Eye movements and reading comprehension in the Greek

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Abstract

The present study aimed to investigate reading comprehension of students while listening to music, using the eye tracking technology. Ten Greek university students participated in this pilot study and their eye movements were recorded, and more specifically fixation duration was measured, while they read two different texts in two different conditions: reading while listening to preferred music and reading in silence. The results of the participants' reading performance and visual patterns obtained for the reading comprehension task showed that were not statistically significant differences between the two reading conditions. The findings are discussed based on previous research studies, which either confirm or contradict them, and several limitations are proposed.

Keywords: reading comprehension, eye movements, background music

Introduction

The reading process is often a very cognitively demanding task and there are a multitude of variables that may affect how well the written information is assimilated. Students often read and study in environments where certain distractions, voluntary or not, compete for their attention, for example reading while listening to music or people talking in a café or watching television (Calderwood, et al., 2014). Previous studies have focused on the effects of background music on reading comprehension and have shown that reading comprehension can be improved using background music, such as Mozart's music and highly repetitive music (e.g., Khaghaninejad et al., 2016). In contrast, other studies have presented negative effects of background music on reading comprehension, using hip-hop music, slow-tempo music, fast and loud music and familiar non-lyrical music as background music (e.g., Zhang et al., 2018). The discrepancy between the findings of the aforementioned studies could be attributed to the differences in music style, such as loudness, tempo, form, complexity, genre, familiarity and whether the music is vocal or instrumental (e.g., Perham & Currie, 2014) and to the participants' individual differences, such as musical preferences and music expertise (e.g., Que et al., 2020).

Previous research has demonstrated that eye tracking is a useful research tool for uncovering the readers' processing strategies during reading (e.g., Jian, 2022). Fixation duration is one of the major general eye movement measures of

relevance to reading. Fixation duration is the time during which the eye fixates on a word and in adult readers, a fixation typically lasts between 60 and 500 ms (milliseconds) with an average of 250 ms (Rayner, 1998), while longer fixation duration is associated with more cognitively-demanding tasks (Reichle et al., 1998), such as tasks with music. For the Greek language, no studies have been conducted up to now that examined reading comprehension and eye movements while listening to music. The aim of the present study is to examine how reading comprehension is affected by preferred music, using the eye tracking technology. Our hypotheses are the following: a) the participants are expected to perform better in the reading comprehension task while listening to preferred music as compared to silence reading, and b) the participants are expected to have longer fixation duration while listening to preferred music as compared to silence reading.

Methodology

Ten undergraduate students of the University of Thessaly, Greece, participated in the experiment. All participants were native speakers of Greek language and the mean age of the participants was 22,8 (SD=7,2) years. Their eye movements were recorded while they read two different texts in two different conditions: reading while listening to preferred music and reading in silence. After each text, the participants completed a reading comprehension task consisting of five true or false questions.

Differences in the readers' visual patterns and reading performance across two reading conditions (preferred music and in silence readings) were examined: visual patterns were measured by fixation duration, and reading performance was measured by reading comprehension score. The Statistical Package for the Social Sciences (SPSS) was used for the statistical evaluation of the data. Reading comprehension performance (reading comprehension scores: average proportion of correct responses) and visual patterns (fixation duration: ms) which are the dependent variables, were analyzed using a within-subjects analysis of variance (ANOVA) with the reading conditions (preferred music and in silence) being the within-subjects factor.

Results

According to our results, as presented in Table 1., there was no statistically significant difference in the scores obtained for the reading comprehension task between the preferred music condition (8.59, SD=0.28) and the silence condition (8.59, SD=0.22). In addition, fixation duration was not presented statistically significant longer for the preferred music (155.13, SD=23.48) as compared to that of reading in silence (155.56, SD=24.16).

Table 1. Mean scores and standard deviations (SD) for the reading performance and visual patterns in preferred music condition and in silence reading.

Variable	Measure (unit)	Preferred Music (SD)	Silence (SD)	F (df)	Sig.
Reading performance	Reading comprehension score (0-10 point scale)	8.59 (0.28)	8.59 (0.22)	.04 (2.00)	.965
Visual patterns	Fixation duration (ms)	155.13 (23.48)	155.56 (24.16)	.002 (1.00)	.968

Discussion

According to the first hypothesis of our study, the participants are expected to perform better in the reading comprehension task while listening to preferred music as compared to silence reading. Our results showed that there were no statistically significant differences for reading performance between the two conditions, thus our first hypothesis is not confirmed.

Our results are in line with those of previous studies which showed that reading comprehension is presented neither improved nor impaired while listening to music (e.g., Que et al., 2020). However, our findings do not confirm those of previous studies which have shown that reading comprehension is better achieved in the presence of music rather than in the absence of it (e.g., Du et al., 2020; Zhang et al., 2018). The discrepancy between our results and those of the latter studies could be attributed to the different methodology they used. They focused on one or more music aspects (loudness, tempo, form, complexity, variety, familiarity, genre, whether it is vocal or instrumental, etc.) that had been selected for investigation by the researchers while this study focused on the participants' personal music preferences (preferred music) while reading. The difference in methodology in addition to the small sample size of our study, could provide an explanation for the different results that were obtained by a number of previous research studies on the subject.

According to the second hypothesis of our study the participants are expected to have longer fixation duration while listening to preferred music as compared to silence reading. Our results showed that there were no statistically significant differences for visual patterns between the two conditions, thus our second hypothesis is not confirmed.

Our results are in line with those of previous studies which showed that the participants did not have longer fixation duration while listening to preferred music as compared to silence reading (e.g., Que et al., 2020). However, our findings do not confirm those of previous studies which have shown that the participants have longer fixation duration while listening to preferred music as compared to silence reading (e.g., Du et al., 2020; Zhang et al., 2018). The discrepancy between our results and those of the latter studies could be attributed to the different kinds of music selected in each study. It is possible

that listening to a certain kind of music, which was not included in this study, might cause longer fixation duration while reading, due to characteristics intrinsic to music (Johansson et al., 2011).

In conclusion, our results showed that adult readers do not present better performance in reading comprehension or longer fixation duration while listening to preferred music as compared to silence reading. However, there are several limitations which do not permit the generalization of the findings of our study and these include: the small sample size of our study, the language of the tasks which was Greek, while in previous studies the language was different, mostly English and the fact that short reading comprehension tasks were used. Therefore, further research with larger samples and more tasks in the Greek language are needed in order to corroborate our findings.

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