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Does Background Music Affect Foreign Language Vocabulary Learning?

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ABSTRACT

Many people choose to listen to background music while working or studying, including while learning a foreign language. Previous research on the effect of background music has produced conflicting results, showing that music can act as a stimulating or disruptive agent, by improving or worsening performance on a cognitive task. This study investigated the effect of background music on foreign language vocabulary learning using a paired-associate task. Twenty-four participants were asked to study three sets of Czech vocabulary and their English translations under three music conditions: instrumental, vocal, and silent. Each study set was immediately followed by a test in which participants were asked to recall the English translations of the Czech words. The findings of the study did not fully support the hypothesis that background music will improve performance on a language learning task; although participants scored higher overall under the two music conditions than in silence, the result was not statistically significant. The results showed no significant difference in performance under the two music conditions, indicating that vocal music was not more disruptive than instrumental music. Additionally, the level of participants' musical training was measured, to examine the interaction between musicality and performance under the learning conditions containing music. No significant difference was found on the performance between higher and lower musicality participants, suggesting that musical training has neither an enhancing nor a detrimental effect on a language learning task under music conditions. Implications and limitations of the study are discussed.

Keywords: background music; foreign language vocabulary learning; verbal memory; musical training

1. INTRODUCTION

Effects of background music on the concurrent or subsequent performance of cognitive tasks have been widely reported in research to date, yet the findings appear to be rather mixed. According to Angel, Polzella and Elvers (2010), background music facilitates cognitive performance as it increased the speed of spatial processing and the accuracy of linguistic processing in their experiment. Furthermore, it has been found that background music can enhance intelligence test performance (Cockerton, Moore, & Norman, 1997). In their study, participants completed a general intelligence test under music and silent conditions, and the data showed that more questions were answered correctly in the presence of music. There also exists some evidence that music can have a positive effect on verbal memory. In Mammarella, Fairfield and Cornoldi (2007), for example, the presence of classical music in the background led to a significant increase in phonological working memory and phonemic fluency.

The evidence of a positive influence of music on cognitive tasks is challenged by a number of studies. Jäncke and Sandmann (2010), for instance, found no influence of background music on learning of verbal material consisting of non-words with and without semantic connotation. Salamé and Baddeley's (1989) findings, on the other hand, assert a negative effect of background music on verbal memory. They investigated the effect of background music on phonological short-term memory using an immediate recall of visually presented sequences of digits. Participants were tested under four different conditions: speech, instrumental music, vocal music, and silence. The results showed that both music conditions led to higher error rates than the speech and silent conditions. Furthermore, vocal music was reported to be significantly more disruptive than instrumental music, suggesting that the presence of words in music has a detrimental effect on immediate memory. Similar results were reported by Belsham and Harman (1977), who tested the different effects of vocal and non-vocal music on visual recall. Participants who listened to vocal music in the treatment condition made more errors than participants in the non-vocal group, demonstrating that vocal music was more distracting than instrumental music in an identical visual recall task.

Background music is very common in work-places, and it has been found that the study conditions in which students perform their schoolwork often include music (Patton, Stinard, & Routh, 1983). Previous research has shown beneficial effects of background music on learning and concentrating in schools. For instance, Savan (1999) studied the effect of background music on learning in pupils with special educational needs, particularly emotional and behavioural difficulties. She observed that the presence of background music in the classroom resulted in a significant improvement in pupils' concentration and co-ordination. A number of studies have further explored the effect of background music in classroom-based foreign language learning. Abdolmanafi-Rokni and Ataee (2014), for example, asserted significantly positive effects of background music in class on foreign language vocabulary recall and retention in Iranian children learning English. Similarly, Yilmaz (2011) investigated whether background music can boost vocabulary learning, with music played in class intended to trigger different moods which would help students associate new words with a certain type of music. At the end of a six-week trial, participants in the experimental group who were exposed to background music learned and retained more words than the control group in silence.

