THE EFFECTS OF CLASSICAL MUSIC ON SHORT TERM MEMORY

RACHEL SUZANNE GRAHAM

To the Graduate Council:
I am submitting herewith a thesis written by Rachel Suzanne Graham entitled "The effects of classical music on short term memory." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree Master's of Science, with a major in Clinical Psychology.

Charles Grah, PhD, Major Professor

We have read this thesis and recommend its acceptance:

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Dean of the Graduate School

THE EFFECTS OF CLASSICAL MUSIC ON SHORT TERM MEMORY

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Abstract

For this study, 40 undergraduate students were studied to determine the effects of classical music on short-term memory. The participants were given a free recall task and asked to recall and then recognize presented lists borrowed from Roediger and McDermott (1995). One list was accompanied by background classical music while the other had no background music. Two pieces of music were used, one relaxing and the other not. It was hypothesized that relaxing classical music played during verbal presentation of the lists would improve recall and recognition. It was also hypothesized that the false recall and recognition would increase with the relaxing classical music. It was hypothesized that the non relaxing music would have no effect. Results showed that there was no significant difference, $F(1,38)=0.586, p>0.05$, between groups with relaxing music versus non-relaxing music. When comparing recall between lists with music and lists without there was no difference, $F(1,38)=0.274$, $p>0.05$. Recall of the non-presented target word showed no significance between the $F(1,38)=0.060, p>0.05$. Total intrusion errors for all conditions showed no difference between the groups $F(1,38)=1.886, p>0.05$. Recognition results showed no difference in the overall ratings, but significant findings among ratings of critical items, list items, and distracter items, $F(1,38)=229.359, p<0.05$.

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CHAPTER 1

INTRODUCTION

Memory has been a subject of research for many years. Still, there is much about memory that is not understood well. Memory is described as "the process of retrieving information gathered during experiences of the individual from the representational system of the mind" (Atkinson & Shiffrin, 1968). The organization of memory needs more explanation.

There are three types of memory that individuals use daily according to Atkinson and Shiffrin (1968). Long-term memory is the portion of the memory where elements are stored for future use. This aspect of memory allows us to recall elements that occurred anywhere from many years ago to several weeks ago. Information for long-term memory is stored semantically. Long term memory is considered to have an unlimited capacity for storage, and is thought to be permanent.

A second type of memory has been termed sensory memory. Sensory memory is believed to have a large capacity, but to only be able to capture an experience for a brief moment, perhaps less than one second. In contrast, the third type of memory, short-term memory, has a limited capacity. Information presented remains in short-term memory anywhere from five to 20 seconds. When new information is needed to be stored, such as a number just looked up in a phone book, old information is either lost

or is moved into long-term store. If the information is actively rehearsed then it will remain there for longer periods of time and may move to long-term memory if rehearsal occurs enough to activate the long-term store. The information for short-term store is most likely to be encoded acoustically.

When the information has been placed in memory the next step is to use that stored information through the process of recall. Much attention has been given to the process of recall. Flanagan (1993) suggested that recall be categorized in two distinct groups. Reproductive memory is accurate recall from memory. This type of memory is used to recall simple word lists, or what is typically used to remember names. Reconstructive memory often involves errors. During this processing the mind fills in information where information is missing. This type of recall is used when telling stories or recounting events. It is also the type of recall that is involved when one falsely recalls. Reconstructive memory also accounts for false recognition.

Recognition memory, on the other hand, involves familiarity of the subject in question. When the subject matter is presented, the recognition memory determines whether it was or was not presented previously (Brainerd, Wright, Reyna, & Mojardin, 2001.) The familiar subject matter triggers the recognition memory and either determines the presented subject

as previously presented material or as material not presented.

One of the problems with recognition is that it is often incorrect. This problem, according to Underwood (1965), begins during the coding process. During the coding process a stimulus is presented. However, the actual "memory" coded may be the opposite of what was presented or one that is similar. For example, one may hear the word "on," but recognize the word "off" as the presented word.

Another explanation of the problem involves the Activation Theory (Collins & Loftus, 1975.) This theory explains the process of remembering as activation through a network that occurs when a memory is evoked. When the network is activated, memories may be recalled that are not related to the original memory being sought due to the fact that the memory was not encoded well in the beginning. Recognition assists in attempting to remember information that was not encoded well enough to recall without prompting.

Research with the free-recall paradigm shows that items recalled from a list are more likely to be the first presented and the last presented (Glanzer M. & Cunitz, 1966.) This serial position curve reflects the fact that as each item is presented, the likelihood that it will be recalled decreases initially. As the end of the list draws near, the likelihood of recall increases. This paradigm demonstrates that the first items

presented are rehearsed enough to have already been placed in long-term store, which aids in recall. The recency effect refers to better recall of the words presented at the end of a series. That is, because these words were just heard.

Deese (1959) also studied the free-recall paradigm. In his study, he constructed 36 word lists that all corresponded to non-presented critical words which were associated to the words on the lists. Deese found that the non-presented critical words were remembered as if they had actually been presented on the list.

