


The effects of background music on the work attention performance between musicians and non-musicians

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For occupational safety and ergonomics, the relationship between work attention performance and background music is a trend for the future. Attention performance may be influenced by some personal factors, such as experience of music training. This investigation explores the difference between the attention performance of musicians and that of non-musicians based on a quasi-experimental design to gain a preliminary understanding of the possible effect of background music on the attention performance of both groups. This study found that a musician's attention performance is better than a non-musician's and that background music tends to improve the attention performance of both musicians and non-musicians, but to a greater extent for musicians.

Keywords: music training; attention; background music

1. Introduction

For occupational safety and ergonomics, the impact of the work environment on attention performance is worth studying [1,2], and background music may increase performance because of its ergogenic effect on mental function [2]. Attention performance can be affected by many personal factors, such as learning and education [1,3,4]. Musical training involves a very specialized learning process, and many studies have found a difference between the attention performance of musicians and that of non-musicians [3,5–7]. One study has proposed that musicians' perceptual and neural enhancements are driven in a top-down manner by strengthened cognitive abilities with training [7], and another study indicated a more balanced attentional capacity in musicians, as well as enhanced visuomotor ability, interpreted with reference to extended musical training [3]. Some neurologists reported on the brain and cognitive effects of musical instrumental training on young children, based on a cognitive neuroscience study and a cross-sectional comparison of older children after 14 months of observation [8]. Therefore, the attention performance score in an attention test may differ between musician and non-musicians. A study of the background music in the workplace of 65 workers found that background music had both positive and negative effects on work attention performance [9].

As already mentioned, personal learning experience may influence attention function; background sounds may also influence people's attention performance when they

are working or performing conducting and other activities. Numerous studies have claimed that background music can affect attention performance [1,10]. Some studies suggested that background music improves worker productivity, continuity [11,12] and attention performance [4,13]. An investigation of vocational training programs for chronic mental patients found that background music clustered their concentration level, lowered their anxiety and enabled them to finish the tasks at hand in a shorter time [14]. One study of group therapy established how various types of background music – classical, popular, traditional Chinese and no music – affected the frequency of occurrence of inappropriate behaviors in patients with psychosis [12]. Others have analyzed how different genres of background music, and how the listeners' degree of preference for the background music, can influence listener concentration in attention tests, based on randomized controlled trials. These studies have also revealed that the effect is more strongly related to the listeners' fondness for the music than to the type of music. The likelihood that background music will affect the attention performance of a test-taker is likely to increase with the degree to which the test-taker likes or dislikes the music [15]. Shih et al. [1] focused on how background music with or without lyrics can influence the attention performance of 102 voluntary participant workers, and they found that background music with lyrics had significant negative effects on concentration and attention. Numerous studies have analyzed the factors that influence the correlation between background

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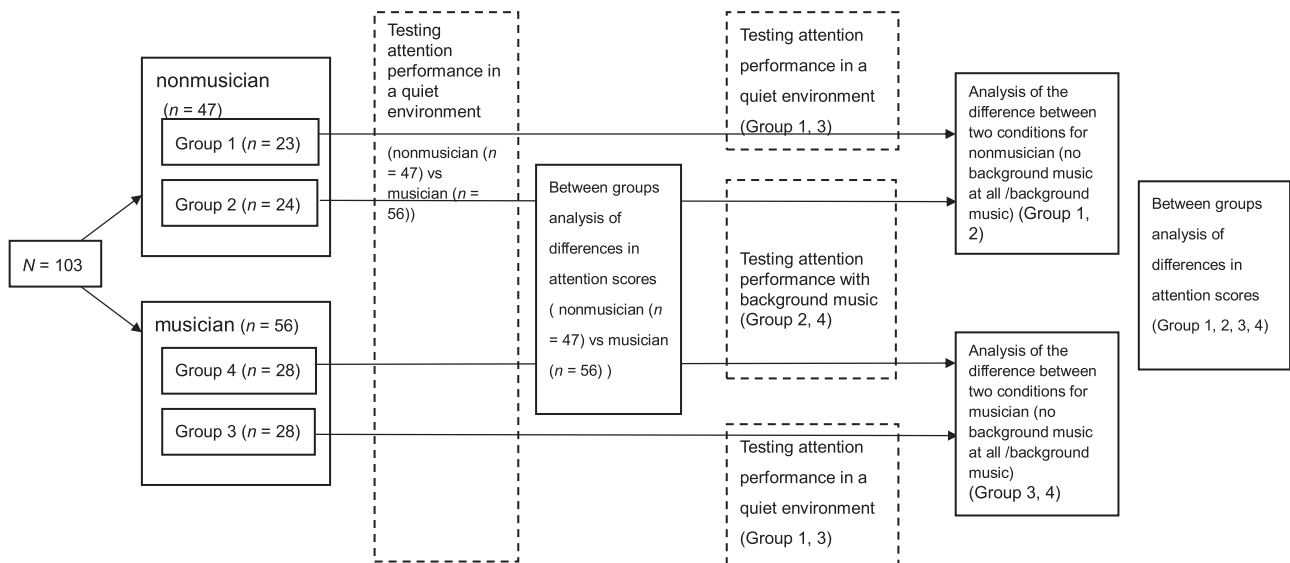


