students from American high schools and international schools in China, ranging in age between 15 to 17 years old, with an average age of 16 years old. All of them had normal visual acuity, as well as normal audition. They reported information about their health conditions. None reported neurological or psychiatric disorders. Each participant did two attention tests: one with background music, and one without background music. They were randomly assigned to two groups: group A took an attention test without background music first, and group B took an attention test with background music first.

2.2 Tools

A. The Schulte Grid is a standard tool for heightening concentration, which is easy to operate and suitable for people in different ages [4, 5]. In this study, a computer version of Schulte Grid was used as an attention test to evaluate the effect of background music on the level of attention of the participants. As shown in Fig. 1, the Schulte Grid is a 5x5 grid, and integers from 1 to 25 are randomly distributed in 25 small squares. Participants were required to click the numbers from "1" to "25" in order, in the shortest time, and read the numbers while clicking. The time each participant spent on the Schulte Grid

was recorded. The accuracy they clicked was also counted. In this study, The data of time and accuracy was used as standards of the attention level. Two different Schulte Grids were provided. This tool is used to test correlations between participants' attention level and background music [6].

B. Background Music: The researchers prepared a music sample of soft, classical music of 3 min segments. The music researchers used was called Gymnopédie No.1 [7], without lyrics. To adapt to the background music, participants listened to the background music for 20 s before starting the tests.

C. Tool for statistical analysis: R studio statistics software.

2.3 Procedure

Step one: 65 voluntary participants were randomly distributed into Group A (34 participants) and Group B (31 participants). The age and gender of the two groups had no significant differences by the two-sample t-test ($p = 0.4357$, ns, see Fig. 1).

Step two: Researchers briefly introduced the steps of doing the Schulte Grid to the participants.

Step three: The Schulte Grid was administered to the two groups. The 34 participants in Group A were tested with the background music first. Then, they did the other Schulte Grid without background music, in a quiet environment. The 31 participants in Group B were tested without background music first, in a quiet environment. Then, they did the other Schulte Grid with background music.

Step four: After each participant finished their tests, the online version of the Schulte Grid provided researchers with the participants' results, including the total time the participants spent on the test and their clicking accuracy. Researchers recorded both the time and accuracy of all the participants and collected all the data in an excel format.

Step five: Shapiro-Wilk normality test was applied to analyze whether the data was normally distributed.

Step six: If the data was normally distributed, a paired t-test would be applied to analyze the difference of attention level between background music and no background music. If the data was not normally distributed, a wilcoxon test would be applied to

```
> res <- t.test(A$A, A$B)
> res

Welch Two Sample t-test

data:  A$A and A$B
t = -0.7845, df = 62.493, p-value = 0.4357
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.3971780  0.1732691
sample estimates:
mean of x mean of y
 15.82353  15.93548
```

Fig. 1. Two-sample t-test between Group A and Group B [Owner-draw].

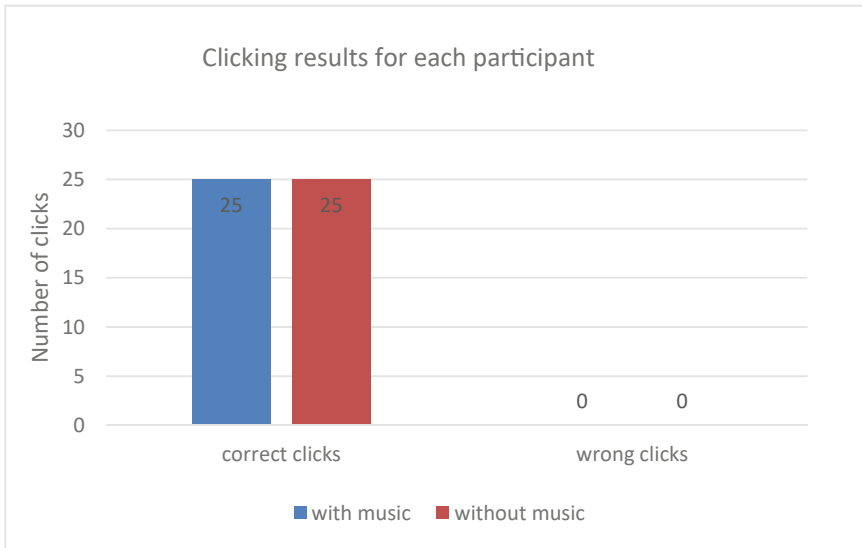


Fig. 2. The clicking results for each participant [Owner-draw].

analyze the difference of attention level between background music and no background music.

3 Results

3.1 The Result of the Data of Clicking Accuracy

There were 25 clicks in total. The attention test results show that the clicking accuracy of the 65 participants was the same. None of them made any clicking mistakes during the tests. As shown in Fig. 2, all participants' clicking accuracy was 100%.

3.2 The Result of the Data of Time

3.2.1 Overall Result

The attention test results indicate participants used less time to finish the Schulte Grid when they were exposed to background music, compared to a quiet environment without background music. The average time 65 participants used to finish the Schulte Grid with background music was 22.6 s, with a standard deviation of 4.9 s, while the average time they used to finish the Schulte Grid without background music was 23.9 s, with a standard deviation of 5.0 s. (see Table 1).