Improved foreign language learning in a music condition compared to silence outside a school context was also reported by de Groot (2006). The main focus of the study was to examine the effects of three verbal stimulus variables (frequency and concreteness of the native language words, and

typicality of the foreign language words) on paired-associate vocabulary learning. An artificial language was used in order to be able to manipulate the typicality variable and to prevent the possibility of previous exposure to the words to be learned. Background music was employed as an additional variable to investigate its effect on foreign language vocabulary learning. Participants were divided into two groups: classical music was played during learning to the treatment group, while the control group completed the task in silence. Although more words were reported to have been learned in the music condition than in silence, the results were not statistically significant as they did not generalise over all participants. This might have been due to the between-participants design of the experiment, which did not account for the natural learning ability of participants as an additional variable. It is likely that some participants performed better overall than others, but the division of participants into two groups who were tested in different conditions meant that participants could not be compared to their results in the other condition. Furthermore, the positive effect of background music did not generalise over all participants in the music condition, indicating that only a subgroup of participants benefited from the presence of music. De Groot speculated that the different effects of background music on participants could be explained by differences in participants' personality traits such as introversion and extraversion, as suggested by previous research (Daoussis & McKelvie, 1986; Furnham & Allass, 1999; Furnham & Bradley, 1997).

Another possible explanation for individual participants being affected by background music to different extents when performing a language learning task could be based on their level of musical training. It has been found that musically trained individuals process music in different ways, as neural resources involved in the processing of language and music strongly overlap (Koelsch, Gunter, Wittfoth, & Sammler, 2005). This has been supported by many studies exploring the effect of background music on cognitive tasks performed by musicians and non-musicians. Patston and Tippett (2011), for instance, investigated the difference in performance on language comprehension and visuospatial search tasks between musically trained and untrained individuals under music and silent conditions. The scores of non-musicians in both tasks were unaffected by background music. No negative impact of musical training was found on participants' performance on the visuospatial search task in the presence of background music. However, musically trained individuals performed significantly worse on the language comprehension task in the music condition, indicating that background music adversely affects the performance of musicians on language tasks. Patson and Tippett argued that this is due to the interference of the neural networks recruited in language and music processing in musically trained individuals, whilst in musically untrained individuals the processing of language and music remain more functionally independent.

The interaction between the effects of background music on learning and the level of the individual's musical training was further assessed by Kang and Williamson (2014), who conducted a study in which they investigated the effect of background music across musically trained and untrained individuals in a two-week foreign language learning trial. The experiment comprised an independent-samples design in which participants took a CD-based course in Mandarin Chinese or Arabic, which either contained background music or did not. This type of design presents a similar limitation to de Groot's (2006) study, as differences in individual participants' performance could not be compared between the two conditions. Background music improved performance on translation and recall tasks in Mandarin Chinese, but no significant effect was found in learning Arabic. The reason why no significant effect of music on learning Arabic was found is not clear; Kang and Williamson suggested that the different results might have been due to the fact that Arabic is a non-tonal language whilst Manadarin Chinese is a tonal language. However, further research into the different effects of background music on learning various tonal as well as non-tonal languages is required in this regard. Contrary to the findings of Patston and Tippett (2011), musicians did not perform significantly worse than non-musicians in the music condition, indicating that the level of musical training had no significant effect on participants' language learning ability in the presence of music. The conflicting findings of these two studies might be explained by the different types of language tasks which they employed as well as the difference in the testing times: in Patston and Tippett's study, participants completed a language comprehension task in one session, whilst Kang and Williamson administered recall and translation tests to participants after a two-week learning session. Kang and Williamson concluded that background music might facilitate long-term learning of certain languages, especially in the early stages of learning tonal languages.

To summarise, the studies discussed above provide interesting insights into how the presence of background music might affect language learning and verbal memory. Positive effects of background music have been reported to a certain extent in many previous studies, although the results across these studies were rather inconsistent, including some contradictory findings. This paper builds on the existing research and attempts to address some of the limitations in methodology of the previous studies. In order to increase the ecological validity of the present paper, Czech was used as the language to be learned, rather than an artificial language often utilised in previous studies. This study employed paired-associates lists, which are commonly used for vocabulary acquisition and can be found in many foreign language textbooks. Paired-associate learning is a simple yet effective method of vocabulary learning, involving the pairing of the target words with their respective translations. Background music was played only during the learning stage in order to simulate a common learning-then-testing experience: foreign language students may study vocabulary while listening to different types of background music (or none), but music is not typically allowed under exam conditions. Rather than a between-participants design, this study adopted a within-participants design in order to account for different executive function abilities of individual participants.

