

# Music Versus No Music Effectiveness On Cognitive Response Time and Typing Efficiency

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The abstract does not get added until after the project is finished or nearly finished.

CCS Concepts: • **Music, Typing Efficiency;**

Additional Key Words and Phrases: Typing Efficiency with Music, Cognitive Function

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## 1 INTRODUCTION

This project will focus on people's ability to type with distractions such as different types of music playing. It will then test their cognitive ability to focus on a hand/eye coordination test in which we will test how well they can match shapes by measuring speed and accuracy. The two-part test aims to help test if the music is too distracting or will help the people be more efficient at their work. This is important because many people do their homework or jobs while listening to music and should they make a mistake, it could end up costing someone their grade or the mistake at work has a cascading effect to cause more errors in their work. The two-part test will help determine if there is a correlation between the effectiveness of music versus no music on cognitive response time and typing efficiency.

### 1.1 Eye Tracking

Eye tracking technology, such as the EyeWriter 2.0, has become increasingly valuable in cognitive research, allowing for precise measurement and analysis of visual attention and eye movements. In this study, we incorporate the EyeWriter 2.0 to track participants' eye movements during the QBTest, a hand-eye coordination task. The EyeWriter 2.0 offers high-resolution tracking, capturing gaze patterns and fixations with accuracy. By analyzing participants' eye movements during the QBTest under different music conditions, we aim to understand how distractions, such as music, influence visual attention and cognitive performance. Understanding the impact of music on cognitive response time and typing

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efficiency, as measured by the QBTest and eye tracking, can provide valuable insights for improving work and study environments where music is commonly used as a background stimulus.

## 1.2 QBTest

The Quantified Behavioral Test (QBTest) is a well-established tool for assessing cognitive function, particularly in measuring hand-eye coordination, speed, and accuracy. Developed as a standardized measure, the QBTest provides valuable insights into cognitive performance across different tasks and conditions. In this study, the QBTest serves as a central component for evaluating participants' cognitive response time and typing efficiency under various music conditions. By administering the QBTest alongside eye tracking using EyeWriter 2.0, we aim to understand the impact of music on cognitive function and task performance. The QBTest's ability to quantify cognitive performance makes it an ideal tool for this study, allowing us to measure the effects of music on participants' ability to focus, process information, and perform tasks accurately. Through this research, we seek to provide insights that can enhance our understanding of how environmental factors, such as music, influence cognitive processes.

## 1.3 Typing Test

Typing proficiency is a fundamental skill in today's digital age, essential for academic and professional success. However, various factors can influence typing efficiency, including environmental stimuli such as music. Understanding how music affects typing speed and accuracy is crucial for optimizing work and study environments. This study uses a typing test to assess participants' typing performance under different music conditions. The test presents participants with lyrics from popular songs, simulating a real-world typing scenario where individuals may listen to music while working or studying. By measuring typing speed and accuracy under conditions of music with lyrics, music without lyrics, and no music (silent condition), we aim to determine the impact of music on typing efficiency. This research will contribute to our understanding of how environmental factors, such as music, can affect cognitive processes related to typing and may have practical implications for improving productivity in various settings.

## 2 RELATED WORKS

While there is not necessarily a concrete answer for whether music or background noise is effective on cognitive function, there have been many studies that attempt to determine the answer. The other studies attempted to search for this answer by focusing on word processing on a computer with the background music and the user's ability to formulate sentences [5], or determining if background music help users to keep their attention on their task at hand [3]. Similar to [3], [4] also examined how motivation and music were used hand-in-hand on "a time-consuming task and task performance". A different study done in 2010 again found similar results of music both being a hinderance and benefit [1]. According to [2], the degree of cognitive function may be based on an individual's personality.

Although [5] suggests that the music is a detriment, those with "musical training and high working memory span wrote better essays with longer sentences". This suggests that while the music slowed down the participants, it did not necessarily lower their cognitive ability in typing on their computer while focusing on forming text for the written essay for this particular study. For [1], the music caused enough of a difference in the time that was taken for writing a paragraph but "there were no significant differences in typing speed between the audio distractions". This again may suggest that the participants cognitive ability was not hindered when typing and may transfer to directly after should

the participants taken a test measuring their cognitive function. The slow timing was again seen in [2] in which “music generally impaired performance on a complex task but improved performance on a simple task”.