Table 1. The average time (s) and standard deviation [Owner-draw].

index	with music	without music
average	22.64615385	23.92307692
standard deviation	4.893971959	5.044513394

3.2.2 The Result of the Shapiro-Wilk Normality Test

Figure 3 shows that the data of time participants took with background music was statistically significant ($p = 0.05076$, ns). Thus, the data of time with background music was normally distributed. Figure 4 shows that the data of time participants took without background music was not statistically significant ($p = 0.02551$). Thus, the data of time without background music was not normally distributed. In general, the two sets of data of time participants used were not normally distributed.

3.2.3 The Result of the Wilcoxon Test

Figure 5 shows that there is a statistically significant difference between the data of the time participants used with and without background music ($p < 0.001$).

```
> shapiro.test(DATA111$With)
```

```
Shapiro-Wilk normality test
```

```
data: DATA111$With
W = 0.96325, p-value = 0.05076
```

Fig. 3. Shapiro test with background music [Owner-draw].

```
> shapiro.test(DATA111$Without)
```

```
Shapiro-Wilk normality test
```

```
data: DATA111$Without
W = 0.95752, p-value = 0.02551
```

Fig. 4. Shapiro test without background music [Owner-draw].

```
> 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. 5. The wilcoxon test [Owner-draw].

4 Discussion

The study demonstrated the effect of soft background music without lyrics on high school students' attention level. Researchers collected two sets of time data. Because the data were not normally distributed, a wilcoxon test was applied. According to the result researchers analyzed from the wilcoxon test, there is a statistically significant difference between the data of time with background music and that without background music. In general, the time participants spent finishing the attention test with background music was comparatively shorter than that without background music (see Fig. 6). Besides, all participants' clicking accuracy in this study was 100% right. The findings support the researchers' hypothesis that soft background music without lyrics has a positive effect on high school students' attention level.

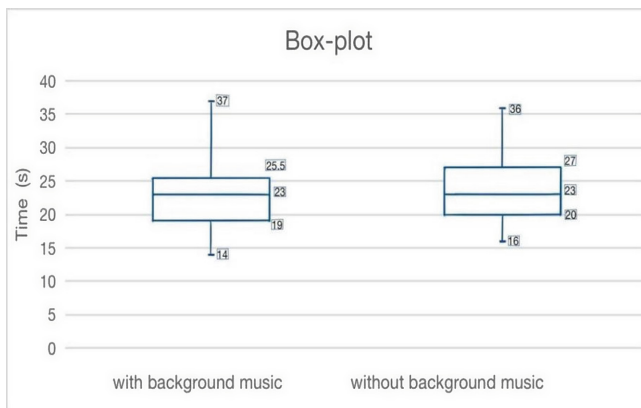


Fig. 6. The Box-plot for comparing the difference of time data of participants' with and without a background music (The time data of maximum, upper quartile, median, lower quartile, and minimum, from the top to the bottom in the Box-plot, are calculated from the dataset of the Schulte Gird attention test in the experiment.) [Owner-draw].

5 Conclusion

In conclusion, researchers observed the expected performance of the participants during the Schulte Grid attention test estimated in the hypothesis. The results of the study suggest that soft background music without lyrics has a positive effect on high school students' attention level. The finding of the study supports the common phenomenon of studying with background music among high school students that researchers observed and surveyed. Based on this study, high school students studying with soft background music without lyrics can increase their attention level and thus lead to higher efficiency.

Admittedly, some limitations are presented in this study. First, the sample size of the study is relatively small. Participants who were high school students from the age of 15 to 17 years old from high schools in China and the United States in this study can not directly represent all high school students in the world. Second, our participants include both Chinese and American high school students, growing up in different cultures and using different languages. Since participants were required to read the numbers while clicking during the test, the pronunciation of Chinese and English could make a difference. Third, only classical music was used in the study as soft background music without lyrics. In order to better evaluate the effect of soft background music, more soft music genres, like R&B and Blues, should be included in the study. Fourth, it's hard to ensure that all participants completely understood the procedures of doing the Schulte Grid after the researchers' brief introduction. Thus, some participants might waste time on understanding the steps while doing the attention tests. This could result in the bias of the time data researchers collected.

Considerably more work will need to be done to analyze the relationship between background music and human attention level. First, future studies should focus more on comprehensive music genres, including not only classical music, but also other music genres like Jazz, Blues and Rock music. Also, researchers can analyze the effects of different types of music on different types of human attention. Intense music with lyrics may decrease the attention level while studying by interfering with people's thoughts [8]. However, it can be effectively used by many people as the background music while doing sports. It helps people to concentrate on sports instead of being disturbed by the surrounding environment [9, 10]. Moreover, future studies should base on the analysis of the effect of music on attention and further explore the function of music therapy on treatments of some mental disorders, like ADHD and Mania. Finally, researchers should not confine studies to analyzing the relationship between music and attention. Instead, future studies should be widely used in different fields, like sports training and company operation.

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