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The Effects of Music Type and Volume on Short-Term Memory

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This investigation focused on the effects of music type and volume on short-term memory. Twenty one university undergraduate students were given a list of sixteen nonsense syllables in Japanese katakana characters to be memorized for two minutes with music, either being present or absent. They were all tested individually and were all tested in seven conditions consisted of memorizing and being tested with no music, tested after memorizing with loud and soft classical music, loud and soft hard rock music and loud and soft familiar music. All the conditions were chosen randomly. After they had memorized the lists of words they were given one minute to recall as many words as they could without being accompanied by any of the background music. It was hypothesized that volume has less effect when memorizing with familiar music than when memorizing with unfamiliar music and it was also hypothesized that familiar music are not as distracting as unfamiliar music, but these expected results were not found. Findings from this study suggested that students who study while listening to familiar music shows no significant differences than of students who study while listening to songs that the participants have only heard once. Results also indicated that volume has no effect on the number of words being recalled in all the music type conditions even in the rock music condition.

Key words: music type, volume, short-term memory

Introduction

Music has been a source of entertainment for many centuries. Studies on music have grown vastly and now music does not only play the role of entertainment for our listening pleasure. The exploitation in music leads to how the 8 key notes affect the functions of a human brain. Researches on how music can calm ourselves in music therapy, how music can enhance learning ability, how music can help recall past events and many more have made music more than just a plain entertainment.

Various kinds genre of music are being played night and day in all corners of the world; rocks, pop, classical and jazz are some genres of music that people listen to. For many years human have been enjoying many unique genres of music. We have progressed through the ages with different sounds of choice. Due to today's popularity of high-fi stereo equipment and louder music, students are finding it harder to study. Yet, many college students do study while listening to music. Music can affect us in many different ways. Music can cause arousal or it can lower arousal depending on the type of music we listen to and how loud we listen to them. Music has established psychological effects, including the induction and modification of cognitive states,

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mood and emotion (Weinberger, 1997).

Previous studies of the effects of music on performance have showed mixed results with some studies reporting positive effects and some reporting negative effects of music on performance.

Numerous studies have been conducted to test the Mozart effect. The Mozart effect is a term used to explain the claim that people perform better on tasks when listening to music composed by Mozart. Rauscher, Shaw, and Ky (1993) found that performance improved on abstract/spatial reasoning tests after participants listened to Mozart as opposed to a relaxation tape or silence. No difference was noted between the latter two interventions.

Contradictory to the above study, the McFarland and Kennison (1987) assumptions are that the right hemisphere of the brain processes the music. Participants require greater effort to successfully learn a task with the presence of music.

Moore (1999) studied on the effects of music type and volume on memorization. Similar to previous studies, music type seemed to have no effect on memory scores; however there was a slight increase in the number of errors for participants who were exposed to high volume levels.

In most research, the experimenter has arbitrarily selected the music. Etaugh and Michals (1975) proposed a study to examine the effects on reading comprehension of music chosen by the subject rather than by the experimenter. They concluded that the more frequently students reported studying to music; the less music impaired their performance.

Wolf and Weiner (1972) did a study on effects of four noise conditions on arithmetic performance. The proportion of correct responses for simple arithmetic problems was compared in four noise conditions. Results showed that in the music condition, it showed significantly better performance than the industrial noise condition while all other conditions were no different from each other. The participants were college students who listened to "hard-rock" music and reported that on occasion they had even studied while listening to this kind of music. This is to say, that unfamiliar noises are potentially more distracting than familiar noises even when loudness levels are equivalent.

The hypotheses of this study were that volume has less effect on familiar music in memorization than on unfamiliar music. A loud sound will give a negative effect than a soft sound. Also in this study, Wolf and Weiner's (1972) hypothesis that unfamiliar sounds are more distracting than are familiar ones was tested as well.

Method

Participants

Twenty-one students from the Tohoku University, Miyagi, Japan participated in this experiment. There were 11 males and 10 females tested. The participants ranged in age from 18 to 25 years old. It was assumed that all participants had normal hearing.

Participants were assigned to bring their own preferred record album which in this experiment would be called "familiar music" to the experiment session. Then, they were assigned to all classical music, hard rock music and familiar music to both loud and soft conditions. The

experiment was conducted in two days.

Materials

Apparatus. Items included in this experiment were a sound level meter and Victor brand compact component CD/MD player. The maximum volume output for this player is 84.5 dB/W.m.