Roediger and McDermott (1995) conducted three experiments using Deese's paradigm. The first experiment of the three conducted was designed to determine the validity of Deese's claims that the non-presented target words would be recalled as often as the words that were presented in the middle of the list. They found that the critical non-presented target words were recalled as often as items in the middle of the list. During the second experiment a recognition test was administered after the recall tasks. In this experiment they found that subjects falsely recognized these non-presented words as "old" words as often as words that had actually been presented. They believed that these false memories might have occurred because of the associations which are activated when a participant hears material. For example, even though the participant may hear the

word "low" it may be associated to the word "high" and thus the word "high" is remembered in addition to, or instead of, the word "low." Through all of the research regarding the complexities of memory, many wonder what may contribute to better memory. Much research has been devoted to this study with specific attention to the belief that relaxation may enhance memory.

Memory and Relaxation

Chaney and Andersen (1972) performed a study that examined memory performance where anxiety was a factor. The presence of the anxiety was determined by a pretest of the study. This study split 48 college age females into three groups. One of the groups employed the assistance relaxation techniques. The participants in the other two groups were either given a placebo pill or were instructed in body mechanics without relaxation training. Fifteen unsystematic digit sets of five to twenty digits each were presented for recall. These random sets were presented prior to the manipulation for each group to set the norm. After six weeks of the manipulation, another test of the fifteen digit sets was presented. Statistical analysis showed that those in the Jacobson relaxation techniques group performed better on the recall task.

There is dissenting research that shows that relaxation may

not always result in an improvement in memory. Rankin, Gilner, Gfeller, and Katz (1993) looked at an elderly population. In this study, thirty volunteers, with a mean age of 74, were given anxiety measures to determine the anxiety level of the participants. The participants were placed in two groups with one group receiving training in relaxation and the other being a control group. When they were administered the Wechsler Memory Scale Revised, there was no difference between those who had been given the training and those that had not been given any training in relaxation. It bears mention, however, the study that did see a difference involved participants of younger age. It is possible that as people age the effects of relaxation on memory may no longer exist.

Relaxation and Classical Music

Training techniques are often used to induce relaxation. They often involve muscle relaxation and specific physical training. Another technique for inducing relaxation is listening to music. Hertz, Hertz, and Klayman (2000) enlisted the assistance from thirty volunteer employees at a medical college. In their study, they separated their subjects into three groups: music (dance style music was played), guided imagery, and a control group that received no treatment. Their study found a difference in recall in the group where relaxation was achieved

and the group where there was no treatment. Relaxation was measured by blood pressure and pulse and was achieved using the guided imagery. There was no difference in the group that used music compared to the other two conditions; however, the researchers did mention in the discussion that the music may have had more of an impact had it not been dance music.

Staum and Brontons (2000) compiled a group of 140 students made up of music and non-music majors. In the study, they manipulated whether music was played at lower decibels versus higher decibels. Their results showed that soft music was preferred for relaxation. This study stated that relaxation could be achieved with softer music.

Classical Music and Mental Tasks

The most popular study of classical music and enhancement of mental tasks produced a finding that became known as the "Mozart Effect" (Rauscher, Shaw, & Ky, 1993.) The researchers hypothesized that musical experiences, even if they are short, can have an effect on intelligence assessments. The participants listened to the Mozart Sonata for Two Pianos in D Major for 10 minutes prior to performing tasks from the Stanford-Binet Intelligence Scale, Fourth Edition (Thorndike, Hagen, & Sattler, 1986). It was found that listening to the music led to an increase of eight or nine Intelligence Quotient points on some

of the spatial reasoning scales. These results, however, only lasted for 10 to 15 minutes.

Steele, Ball, and Runk (1997) attempted to extend this study using backward digit span recall. This study included 36 college students from psychology courses from a local university. For their study, two tapes were made. One tape was a recording of Mozart's Sonata while the other was of a soft rainstorm. After verbal instructions, each participant heard one of the two tapes or sat quietly. The participants were then presented with three different digit strings each containing nine digits. After presentation of the digits they were asked to recall the string in reverse order. Their results were not consistent with the results of Rauscher, Shaw, and Ky (1993.) Rather they found no performance enhancement in backward digit recall after listening to 10 minutes of the Mozart Sonata.

Other studies have also looked at the effects of music on recall. Baugh and Baugh (1965) performed a study that looked at the effect of four different music styles on recall of nonsense syllables. This study involved 50 volunteer college students from undergraduate college courses. Participants were randomly assigned to five different conditions. They were 1) no music, 2) classical music, 3) oriental music, 4) jazz music, and 5) rock and roll music. The nonsense syllables were presented visually to all participants. When music was played, it was played while

the nonsense syllables were being presented. The participants were asked to recall and correctly spell as many of the nonsense syllables as possible. They did not find a significant difference. They did find that there was a difference between the types of music played. If the subject was more familiar with the music, as discovered by a questionnaire given during the study, they did not recall as much as those who were unfamiliar with the music being played. This "familiarity effect" is thought to be the result of distraction caused by hearing familiar music during the study period.