The aim of this paper is to examine whether the presence of background music can enhance foreign language vocabulary

learning in a paired-associate task, as measured by participants' ability to translate words from the target language in a translation test immediately following the learning trial. The previously mentioned literature, revealing that the presence of background music can aid verbal memory and language learning, provides a starting point for the hypothesis for the present paper that participants' performance will improve in the music conditions compared to silence. Drawing on previous research, vocal music is expected to be more disruptive than instrumental music. However, due to the lack of existing research comparing the effects of vocal music and silence on a language learning task, no reliable prediction can be made as to whether participants will perform better in the vocal condition or silence. Participants' musical training will be measured to assess whether levels of musical training can affect participants' performance under music conditions. Higher level of musical training is predicted to be associated with worse performance in the music learning conditions compared to the silent condition.

2. METHOD

Design. The experiment employed a within-participants design in which all participants completed all tasks in all experimental conditions. Independent variables included three different music conditions: instrumental, vocal, and silent. Immediate vocabulary recall was used as a dependent measure. Three versions of the experiment were created with the music conditions in different orders to counteract order effects.

Participants. 24 subjects (15 females and 9 males) participated in this study. Their ages ranged from 19 to 31 years old (M = 22.08, SD = 2.88). All participants confirmed that they had no previous knowledge of the Czech language. Some experience in foreign language learning was claimed by all participants, as all indicated that they can speak at least one language other than their first language. No participant indicated a knowledge of any Slavic language, the language group to which Czech belongs. Participants' musical background was measured using the *Musical Training* subscale of the Goldsmiths Musical Sophistication Index (Gold-MSI henceforth; Müllensiefen, Gingras, Musil, & Stewart, 2014). The scores ranged from 8 to 49[1] (M = 33.42, SD = 11.99), showing a wide variety of levels of participants' formal musical training.

Materials.

Questionnaires. Before the participants began the main learning task, they completed two preliminary questionnaires: (1) a demographics questionnaire, and (2) the *Musical Training* subscale of the Gold-MSI (Müllensiefen, Gingras, Musil, & Stewart, 2014). The demographics questionnaire included questions about participants' age, gender, experience in foreign language learning, knowledge of foreign languages, and their listening habits during studying. The *Musical Training* dimension of the Gold-MSI self-report inventory comprises 7 questions relating to formal musical training, including years of lessons in an instrument (or voice), lessons in music theory, average daily practice, and the degree of self-assessed musicianship.

Learning task. For the vocabulary to be learned, the Czech language was chosen to minimise the chances of previous exposure, as Czech is not typically taught as a foreign language around Europe. Three vocabulary sets were created, each containing 15 Czech words and their English equivalents (see Appendix). The Czech words were all nouns ranging from 3 to 7 letters in length and were distributed equally across the three sets so that each set would contain the same number of words of equal length. All vocabulary was taken from the *Frequency Dictionary of Czech* (Čermák & Křen, 2011) which contains a list of the 5,000 most frequently used words in the language. The words were selected on the basis that they did not resemble any English word.