Music. The classical music that was played was "Allegro" from Mozart's Symphony No. 4 in D major KV 19. The hard rock music that was played was "Here to Stay" from Korn's Greatest Hits Volume 1 album. Both were chosen due to its unfamiliarity among the participants.

The familiar music chosen by the participants were mostly pop and were mostly Japanese music. Participants were asked how familiar were they with the music that they brought to participate in the experiment, how often they listen to the music that they brought to the experiment and also how often do they listen to the music while studying. The results of the ANOVA calculation on the above questions given to the participants revealed that the participants are familiar with the music that they brought, they listened to the music very often but they rarely listen to the music that they brought to the experiment.

The same questions were asked for the classical music and rock music. All participants were not familiar with both classical music and rock music at all.

Memory Test. The memory test was a list of 16 nonsense syllables for each session. The syllables are all in two Japanese Katakana characters form displayed in a 4×4 table. The words were randomly chosen from the harder to recall sections. The reason of choosing words that was harder to recall was to avoid a perfect score.

Distraction Test. The Uchida-Kraepelin Psychodiagnostic Test was chosen as the distraction test in the experiment. It was thought that the item that was used to recall should be different from the item that was used to distract the participants to avoid zero number of words recalled in the second recall.

Questionnaires. There were two kinds of questionnaires given out to the participants in the experiment. One of them was the five question questionnaire that was given out to the participants after each session to ask the participants regarding the music and volume that was played in each session. The other questionnaire was given to the participants at the end of the experiment on the second day. The questionnaire asked if they have listened to music while studying and what kind of music, if they have any musical background and other questions that were related to the study.

Conditions

There were a total of seven testing conditions. These conditions consisted of a participant either studying no music, studying with loud classical music, studying with soft classical music, studying with loud hard rock music, studying with soft hard rock music, studying with loud familiar music and studying with soft familiar music. Recall sessions were held without music in all conditions.

Soft music was played at 45 ± 5 decibels and loud music was played at 65 ± 5 decibels and the musical source was two meters away from the participants. The measurements of the volume were taken in the test room. In the study of the effects of music type and volume on memorization (Moore, 1999), the soft music was played at 55 decibels and the loud music was played at 70

decibels and both musical sources were 10 feet away from the participants. In the current experiment, the distance between the musical sources and the participants were closer it was decided that the soft music was played at 45 ± 5 decibels.

Procedure

Participants were placed in a sound proof room. Testing occurred in 4, forty minutes session. A memory test was present, faced down at the participant's seat. The participants were then instructed that on the first cue they were to turn over the word list in front of them and given two minutes to review it. On the second cue they would return the list face down then were given one minute to recall as many words as possible.

Then after that, they were given the Uchida- Kraepelin Psychodiagnostic Test and were assigned to do the test for two minutes. After the test, the participants were then given one minute to recall as many words as possible from the list that they were provided earlier at the beginning of the session. Finally, for each session with music, the participants were given the five question questionnaire.

The participants participated in all music conditions and volume for 2 days. They were randomly assigned to participate in either a two loud one soft condition on the first day and a two soft one loud condition on the second day or a two soft one loud condition on the first day and a two loud one soft condition on the second day. On the second day, the participants were given the general questionnaire at the end of the last session. The participants were tested individually.

Results

The Analysis of Variance (ANOVA) test was calculated in order to compare music volume levels and music type on correct test responses. It was also calculated in order to know if participants are familiar with all the music that was played.

A 2(Recall sessions) $\times$3(Music Type) $\times$2(Volume) within-subject factorial Analysis of Variance (ANOVA) was calculated comparing music type and volume to memory test scores in two recall sessions. The results of the no music condition were also calculated using the same method. The ANOVA test was calculated in order to compare music volume levels and music type on the number of words recalled. The main effect of volume level on number of words recalled was not significant ($F\,(1, 20) = .181, p > .05$ n.s). However, the main effect of music type on the number of words recalled was significant ($F\,(2, 40) = 8.621, p < .001$). The interaction between music type and volume was not significant ($F\,(2, 40) = 2.289, p > .05$). Thus, it appears that only music type has effect on the number of words recalled on memory test.

Table 1 show the mean number and standard deviation of the number words recalled in each testing sessions in both volume conditions. It is revealed that in all three music type conditions, the numbers of words recalled were less in the 2nd recall session than the 1st recall session. It also revealed that participants were able to recall more words in the classical music condition words in the classical music condition than the other two music conditions.