Another study by Belsham and Harmon (1977) studied the effect of vocal and non-vocal music on visual recall. For this study there were 40 participants. The subjects were given a photograph to study for 60 seconds. Two groups of ten participants heard vocal music in the background during their study period. Two other groups, both with ten subjects, heard non-vocal music in the background. The results showed that the groups presented with vocal music had more recall errors than the group with the non-vocal music. The researchers believed that the vocal music was distracting because of its semantic qualities.

Nittono (1997) performed research that looked at the effects of background music on serial recall. More specifically, it looked at how non-vocal music played both forward and

backward would affect the serial position curve. During this study participants were shown a nine-digit sequence. They were presented one digit at a time for a time period of 750 milliseconds. They then were instructed to wait 13 seconds before beginning to write down all nine digits in sequence. The music played forwards, with each of the four compositions, produced more errors than the music played backwards. This study used musical compositions, *El Bimbo*, *In the Mood*, *William Tell Overture*, and *The Entertainer*. These compositions were believed to be more popular by the authors of this study than others. Consequently, the negative effect on recall could have been due to the familiarity effect described by Baugh and Baugh (1965).

Overall music's effect on mental tasks and memory has been studied often, but have all found different results. Chaney and Anderson (1972); Hertz, Hertz, and Klayman (2000); and Rauscher, Shaw, and Ky (1993) found relaxation improves recall. However, Rankin, Gilner, Gfeller, and Katz (1993); Baugh and Baugh (1965); and Nittono (1997) did not. This study further investigates this effect.

Overview of the Study

This study required participants to listen to word lists simultaneously with classical music and then to recall as many words as possible. The purpose of this study was to do two

things: a) determine how recall and recognition might be influenced by the relaxing qualities of music and b) determine how music influences false memory.

The intent of this study is to have participants listen to presented word lists, having the lists alternate between music in the background and no music in the background. Two musical selections, one relaxing and one non-relaxing will alternate sessions. Recall and recognition tasks follow the list presentations.

It was hypothesized that recall would increase during the relaxing music phase since relaxing music is believed to assist in the processing of presented words and might also result in the lowering of the response criterion. It was also hypothesized that background classical music with a relaxing quality would increase recall of non-presented target words because relaxing state would reduce the mind's ability to discriminate among presented and non-presented words. With regard to recognition, it was hypothesized that the relaxing music would aid in the processing of the presented words. Relaxing music would increase ratings of words presented and for the critical word. Ratings for words not presented would decrease because of the relaxation. Finally, it was also hypothesized that non-relaxing music would have no affect on correct recall, correct recognition, or false memory.

CHAPTER 2

METHOD

Participants

This research used 40 college age participants who volunteered for the study. The average age of participants was 27. Of the participants in the main study, 77.5% were female, and 22.5% were male. All participants were at or above the age of 18. Each participant received an extra-credit slip for participation in the study.

Materials

The two word lists (see Appendix A) used in this study were taken from Roediger and McDermott (1995.) The two lists were chosen because of their high concentration of concrete words and the concreteness of the critical non-presented target-word. Each list contained 15 presented words and one non-presented critical word. The words on each word list were related to a non-presented critical word. The non-presented target word made it possible to study false recall. Each list was recorded on its own cassette tape.

The musical pieces were chosen through a pilot study where 17 participants listened to four different selections and then rated how relaxing each selection was. The music used in the pilot study were obscure classical pieces that were meant to be

unfamiliar to the participants. The four selections were *Bach's Minuet #3 in C Major*, *Chopin's Nocturne for Violin and Piano*, *Tchaikovsky's Piano Concerto #1 Allegro*, and *Schubert's Unfinished Symphony*. The pieces were rated on a scale of one to five, with one being "not relaxing" and five being "very relaxing." *Bach's Minuet* was rated at 2.5, *Chopin's Nocturne* at 4.44, *Tchaikovsky's Piano Concerto* at 2.06, and *Schubert's Symphony* at 3.38. Findings from the pilot study determined that the selections to be used in the current study would be *Chopin's Nocturne for Violin and Piano* as the relaxing piece and *Tchaikovsky's Piano Concerto* as the non-relaxing piece. There were no vocals in the two pieces used. The non relaxing pieces allowed for a better look into the effect of relaxing music.

Recall forms were created for the study. Each form contained six sheets. The first two pages were for recall of the presented words. Each list had its own sheet. The next sheet was blank. The Recognition sheets followed. The Recognition sheets were made up of presented words, the critical non-presented word, and 16 other words (distracters) that may or may not have been related to the words presented in the lists. For example, for the list with fruit as the critical non-presented word, the word tree might have been added as a word that closely relates. Then the word winter might be added as it does not relate to the critical word fruit. For each list there were 32 words from

which to choose for the recognition task. The participants were asked to indicate on a scale of one to five how well they remembered hearing the word with one being "not at all," and five being "very well." The last sheet was post-experimental information sheet. Questions that were asked included (1) age, (2) gender, (3) "were you familiar with the piece of music?" (4) "did the music help you relax?", (5) "on a scale of one to five, with one being 'not very relaxed' and five being 'very relaxed' how relaxed were you during the experiment?"