Figure 1. Research procedure.

music and attention performance – factors such as type of background music, fondness for the background music and whether the background music has lyrics. However, few studies have compared musicians to non-musicians in terms of attention performance, and the effect of background music thereon, as a result of personal musical learning experiences.

This study uses a quasi-experimental design to provide a preliminary understanding of the difference in attention performance between musicians and non-musicians, and of the possible effect of background music on their attention performance during the performance of tasks.

2. Methods

In this study, a quasi-experimental design was conducted. The Institutional Review Board approved the experimental procedure. All of the test-takers participated voluntarily after giving informed consent; each will receive a small gift. Figure 1 shows the experimental procedure.

2.1. Participants

Of the 103 test-takers, 56 were musicians and 47 were non-musicians. Musicians had studied music since childhood and had learned to play musical instruments; they also majored in music in college. Non-musicians had never studied music theory or learned to play an instrument, and they did not take music as a college major. Musician test-takers were aged 21–25 years; 13 were males and 43 were females. Non-musician test-takers were also aged 21–25 years; 11 were males and 36 were females, as presented in Table 1.

2.2. Research equipment

2.2.1. Chu's attention test

Chu's attention test is a standard evaluation tool frequently used in occupational therapy [1,16]. It is usually applied in case studies of attention to demonstrate the level of attention provided by community services in the future. This is a writing test including more than 100 questions, each of which requires the participants to view a series of scrambled codes, search for the '*' sign among these codes, count the occurrence of '*' and record this as the answer. The testing time is 10 min, and the final score is the 'Total number of answers' minus the 'Number of wrong answers'. This tool has been used to measure the correlation between work attention level and background music [16].

2.2.2. Background music

We prepared some soft music, songs popular in the Asian area.

2.2.3. Tool for statistical analysis

All statistics were performed using SPSS version 20.0 and $p < 0.05$ was considered to be statistically significant. The t test, mean and standard deviation were used to analyze how different types of background music can influence attention test performance.

2.3. Research procedure

The research procedure, shown in Figure 1, was as follows.

Step one involved 103 voluntary participants (musicians = 56, non-musicians = 47). We used an

Table 1. Characteristics of participants ($N = 103$).

Characteristic		Musicians ($n = 56$)	Non-musicians ($n = 47$)
Gender	Males ($n = 24$)	13	11
	Females ($n = 79$)	43	36
Age ($M \pm SD$)		22.90 ± 2.21	23.00 ± 2.39

independent-samples t test to ensure there were no significant group differences in age and gender between non-musicians and musicians.

In step two, in a quiet environment, we conducted an attention test on the 103 participants (56 musicians, 47 non-musicians). We then used a t test to compare the scoring differences between musicians and non-musicians.

In step three, we divided the test participants into four groups: group 1, 23 non-musicians; group 2, 24 non-musicians; group 3, 28 musicians; group 4, 28 musicians. At the pre-test stage, we conducted the attention test in a quiet environment for all four groups. At the post-test stage, groups 1 and 3 remained in a quiet environment, whereas groups 2 and 4 took the test with soft music in the background.

Finally, step four compared the scoring differences between pre-test and post-test for groups 1, 2, 3 and 4 respectively.

3. Results

The attention performance of musicians was better than that of non-musicians. The mean attention performance of musicians was 111.19 and that of non-musicians was 97.64, and the variance between the two was statistically significant ($p = 0.003$), as presented in Table 2. In studying ‘the effect of background music on the attention performance of musicians and non-musicians’, soft music was played in the background. The test participants were divided into four groups. For groups 1 and 3, both the pre-test and the post-test were performed in a quiet environment; the score for the pre-test in groups 1 and 3 was 94.35 and 109.20, and for the post-test in groups 1 and 3 was 98.74 and 112.40, respectively, but the results revealed no significant variance. For groups 2 and 4, the pre-test was performed in a quiet environment but the post-test was performed in a soft music environment. The score for the pre-test in groups 2 and 4 was 106.74 and 119.14, and for the post-test in groups 2 and 4 was 118.53 and 133.07, respectively; the results exhibited significant variance, as presented in Table 3. Both musicians and non-musicians present better attention performance with background music than in a quiet environment.