Table 1 Mean and Standard Deviation of number words recalled in each testing sessions

Recall	Music Type	Volume			
		Soft		Loud	
		M	SD	M	SD
1	No Music	7.33	2.30	7.33	2.30
	Familiar	6.43	1.71	7.00	2.00
	Classical	8.10	2.16	7.33	1.98
	Rock	6.19	1.84	6.24	1.20
2	No Music	6.81	2.36	6.81	2.36
	Familiar	5.71	1.69	6.52	2.20
	Classical	7.19	2.50	5.67	1.96
	Rock	5.10	2.39	5.29	2.27

Comparisons of each of the music type conditions at soft volume with the no music condition revealed significant differences in performance only in the rock music ($p < .05$). The result revealed that the numbers of words recalled were less when the rock music was played than with no music even if loudness level is low. None of the other comparisons with the no music condition were significant. However, significant differences on tests number of words recalled in comparison of classical music condition with rock music($p < .05$) and in comparison of classical music condition($p < .05$) shows significant differences in performance as well. Comparison of familiar music condition with rock music condition did not show any significant differences (Figure 1) because the types of music that most participants chose for the experiment were almost the same as the rock music that was played in the rock music condition.

Comparisons of each of the music type conditions at loud volume with the no music condition revealed significant differences (Figure 2). Furthermore, there were no significant differences on the number of words recalled in comparison between music type conditions with each other. The results showed that participants were able to recall more words in the classical music condition than the other two music conditions.

Table 2 shows the mean numbers for interaction between the number of words recalled in both recall sessions and music type. It is revealed that in all three music type condition, the number of words recalled were less in the 2nd recall than the 1st recall in all three music type conditions. It also revealed that participants were able to recall more words in the classical music condition than the other two music conditions in both the 1st and the 2nd recall.

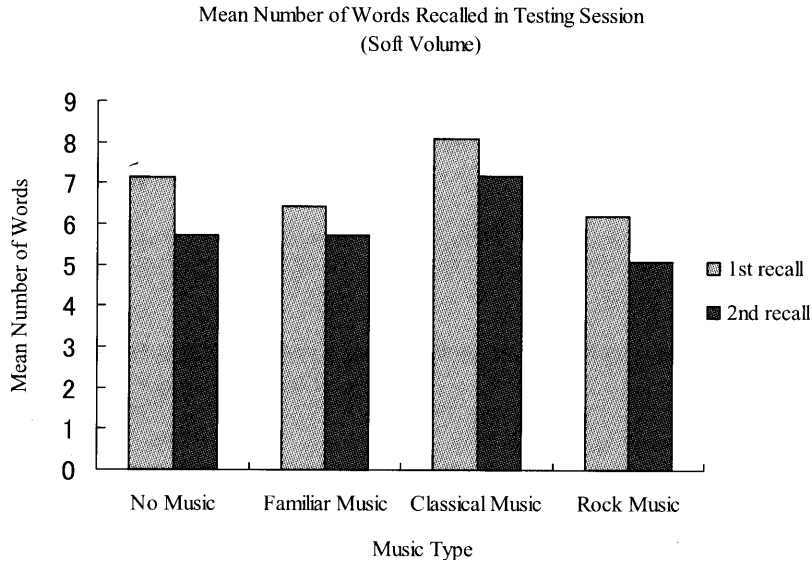

Figure 1. Mean number of words recalled in each testing session according to music type in the soft volume condition

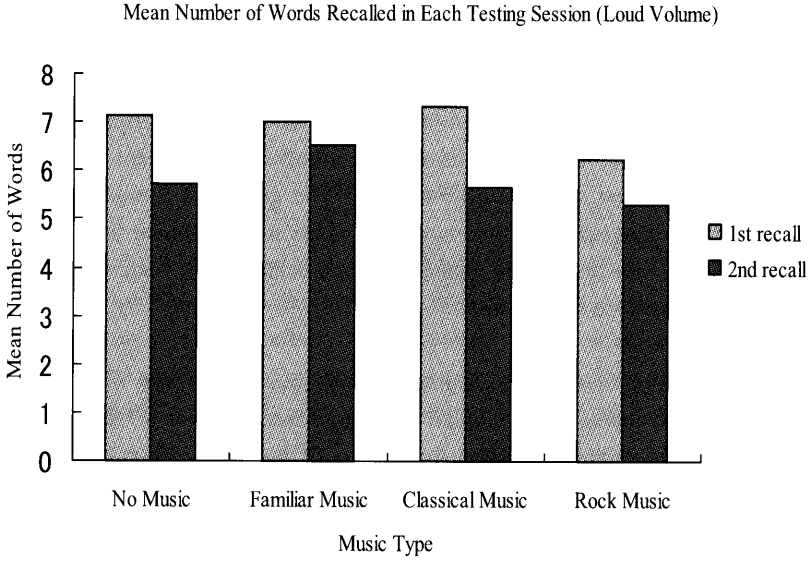

Figure 2. Mean number of words recalled in each testing session according to music type in the loud volume condition