The study done through [3] saw opposite results as to [2]. The music or background noise “enhanced” the reaction time and performance of the tasks that we given to be completed. The results from [4] were split. The music was a detriment for logic puzzles in the user’s accuracy but aided in the efficiency of a writing task.

### 3 METHODOLOGY

After obtaining consent from all participants, they proceeded to take the typing test. The test presented lyrics from popular songs within a graphical user interface (GUI). The interface automatically calculated typing speed and accuracy in the program’s backend, allowing participants to focus solely on completing the test. Each participant completed the typing test under three conditions: music with lyrics, music without lyrics, and no music (silent condition). Multiple levels of music intensity were utilized within each condition to assess varying degrees of distraction. The GUI of the typing test was built with simplicity in mind. The starting window was pulled up so as not to confuse participants with the code as seen in Figure 1. The participants saw Figure 2 while the test is running, while Figure 3 is the signifier that the typing portion is finished.

They were given the instructions in the GUI with the text area where their text goes clearly visible and the only button in the window to start the test and timer. After they hit the “Get the Typing Test” button, the lyrics of the randomly

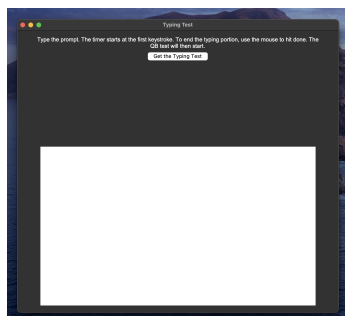


Fig. 1. Starting window of typing test

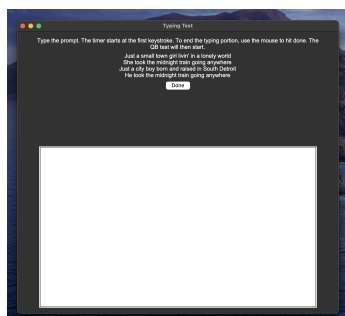


Fig. 2. Test started

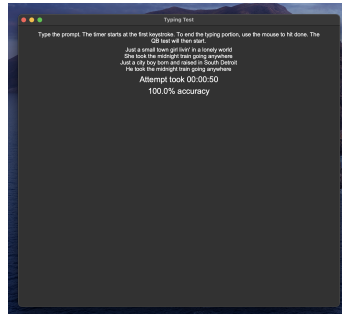


Fig. 3. Test finished

selected songs were displayed for the user to type. The text box for the users was already in focus with a “Done” button. After the users hit “Done”, their accuracy and speed were presented.

Following the typing test, participants proceeded to the cognitive task component of the study, which were also conducted under the three aforementioned conditions. While the participants did the cognitive task of a quantified behavioral test, they wore the EyeWriter 2.0 glasses that we specially built for this study.

### 3.1 Participants

Approximately twenty participants were recruited from Colorado State University. Ten males and ten females all in the age range of 18-99. There were no restrictions in regards to their major as long as they were able to type on a keyboard with no tilt on the keys. They have all previously either learned to type at primary school or through necessity.

### 3.2 Apparatus

Participants used two different Macbook Pros in this study. One Macbook ran the typing test while the other was used for the QBTest. The keyboard on the second Macbook was inaccessible as the eye tracker positioning would block the majority of the keys should they have taken the typing test and QBTest on a singular device.

#### 3.2.1 EyeWriter 2.0.

#### 3.2.2 QB Test.

**3.2.3 Typing Test.** The typing program was written in Python and compiled using Python3.9. While python can run on any device that has python installed, this study only used Macbook Pros running on Sonoma or MacOS 14. The singularity of the devices was used as the center of the screen for the typing test was hard coded when setting the starting position of the window for the typing test.

### 3.3 Procedure

Procedure

### 3.4 Design

Design

## 4 RESULTS AND DISCUSSION

Results and Discussion

## 5 CONCLUSION

Conclusion

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