Design

The design for this study was a mixed design, with music versus no music as the within subjects and relaxing versus non relaxing as between subjects. Counterbalancing of the variables was used. There were two lists (List 1 and List 2) and two pieces of music (relaxing and not relaxing). For each test session the lists and music were presented in the following order. The first session presented List 1 and List 2 and played them in that order. For this session, no music was played with List 1 and the relaxing music was played for one minute then continued until the completion of the list presentation. There was no music during the recall phase. Then List 2 was presented. The music was played in the same way for each session. The second session played List 2 with no music then List 1 with the

relaxing music. Sessions three and four continued in this manner, but utilized the non-relaxing music in place of the relaxing music. For sessions five through eight the lists with the music were played first with the lists without music played second. See Appendix F for a diagram of the design.

Procedure

Participants were asked to read and sign a consent form prior to participation in this study. An opportunity to ask questions and withdraw from the study was given after all participants had read the consent form. They were provided with all needed materials including a pen and all booklets. Instructions told them to leave their booklets alone until told otherwise. They were also told the intentions of this study.

All participants were read a standardized set of instructions. Participants were tested in small groups of five. They were informed that two different word lists would be presented to them. The words were spoken at a rate of one word every two seconds. Emphasis was placed on trying to recall as many words as possible without guessing. After a list was played a hand-signal was given and participants began writing down the words they could recall. Seventy-five seconds was allotted for recall. When this period of time was over, subjects were asked to stop and turn their booklets to the next blank page. The next word list followed the same procedure. When the recall period

was completed, the participants were instructed to complete the recognition sheets. They were instructed to circle the number, which correlated with how well they remembered the word with one being "not at all," and five being "very well." They were then instructed to turn to the back page and answer the post-experiment questions as honestly as possible.

CHAPTER 3

RESULTS

Post-Experimental Information

Three questions were asked on the post experimental questionnaire that related to the musical pieces. The first asked if the participants were familiar with the music. Of the 40 participants in the study, 13 or 32.5% stated that they were. When the participants were asked if the music helped them to relax, 30 or 75% stated that the music, regardless of relaxing versus non-relaxing, did help them to relax. Only five participants from each condition reported that they were not relaxed by the music. The last question asked them to rate how relaxed they were. On a scale of one to five, with one being "not at all" and five being "very," the mean for the relaxing piece was 3.750 (SD=1.020), while the mean for the non-relaxing piece was 3.200; (SD=1.105). A *t* test showed that the difference was not statistically significant, $t\ (1,38) = 1.636$, $p > 0.05$.

Classical Music and Recall

Means and standard deviations were computed for correct recall of words with and without music. These statistics are presented in Table 1.

TABLE 1: CORRECT RECALL OF PRESENTED WORDS

	With music Relaxing	With music Non-relaxing	Without music Relaxing	Without Music Non-relaxing
Means	9.250	8.750	9.300	9.100
Standard Deviations	1.552	2.197	1.720	1.997

A 2x2 mixed analysis of variance indicated that the overall recall performance for the group which heard the relaxing piece of music did not differ statistically from that of the group which heard the non-relaxing music, $F(1, 38) = 0.586$, $p > 0.05$. The analysis also failed to find a difference in the recall resulting from whether music had been played or not, $F(1, 38) = 0.274$, $p > 0.05$. This was true regardless of the specific type of music played, $F(1, 38) = 0.154$, $p > 0.05$.

Recall of the critical word was examined next. Means and standard deviations of recall of the critical word with respect to the type of music played and whether there was music or not is found in Table 2.

TABLE 2: RECALL OF THE CRITICAL WORD

	With music Relaxing	With music Non-relaxing	Without music Relaxing	Without Music Non-relaxing

Means	1.700	1.600	1.700	1.850
Standard Deviations	0.470	0.503	0.470	0.366

A 2x2 mixed analysis of variance indicated that the overall recall of the critical words did not differ statistically between the group that heard relaxing music and the group that did not, $F(1, 38) = 0.060$, $p > 0.05$. The analysis also failed to find a difference in recall of critical words regardless of whether music was played or not, $F(1, 38) = 1.508$, $p > 0.05$. This was also true regardless of the specific type of music played, $F(1, 38) = 1.508$, $p > 0.05$.

The final analysis with respect to recall involved intrusion errors. The total number of intrusion errors did not include the critical words recalled. The means and standard deviations of these intrusions are found in Table 3.