Table 2 Mean Numbers for Interaction between Number of Words Recalled in Both Recall Sessions and Music Type

Recall	Music Type		
	Familiar	Classical	Rock
1	6.71	7.71	6.21
2	6.12	6.43	5.19

Table 3 Mean number of participants' familiarity on the music that was played in the experiment

	Music Type		
	Familiar	Classical	Rock
How familiar are you with this music?	4.76	1.00	1.00
How often do you listen to this music?	4.71	1.00	1.00
How often do you listen to this music while studying?	2.91	1.00	1.00

According to Table 2 and the results calculated with Ryan's method, it is clearly shown that participants recalled more words in the classical music condition in both recall sessions though the classical music selected was unfamiliar to all participants. There were no significance differences in comparison between the numbers of words recalled in both session and the music type between familiar music condition and rock music condition. The genres of familiar music that most participants brought to participate in the experiment were mostly upbeat (e.g., pop music and rock music) and a bit similar to the rock music that was selected by the experimenter. Therefore, no significant differences were calculated.

Questionnaires

The familiar music chosen by the participants were mostly pop and were mostly Japanese music. Participants were asked how familiar were they with the music that they brought to participate in the experiment; how often they listen to the music that they brought to the experiment and also how often do they listen to the music while studying (Table 3). The results of the ANOVA calculation on the above questions given to the participants revealed that the participants are familiar with the music that they brought, they listened to the music very often but they rarely listen to the music that they brought to the experiment while studying.

The same questions were asked for the classical music and rock music. All participants were not familiar with both classical music and rock music at all.

Table 4 Mean Numbers of Participants' Grading on the Loudness of the Music that was played in the Experiment (Soft Volume)

	Music Type		
	Familiar	Classical	Rock
How loud was the music being played?	2.71	2.57	3.00
Were you distracted by the volume?	3.24	2.62	4.24

Table 5 Mean Numbers of Participants' Grading on the Loudness of the Music that was played in the Experiment (Loud Volume)

	Music Type		
	Familiar	Classical	Rock
How loud was the music being played?	4.62	3.81	4.57
Were you distracted by the volume?	4.00	3.14	4.62

Earlier it was shown that the main effect for volume level on the number of words recalled was not significant. According to the participants' answer to how much the volume distracted them, it showed clearly that in the rock music condition, participants were distracted in both the soft condition (Table 4) and the loud condition (Table 5) but not distracting enough for the participants to show significantly poor performance in the number of words recalled.

Discussion

The data from this study did not support the hypothesis that volume has less effect on familiar music in memorization than on unfamiliar music because it was revealed in the results that the main effect for volume level on number of words recalled was not significant.

According to the participants' answer to how much the volume distracted them, it clearly showed that in all music conditions, participants were not much distracted in the soft condition but more distracting in the loud condition. Thus, it was not distracting enough for the participants to show significance poor performance in the number of words recalled.

However, significant differences on number of words recalled in comparison of classical music condition with rock music and in comparison of classical music condition with familiar music condition showed that participants finds it easier to recall more words in the classical music condition than in the familiar music condition and rock music condition in both volumes.

Comparison of the familiar music condition with the rock music condition did not show any significant differences because the types of music condition and rock music condition in both

volumes.

It also did not support Wolf and Weiner's (1972) hypothesis that unfamiliar sounds are more distracting than are familiar ones. Participants found that the music that they are familiar with is distracting them from memorizing the words and also recalling them in both the recall sessions. The music that they had chosen has become a distracter instead of helping them with the memorization and recalling.

The data from this study did not support both hypotheses maybe a result of a number of different circumstance. One reason could be the lack of sufficient numbers of participants. Only data from 21 participants were able to gather due to lack of participation. Had there been more subjects, it is possible that both the hypotheses would have been supported.

The types of music that participants brought to the experiment were similar to the hard rock music that was prepared. Therefore, results to compare the differences in mean number of words recalled between familiar music condition and rock music condition did not show any significant differences.

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