4. Discussion

Medically, background music has an excellent regulating effect on human psychology and physiology [2]. This study

Table 2. Difference in attention performance between musicians and non-musicians.

Participants	n	M	SD	p (t test)
Non-musicians	47	97.64	23.56	0.003*
Musicians	56	111.19	18.49	

* $p < 0.005$ statistically significant difference.

investigated the attention performance of musicians and non-musicians, and the findings and a discussion thereof follow.

4.1. Musicians' attention performance is better than that of non-musicians

In this study, musicians' attention performance was better than that of non-musicians (Table 1). Numerous studies have discussed how early-childhood musical education/training can help people [7,8] and positively affect attention performance [3]. One study with 42 research objects found that high musical performance may be associated with high executive and control function [5], and that attention performance is related to executive and control function [16], so the finding that a musician's attention performance is better than a non-musician's is reasonable. Based on a popular attention test in 103 ethnic Chinese individuals as research objects, this study drew the same conclusion. This finding explains why music education/training improves the attention performance of all.

4.2. A background musical environment tends to produce better attention performance than a quiet environment

Both musicians and non-musicians exhibit better attention performance in the post-test with soft music in the background than in a quiet environment (Table 3). Many researchers have investigated the effect of background music on human attention levels, but no unanimous conclusion has been reached [1,10,12], mainly because researchers have used various types of background music. Some studies have found that, unlike rock music or music with lyrics, beautiful classical tunes and music without lyrics tend not to influence people's attention, and they may even help people to stabilize their mood and concentrate on the issue at hand [12,15]. Since the soft music used in this study is fairly similar to such music, it yielded similar results.

Table 3. Influence of background music on attention performance between musicians and non-musicians.

Participants			<i>M</i>	<i>SD</i>	<i>p</i> (<i>t</i> test)
Non-musicians (<i>n</i> = 47)	Group 1 (<i>n</i> = 23)	Pre-test (in a quiet environment)	94.35	21.27	0.234
		Post-test (in a quiet environment)	98.74	24.36	
	Group 2 (<i>n</i> = 24)	Pre-test (in a quiet environment)	106.74	22.01	0.006*
		Post-test (with background music)	118.53	17.95	
Musicians (<i>n</i> = 56)	Group 3 (<i>n</i> = 28)	Pre-test (in a quiet environment)	109.20	19.99	0.063
		Post-test (in a quiet environment)	112.40	16.36	
	Group 4 (<i>n</i> = 28)	Pre-test (in a quiet environment)	119.14	14.56	0.003**
		Post-test (with background music)	133.07	13.71	

* $p < 0.01$ statistically significant difference; ** $p < 0.005$.

4.3. Soft background music increases the attention level of musicians significantly more than that of non-musicians

The effect of listening to music on cognitive abilities is highly debated [13]. Some studies have found that soft music can stabilize a listener's moods and positively influence the listener's attention performance [11,12,14]. Some studies have noted that background music can also distract a listener [9,15]. Such positive and negative effects on listeners are worth studying. This study, in which the background music was soft, finds that musicians' attention levels are improved significantly more than those of non-musicians. Why? Two investigations have found an association between music training and listening abilities [6,17], and a recent study found that musical training in childhood improves children's resistance to disturbance by a noisy environment [7]. Some studies have noted that musicians have enhanced auditory processing abilities, and these abilities are paralleled by an improved understanding of speech in noisy environments [18], because musicianship is associated with neuroplastic changes in brainstem and cortical structures [17]; in other words, musicians may work more smoothly than non-musicians with background sounds. Therefore, the musicians and non-musicians in our study may have been equally influenced by the soothing effect of soft background music, exhibiting better attention performance over that in the absence of background music. Furthermore, since musician test-takers are less distracted by background music, improvement in their attention performance exceeds that of non-musicians. This study involved only 103 participants, of whom males were a small minority. In the future, we shall use a much larger sample size to better understand the difference between the attention performance of musicians and that of non-musicians.

5. Conclusions

Based on the results of this study, the following conclusions are drawn and suggestions offered.

5.1. Education and training in music can improve one's work attentiveness

Many researchers have investigated the importance of musical education to human society. This study found that people who had childhood musical training demonstrate better at-work attention performance than those who did not. This study included only 103 research objects, who were all ethnic Chinese. In the future, we shall use a much larger sample size and compare the effect of musical education on the at-work attention of various ethnic groups.

5.2. More ergonomic issues between background music and work performance

The research equipment (Chu's attention test) in this study is classified as a visual attention test. In the future, we shall explore other work behavior, such as auditory attention, eye-hand coordination, long-term memory or work memory. A full-scale approach will be utilized to examine the effect of background music on work performance.

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