Table 3: RECALL OF WORDS NOT PRESENTED

	With music Relaxing	With music Non-relaxing	Without music Relaxing	Without Music Non-relaxing
Means	0.500	1.050	0.700	0.700
Standard Deviations	0.761	0.887	0.733	0.733

A 2x2 mixed analysis of variance indicated that overall intrusion errors of the group that heard relaxing music did not differ statistically from that of the group that heard the non-relaxing music, $F(1, 38) = 1.886$, $p > 0.05$. The analysis also failed to find a difference in this recall result regardless of whether music was played or not, $F(1, 38) = 0.269$, $p > 0.05$. This was true regardless of the specific type of music played, $F(1, 38) = 3.620$, $p > 0.05$.

Recognition

The means and standard deviations were computed for the confidence ratings of critical items, list items and distracter items on the recognition test. These statistics are presented in Table 4 (relaxing music) and Table 5 (non-relaxing music.)

Table 4: RECOGNITION WITH RELAXING AND NONRELAXING MUSIC

		Critical Items	List Items	Distractor Items
Relaxing Music	Means	3.800	3.897	1.239
	Standard Deviations	1.044	0.572	0.209
Non-relaxing Music	Means	3.800	4.025	1.312
	Standard	1.140	0.382	0.244

	Deviations			

A 2x3 mixed analysis of variance indicated that overall of the group that heard relaxing music did not differ cally from that of the group that heard non-relaxing F (1, 38) = 0.194, p > 0.05. There were significant ces among the ratings of critical items, list items, and er items, F (1,38) = 229.359, p < 0.05. A Tukey's HSD analysis indicated that the ratings for distracter significantly lower than the ratings for either list critical items (critical difference = 0.372). In the analysis indicated that difference in ratings he list items and critical items was not significant. he analysis of variance indicated that this pattern tially the same regardless of the type of music played, = 0.105, p > 0.05.

CHAPTER 4

DISCUSSION

Classical Music and Recall

The main hypothesis of the study was not supported. There was no difference in the correct recall of words when relaxing classical music was played in the background. There was also no difference in the recall of critical words relaxing classical music was played in the background. Similarly, analysis of intrusion errors showed no significant difference when relaxing classical music was played. This research supports the conclusion that classical music does not assist in better recall or improved memory.

There are a few possibilities as to why these results were found. One reason could be that classical music simply does not affect memory. Many researchers have attempted to replicate "The Mozart effect and have been unsuccessful (Carstens, Huskins, & Hounshell, 1995; Dalla Bella, Dunlop, Dawe, Humphrey, & Peretz, 1999; Kenealy & Monsef, 1994; Newman et al, 1995; Steele, Ball, & Runk, 1997; Steele, Bass, & Crook, 1999; Stough, Kerkin, Bates, & Mangan, 1994; Weeks, 1996). Although the research of Rauscher, Shaw, & Ky (1993) suggests that *The Mozart Effect* occurs it may be limited to spatial reasoning and not expand to recall. Their choice of music may also have been an important component.

The musical pieces that were chosen for this study may not have evoked the relaxing and non-relaxing responses that were sought. One question asked on the post-experimental questionnaire was to determine if the participants found themselves relaxed during the process. An equal number of participants stated that they were relaxed regardless of the music played; therefore, the two selections of music were not successful in producing a difference in the participants' level of relaxation.

The fact that the two selections of music did not produce a difference in relaxation was not anticipated. As mentioned earlier, the selections were originally chosen based on ratings obtained during a pilot study. The question asked during the pilot study had participants rate how relaxing they thought the various pieces of music were, not how relaxed the music made them as in the current study. Although similar, it is likely that the two questions are not entirely equivalent.

Another musical issue may be responsible for the lack of significance in this study. The music played during the test sessions may not have been played long enough to evoke a relaxed response. It may take a more lengthy musical selection to relax.

Recognition

It was hypothesized that recognition would improve for the

participants exposed to the relaxing music versus those exposed to the non-relaxing music. The analysis showed that there was no significant difference where music was concerned. This was consistent regardless of whether the word was a list item, a critical item or a distracter. The reasons for this are the same as the reasons for the lack of significance with the recall section.

Interestingly, this research replicated the previous research of Roediger and McDermott (1995). Specifically, participants were as confident that the critical items had been on the list as they were that actual list items had been on the list. It appears that the similarity of the critical words to the words presented continues to cause false memories regardless of musical intervention.

Implications and Limitations

Although the expected results were not found, the research here indicates that music does not affect recall or recognition. This may be an indication that The Mozart Effect (Rauscher, Shaw, & Ky, 1993) is not a replicable finding. However, problems in this study may have been responsible for the results.

There were some issues that were not foreseen that may have prevented the hypothesized results. One issue that may have caused these results is the wording of the questions in regards

to the relaxation of the music and relaxation of the person. Although it was believed that the question asked in the pilot study would identify musical selections that varied in terms of how relaxed they made the participants feel, the questions were not successful in accomplishing this. Rather than asking how relaxing a musical selection was, participants in the pilot study should have been asked how relaxed they became from listening to the music

In the end, there were no differences in how relaxed participants became. This might also have been the result of not having played the musical pieces sufficiently long for them to have the desired effect.