Musical stimuli. The background music chosen for this study were excerpts from two pieces of classical music. The instrumental music condition contained an excerpt from the third movement of Mozart's *Clarinet Concerto in A major*, K. 622, which was also used in Savan's (1999) study, where it suggested increased levels of concentration. The movement employs a soloist with a full orchestra and features variations in texture, tonality and dynamics. It is fast (it is marked *Allegro*), generally moderately loud, and is often described as happy and high-spirited. For the vocal music condition, the aria "La Calunnia è un venticello" from Rossini's *The Barber of Seville* was used. This aria was also used in Salamé and Baddeley's (1989) paper where the researchers studied the negative effect of vocal music on short-term memory for visually presented verbal material. The aria is in Italian and features a bass soloist accompanied by an orchestra. It was beneficial to use a vocal piece in a foreign language rather than English, as a piece in a language of which the participants have a good command might be more distracting due to the participants' ability to understand the lyrics. The opening of the aria is slow, but towards the end of the excerpt the tempo gets faster (marked *Allegro*). The dynamics stay relatively quiet throughout the excerpt. Carrying typical features of the *opera buffa* genre, the aria can be characterised as light-hearted and playful. For both music excerpts the first 2 minutes of the pieces were used. The silent condition contained a silent countdown which beeped after 2 minutes.

Procedure. The study was advertised via social media and word-of-mouth. Respondents were invited to take part in the experiment on an online survey platform (onlinesurveys.ac.uk) on the condition that they were aged over 18 years and that they had no previous knowledge of the Czech language. Following completion of an online informed consent form and the two preliminary questionnaires (a demographics questionnaire and the *Musical Training* dimension of the Gold-MSI), participants were provided with instructions for the main task. They were

[1] The scores on the *Musical Training* subscale of the Gold-MSI can range from 7 to 49, with 7 being the lowest possible score and 49 indicating the highest level of musical training.

asked to learn a vocabulary set while listening to a 2-minute musical excerpt (or a silent countdown). They were informed that each set would be followed by a translation test.

Before the main experimental trial, participants completed a short practice trial of the task to ensure that they understood the procedure. The practice trial contained 5 pairs of stimuli and a 20-second musical excerpt, followed by a translation test. The vocabulary and music in the practice trial were different from the treatment conditions. Participants were instructed to play the practice audio file to check their sound playback was working and to adjust the volume to an appropriate level.

The main experimental task consisted of three learning sessions, in each of the three experimental conditions. The order of the conditions was counterbalanced, while the order of the vocabulary sets to be learned remained the same for all participants. In each condition all 15 translation pairs were presented simultaneously. Czech words and their corresponding English translations were presented in pairs, next to each other. Each vocabulary set was immediately followed by a translation test in which participants were asked to recall English translations of the Czech words from the set they had just studied. The Czech words in the translation test were presented in a different order to the learning set. Participants were given as much time as they wanted for the translation test. The music was played only during the learning section, not during the translation test. The completion of the whole experiment took approximately 15 minutes.

3. RESULTS

The highest possible score in the translation test following each learning set was 15. Figure 1 shows the mean scores across all participants in each condition. The data indicated that on average participants scored higher in the two music conditions than in silence. The mean score for the instrumental and vocal condition was 11.75 (SD = 2.89 and 2.98, respectively) and 10.83 for the silent condition (SD = 3.27). A one-way repeated measures ANOVA carried out to analyse the scores on the translation test achieved by participants in each condition revealed that the difference in scores was not statistically significant: $F(2, 46) = 1.88$, $p = .16$.

In order to determine whether musical training as an additional variable could explain the individual differences in the task performance, participants were divided into two groups using a median split on their scores on the Musical Training dimension of the Gold-MSI (Mdn = 36). Figure 2 shows the mean scores of participants in the higher and lower musicality groups in each condition. Overall, participants in the higher musicality group (M = 12.14, SD = 2.82) scored higher than participants in the lower musicality group (M = 10.75, SD = 2.34) across all three conditions. In the instrumental condition, the mean score of higher musicality participants was 11.92 (SD = 3.06), compared with lower musicality participants who scored 11.58 on average (SD = 2.84). In the vocal condition, the mean score of higher musicality participants increased to 12.67 (SD = 2.87), while that of lower musicality participants decreased to 10.83 (SD = 2.92). Both groups performed worst in the silent condition, in which higher musicality participants on average scored 11.83 (SD = 3.51) and lower musicality participants 9.83 (SD = 2.79). Using an independent samples t-test, no significant difference was found on the overall mean score across all conditions between the higher and lower musicality groups groups, $t(21.28) = 1.31$, $p = .20$.