The relaxing piece used for this study may not have been similar enough to the piece used by Rauscher, Shaw, & Ky (1993.) Further research indicates the use of the same piece to determine if results could be produced in additional research yet to be done to find this effect exists with recall and recognition. This is to say that the Mozart piece should be used with the recall sessions to examine the effect that piece of music has to determine if the effect is exclusive to that exact musical piece.

Future Research

Recognition results for this study may have been more

complete had data been gathered following each word list given, and not grouped at the end of the session. Future study in this area may use recognition tasks after exposure to each separate piece of music. Analyses would produce results to determine differences with respect to recognition between relaxing and non-relaxing musical pieces. In this case the effect would only be for the music played for that list.

Further examination into the pieces used in future studies may be necessary to determine how reliable and general the present findings are. Future research should also use musical selections that are longer in duration so that the music has an adequate opportunity to have an effect. Finally, future research should use other, objective measures of relaxation so that the intended effect of the musical selection could be validated.

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Appendix A

The Two Word Lists Used In This Study

River (critical word)	Fruit (critical word)
water	apple
stream	vegetables
lake	orange
Mississippi	kiwi
boat	citrus
tide	ripe
swim	pear
flow	banana
run	berry
barge	cherry
creek	basket
brook	juice
fish	salad
bridge	bowl
winding	cocktail

Appendix B

1. Age _____

2. Gender _____

3. Were you familiar with the piece of music? _____

4. Did the music help you to relax? _____

5. On a scale of 1 to 5, with 1 being not at all and 5 being very, how relaxed were you during the experiment? _____

Appendix C

Circle the number which correlates to how well you remember the word from the previous lists with one being "Not at all" and five being "Very Well"

Fruit	1 2 3 4 5	Ocean	1 2 3 4 5	Tree	1 2 3 4 5
Cocktail	1 2 3 4 5	Stand	1 2 3 4 5	Water	1 2 3 4 5
Red	1 2 3 4 5	Citrus	1 2 3 4 5	Winter	1 2 3 4 5
Beach	1 2 3 4 5	Stream	1 2 3 4 5	Vegetable	1 2 3 4 5
Basket	1 2 3 4 5	Winding	1 2 3 4 5	Night	1 2 3 4 5
Fish	1 2 3 4 5	Grove	1 2 3 4 5	Royal	1 2 3 4 5
Juice	1 2 3 4 5	River	1 2 3 4 5	Wood	1 2 3 4 5
Apple	1 2 3 4 5	Ash	1 2 3 4 5	Boat	1 2 3 4 5
Peach	1 2 3 4 5	Fresh	1 2 3 4 5	Flow	1 2 3 4 5
Salad	1 2 3 4 5	Air	1 2 3 4 5	Rock	1 2 3 4 5
Berry	1 2 3 4 5	Mouth	1 2 3 4 5	Time	1 2 3 4 5
Lake	1 2 3 4 5	Cherry	1 2 3 4 5	Chicken	1 2 3 4 5
Run	1 2 3 4 5	Bridge	1 2 3 4 5	Kiwi	1 2 3 4 5
Rotten	1 2 3 4 5	Ball	1 2 3 4 5	Ripe	1 2 3 4 5
Dam	1 2 3 4 5	Tide	1 2 3 4 5	Plane	1 2 3 4 5
Lemon	1 2 3 4 5	Grape	1 2 3 4 5	Pear	1 2 3 4 5
White	1 2 3 4 5	Brook	1 2 3 4 5	Plate	1 2 3 4 5
Bowl	1 2 3 4 5	Knife	1 2 3 4 5	Barge	1 2 3 4 5
Orange	1 2 3 4 5	Light	1 2 3 4 5	Sea	1 2 3 4 5
Rapids	1 2 3 4 5	Trickle	1 2 3 4 5	Mississippi	1 2 3 4 5
Love	1 2 3 4 5				
Swim	1 2 3 4 5				
Creek	1 2 3 4 5				
Banana	1 2 3 4 5				

Appendix D-1

Consent to Participate in a Research Study

You are being asked to participate in this research study. This form is provided for you to give you information about the study. If you have any questions about the study you make contact the researchers of this study.

TITLE OF THE RESEARCH

The Effects of Classical Music on Short Term Memory

PRINCIPAL INVESTIGATORS

Suzanne Graham, student, Austin Peay State University
(suzanne32778@iwon.com)
Dr. Charles Grah, thesis committee chair, Austin Peay State University
(grahc@apsu.edu)

THE PURPOSE OF THE RESEARCH

The purpose of this research is to determine if classical music has an effect on your ability to remember words that you just heard.

PROCEDURES FOR THIS RESEARCH

During the coarse of the experiment you will be exposed to verbally presented words. These words will be presented either without music, or with classical music, one of two different pieces. You will be asked to recall as many words as you can after you hear the words. After this, you will be asked to recognize the words you heard from a list the researcher will give you. Then you will be asked to complete a demographic questionnaire (age, gender and a few questions about the study.) The study will take about 30 minutes. All information that is obtained in this study will remain confidential in accordance with the law. All data published or presented will be done in a way that does not reveal the identity of a participant.