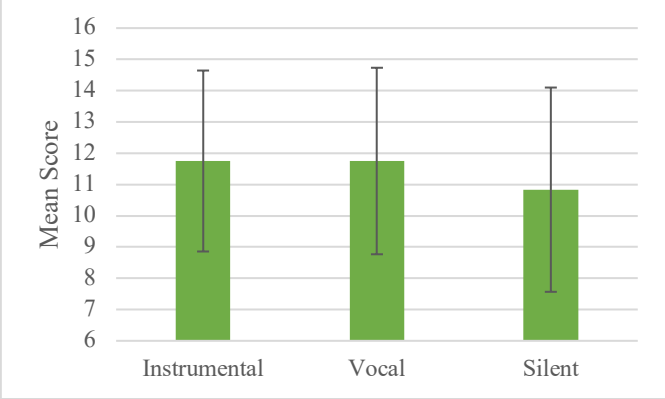

Figure 1. Mean scores and standard deviations on the translation test across participants under each condition.

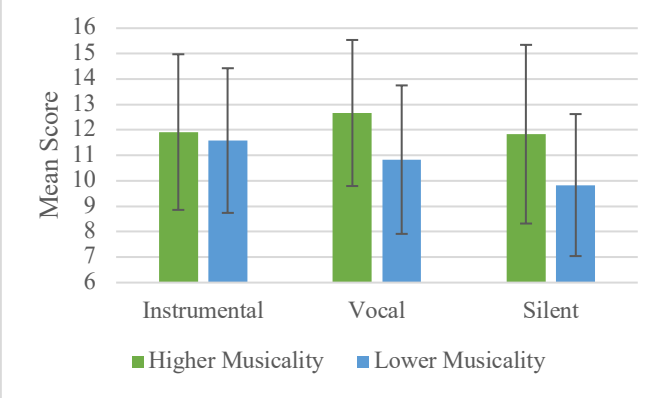

Figure 2. Mean scores and standard deviations on the translation test between higher and lower musicality groups under each condition.

The distribution of the conditions in which participants achieved their best scores, as shown in Table 1, was quite inconsistent with the mean scores in each condition. Most higher musicality participants (75%) scored highest in the vocal condition, while only a subgroup of 33.33% performed best in the instrumental condition, compared with 41.67% of highest number of correct answers achieved in silence. 66.67% of lower musicality participants performed best in the instrumental condition, 41.67% in the vocal condition, and only 8.33% in the silent condition. Quite interestingly, only one – higher musicality – participant from the whole sample scored the highest in the silent condition only.

No strong correlation ($r = .01$) was found between participants' mean performance across the two music conditions and the frequency with which they usually listen to music while studying.

Table 1. Percentage of Participants in the Higher and Lower Musicality Groups Who Achieved their Best Score under Individual Conditions

	Instrumental	Vocal	Silent
Higher musicality	33.33%	75%	41.67%
Lower musicality	66.67%	41.67%	8.33%

Note: Some participants achieved their best score in more than one condition.

4. DISCUSSION

The main experimental hypothesis that the presence of background music will improve performance on a paired-associate language learning task has received partial support. The results showed that participants performed better overall in the music conditions compared to silence, although the individual scores were rather inconsistent. The analysis of the results failed to reveal a significant difference in scores across the three conditions, contradicting the existing evidence of positive effect of music on language learning in previous research (e.g. Abdolmanafi-Rokni & Ataee, 2014; Yilmaz, 2011). The discrepancy in the findings may be due to the different methodology and word learning task: effects of background music on a paired-associate task completed in one session as studied in the present paper vary from those on long-term language learning in the real-world setting of a school classroom examined by Abdolmanafi-Rokni and Ataee, and Yilmaz. Contrary to the original hypothesis, participants performed equally well in the instrumental and vocal condition. Whilst Salamé and Baddeley (1989) reported a detrimental effect of vocal music on a recall task involving numbers, the findings of the present paper suggest that vocal music is not more disruptive than instrumental music in a language learning task, implying the tasks recruited different neural resources.