POTENTIAL RISKS OR BENEFITS TO YOU

This study is only interested in your honesty and serious attempt to do your best. Your identity will never be revealed for any purpose, published or oral presentation. There is minimal risk to this study. The recall of the words may cause some stress or anxiety. If this happens please tell the researcher. You do not have to answer any questions that you do not want to answer. You may quit participating in this study at any time, for any reason, with no questions asked. If you withdraw from the study, your information will be destroyed.

As a participant of this study you will be helping to further the knowledge of the improvement of short term memory. One benefit from your participation is that you may receive extra credit in one of your psychology classes, at the discretion of the professor. Another benefit is that you may gain knowledge as to the way that psychological research is done.

INFORMED CONSENT STUDY

I have read the above information and have been informed what the study is about, why it is being done, and any risks or benefits involved

I have been informed that I do not have to take part in this study, and my refusal to participate will involve no penalty or loss

I agree to participate in this study and understand that agreeing to participate I have not given up any of my human rights.

I have been informed that I have the right to withdraw my consent and stop participating at any time during the study and all data 255 collected from me will be destroyed.

If I choose to withdraw, that choice will be respected and I will not be penalized or coerced to continue

I have been informed that I will receive a copy of this form

If I have any questions about this study I may call the researcher at (270) 338-4661 or Dr. Charles Grah (thesis committee chair, Austin Peay State University) at (931) 221-7231.

_____ _____

Signature Date

_____

Signature of Researcher

If you have any questions you any contact any of the following.

Suzanne Graham
3509 St Rt 181 N
Greenville, Ky 42345
270-338-4661
Suzanne32778@iwon.com

Dr. Charles Grah
APSU
PO Box 4537
Clarksville, TN 37044
931-221-7231
grahc@apsu.edu

Office of Grants and Sponsored Programs
APSU
PO Box 4517
Clarksville, TN 37044
931-221-7881 (Phone)
931-221-7304 (Fax)
Grants@apsu.edu

Appendix D-2

Consent to Participate in a Research Study

You are being asked to participate in this research study. This form is provided for you to give you information about the study. If you have any questions about the study you make contact the researchers of this study.

TITLE OF THE RESEARCH: PILOT STUDY

The Relaxing Qualities of Classical Music

PRINCIPAL INVESTIGATORS

Suzanne Graham, student, Austin Peay State University
(suzanne32778@iwon.com)
Dr. Charles Grah, thesis committee chair, Austin Peay State University
(grahc@apsu.edu)

THE PURPOSE OF THE RESEARCH

The purpose of this research is to determine the relaxing qualities of classical music.

PROCEDURES FOR THIS RESEARCH

During the course of the experiment you will be exposed to four separate pieces of music. You will be asked to rate the music on how relaxed it makes you feel. The study will take about 15 minutes. All information that is obtained in this study will remain confidential in accordance with the law. All data published or presented will be done in a way that does not reveal the identity of a participant.

POTENTIAL RISKS OR BENEFITS TO YOU

This study is only interested in your honest and serious attempt to do your best. Your identity will never be revealed for any purpose, published or oral presentation. There is minimal risk to this study. You may quit participating in this study at any time, for any reason, with no questions asked. If you withdraw from the study, your information will be destroyed.

As a participant of this study you will be helping to further the knowledge of research in the area of relaxing qualities of classical music. One benefit from your participation is that you may receive extra credit in one of your psychology classes, at the discretion of the professor. Another benefit is that you may gain knowledge as to the way that psychological research is done.

INFORMED CONSENT STUDY

I have read the above information and have been informed what the study is about, why it is being done, and any risks or benefit involved

I have been informed that I do not have to take part in this study, and my refusal to participate will involve no penalty or loss

I agree to participate in this study and understand that agreeing to participate I have not given up any of my human rights

I have been informed that I have the right to withdraw my consent and stop participating

at any time during the study and all data collected from me will be destroyed.

If I choose to withdraw, that choice will be respected and I will not be penalized or coerced to continue

I have been informed that I will receive a copy of this form

If I have any questions about this study I may call the researcher at (270) 338-4661 or Dr. Charles Grah (thesis committee chair, Austin Peay State University) at (931) 221-7231.

_____ _____

If you have any questions you any contact any of the following.