Another aim of the paper was to determine whether musical training as an additional variable can help explain the differences in the task performance. Participants in the higher musicality groups performed generally better than lower musicality subjects, however the difference in scores was not statistically significant. The results showed that the ability of more musically trained people to learn and recall vocabulary was not reduced when music was played in the background, supporting the findings of Kang and Williamson (2014) rather than those of Patston and Tippett (2011). This implies that musical training might not have any effect on short-term verbal memory, as opposed to the positive relationship between musical training and second language acquisition suggested by previous research (e.g. Francois & Schön, 2011). Further research is required in order to support this hypothesis.

However, a potentially important factor in the results obtained could be the scale of the difference between the higher and lower musicality groups compared. Despite a wide ranges of scores on the *Musical Training* subscale in the present paper (the lowest recorded score was 8, and 49 the highest), the scores were generally high (M = 33.42, SD = 11.99), indicating that many individuals in the lower musicality group should not be regarded as "non-musicians" due to their relatively high level of musical training. Future research should therefore aim to sample participants with more prominent differences in their musicality. It is also recommended to use more subscales of the Gold-MSI or an alternative way of measuring musicality, as the *Musical Training* subscale in itself covers only a small portion of what constitutes musicality.

Other limitations linked to the sample of participants in this study was the age of the participants, as the sample included mainly young adults (M = 22.08, SD = 2.88). Previous research suggested that learning a foreign language is more difficult for adults than children (e.g. Johnson & Newport, 1989; Newport, 1990); studying the effect of background music on language learning between different age groups might therefore be a potential avenue for further research.

The choice of the pieces used in the learning task posed several limitations in the method of the present study. The stimuli in this paper reused pieces of classical music employed in previous studies, and they were chosen based on their instrumentation (instrumental vs. vocal) without considering other aspects of the music, such as tempo, volume, emotion conveyed, etc. Designing a study in which the stimuli would be drawn from a greater variety of genres, and which would take into account more parameters of the music than instrumentation alone, might produce more ecologically valid results. Furthermore, familiarity with music as a potential confounding variable was not considered, although it might have interacted with the role of the background music in the learning process. Data was not collected on whether participants had been equally exposed to the music prior to the experiment, and the sample most likely included some individuals who were familiar and some who were unfamiliar with the stimuli. In future research it might be interesting to study whether participants' familiarity with the musical stimuli can affect their performance on a language learning task. Finally, a different experiment in which music would be played during both learning and testing, not only in the learning process, might yield different results to the present study.

In conclusion, the findings of this study suggest that background music had neither a significantly enhancing nor a significantly detrimental impact on a foreign language vocabulary learning task. Participants with a high level of musical training did not demonstrate worse performance on the language learning task under music conditions than in silence, yet the sample of musically untrained individuals was not representative in this study due to the participants' relatively high levels of musicality. Further research is required to gain a better understanding of how different types of music and familiarity with musical stimuli can affect language learning.

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APPENDIX: Vocabulary Sets Used in the Experiment

Set A

Czech word	**English translation**
Oko	Eye
Cesta	Road
Voda	Water
Divadlo	Theatre
Den	Day
Koruna	Crown
Vstup	Entrance
Srdce	Heart
Otec	Father
Ulice	Street
Pokoj	Room
Hora	Mountain
Město	City
Žena	Woman
Postel	Bed

Set B

Czech word	**English translation**
Les	Forest
Hlava	Head
Cena	Price
Postava	Figure
Syn	Son
Budova	Building
Stroj	Machine
Schod	Stair
Ruka	Hand
Matka	Mother
Dopis	Letter
Vlas	Hair
Škola	School
Svět	World
Peníze	Money

Set C

Czech word	**English translation**
Zub	Tooth
Slovo	Word
Pole	Field
Letadlo	Airplane
Bod	Point
Kostel	Church
Strom	Tree
Dcera	Daughter
Kruh	Circle
Kapsa	Pocket
Obraz	Image
Kolo	Bike
Židle	Chair
Dítě	Child
Obchod	Shop