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Suzanne32778@iwon.com

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Clarksville, TN 37044
931-221-7231
grahc@apsu.edu

Office of Grants and Sponsored Programs
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Clarksville, TN 37044
931-221-7881 (Phone)
931-221-7304 (Fax)
Grants@apsu.edu

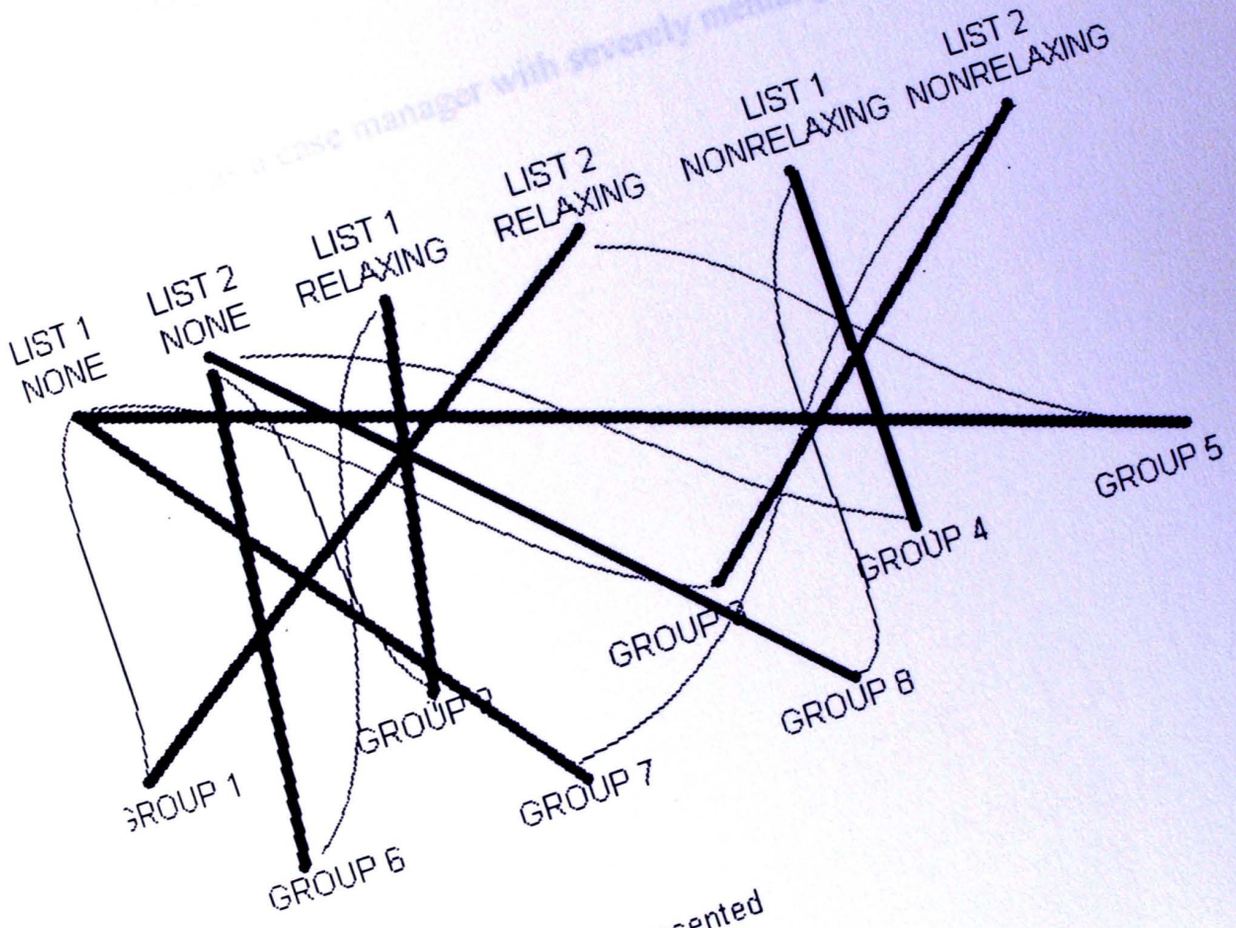
Appendix E

Standard Set of Instructions

For this study you will hear two separate word lists. After each list is heard you will be given a hand signal (researcher will hold up hand as signal) like this, which will tell you to begin writing on the top page the words that you recall. During the recall phrase please try to recall as many words as possible. You will be given 75 seconds to recall the words you remember. After the 75 seconds I will tell you to stop. When you hear the word STOP please turn your booklets to the next blank page and the second tape will be played. Are there any questions at this time? Please do not begin writing until I signal that you may. (Researcher hands out the booklets and pencils)

(After the two recall periods) Now I want you to turn over your booklets past the blank page to the page with words and numbers. As the instructions say circle the number that best corresponds to how well you remember hearing the word with one being "not at all," and five being "very well." Complete both pages. When you are done turn to the last page. Now I have a few questions that I would like you to answer. Answer these questions as honestly as possible. When you have completed the question please bring your books and pens to me and you may leave.

Appendix F



* curvy line indicates first list presented

VITA

Rachel Suzanne Graham was born in Madisonville, Kentucky on March 27, 1978. She attended primary school in the Madisonville area and graduated from high school at Madisonville North Hopkins High School in May 1996. That fall she attended Southeast Missouri State University and received a Bachelor's of Science in Psychology in May of 1999. In January of 2000, Suzanne entered Austin Peay State University in Tennessee to earn her Master's of Science in Clinical Psychology.

Suzanne currently works as a case manager with severely mentally ill adults in western Kentucky.