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Effects of Baroque Music on Encoding and
Retrieval of Southern College Students

Tracy L. Krout

Southern College of Seventh-day Adventists

Effects of Baroque Music on Encoding and
Retrieval of Southern College Students

When trying to remember a name, a phone number, or an answer for a test, sometimes information cannot be recalled. It also does not matter how important the information is, it can be difficult to be retrieved. Memory is affected by a variety of factors including attention and attention span (Estes, 1976) and how data is stored in the brain (Woolfolk, 1993). Bolles (1988) states that memory is an "act of imagination". Bolles believes that remembering is based on images in the brain but constructed in a different order.

Music plays a significant role in society. It is used to promote ideas (commercials, political slogans) (Yalch, 1991), social events (church services, weddings, funerals, parades, carnivals, amusement parks) (Westmeyer, 1992), a form of entertainment (opera, orchestras and symphonies, vocal concerts) (Walsh, 1993) as well as learning discipline and responsibility (owning an instrument, taking lessons, daily practice) (Dunlap, 1993).

Several studies have been done on the relationship

between music and education. Collett (1992) states the Learning to Read Through the Arts (LTRTA) program. This program uses music not only in the music classes, but in every class period. Sergey Prokoviev's "Peter and the Wolf" is one piece of music that has been used in the LTRTA Program.. Use of this piece of music has led to scientific discussions of different animals as well as English creativity assignments where the students rewrote the plot of the story. This method has been in use since 1971 in over 30 states.

Music used for specific situations has also been studied. For example, Nelson (1991) reports on Suggestive Accelerative Learning and Teaching (SALT), a process invented in Bulgaria in the mid-1960s by Georgi Lozarnov. One facet of the SALT method uses music to improve learning. A previous study (Portes and Foster, 1989) showed positive effects for reading but none for math. Nelson's experiment tested the SALT method with a fourth-grade spelling class and found that there was a significant difference in spelling achievement but not in attention or memory.

Various studies have focused on the effects of

music on memory. For example, Karimer's (1984) study used musical chants and rhymes as leitmotifs on Cambodians, Lao Hmong, and Vietnamese learning English as their second language. Leitmotifs are musical motives that are associated with things, ideas or symbols. In the 19th century, Richard Wagner used many leitmotifs in his operas to subtly show thoughts of characters although what they were saying was something totally different (Kerman, 1992).

Karimer's experimental group had a higher mean score and lower standard deviation than the control group, suggesting the treatment is effective for all students, those with high as well as low initial testing levels.

Wohlwill (1981) examined the relationship between Piaget's concrete operational thought and how music is understood by children. According to Wohlwill, children being able to notice unchanging patterns in music is a demonstration of Piaget's concept of conservation. Using music that unexpectedly changes and distorts what is expected to come next is related to the process of assimilation.

Stratton and Zalanowski (1985) worked with an Introduction to Psychology class using background music or no background music and directions using images or repetition. The results showed a positive correlation between music and images and the students significantly improved when music was used with repetition.

These studies demonstrate a relationship between music and memory. However, virtually all of this research is classroom based and all but one (Stratton and Zalanowski) used music as an instrument for teaching, not just the presence or absence of music.

Processing information can be broken down into three areas: the sensory registers (receiving stimuli through the senses), short-term memory (what is being thought about at a particular moment) and long-term memory (unlimited and permanent area of storage) (Woolfolk, 1993).

Storing information in the long-term memory can be helped by elaboration (connecting new information with existing knowledge) as well as well-organized material. A third factor is the context when the information is encoded. Feelings, the room, or people in the room are

influencers. Smith, Glenberg & Bjork (1978) report that students had higher scores on tests when they were taken in the same room that the information was given.

Woolfolk also reports problems with retrieving information. Time decay is the loss of connections between the neurons and can be reenforced with practice. Interference can also be a problem, whether it is retroactive (new information interferes with old) or proactive (old information obstructs the new).

The purpose of this study was to examine what are the effects on recall when students study in the presence of baroque music. To date, no empirical evidence has been found that demonstrates the effects of baroque music on recall.

Hypotheses

The research hypotheses for this study were the following:

- 1) Students having music during encoding will have higher retrieval scores than the control group.
- 2) Students having music during retrieval will have higher retrieval scores than the control group.
- 3) Students having music during encoding and retrieval

will have higher retrieval scores than the two above mentioned groups.

Operational Definitions

The baroque music that was used as the background music was of various Baroque composers.

Retrieval was defined as the ability to bring data into the conscious mind from long-term or short-term memory storage.

Encoding was defined as the process of converting images or sounds to data that can be stored in the brain.

Limitations of the Study

This study has a problem with ecological validity when compared to a general population, since results can only be generalized to Southern College Students. Another problem could result from the control of the study area. Some students are more comfortable studying on the floor or on a bed, but for this study students will be studying at desks.

Method

Subjects

Participants were 46 male and female students.

They were all enrolled in two sections of the Developmental Psychology course taught in the Spring semester 1994. Each student received extra course credit for his/her participation. Participants were randomly assigned to one of four groups by using a random number generator on a computer.

Tests and Materials

The music used in this project included works from various composers of the Baroque era (1685-1750) such as Bach, Handel, Corelli, Vivaldi and Telemann (See Appendix B).

The instrument to test retrieval was adapted from Hirsch's (1987) book, Cultural literacy: What every american needs to know. In this book there is an appendix of the terms that the author argues that each American should know. These concepts were tested in elementary schools in Dade County, Florida. Hirsch himself was amazed at the results of his implemented program. The posttest used in this study may be found in Appendix C.

Procedure

Three lab assistants (Taris Gonzalez, Cathleen

Pedigo, and Suzanne Schmid) assisted the investigation and we were each previously randomly assigned to different groups. As the subjects entered Summerour Hall, each one was also randomly assigned to one of the four groups. Random assignment was calculated in both instances by a random number generator. These numbers ranged from .000 to .999. Participants receiving numbers between .000 and .250 were assigned to Group A (music during encoding and retrieval), those receiving numbers between .251 and .500 were assigned to Group B (music during encoding only), subjects receiving numbers of .501 to .750 were assigned to Group C (music during retrieval only), and the subjects correlating with numbers from .751 to .999 were placed in Group D (control group, no music during encoding or retrieval).

All the subjects were brought into Summerour Hall, Room 108, and told the outline of the study, as well as asked to sign an informed consent form (see Appendix A).

Each group was then taken to a separate room in the building for 30 minutes: Group A in Room 110, Group B in 106, Group C in Room 212 and Group D in Room 205.

Each subject was given a study sheet for the posttest (see Appendix D). During the encoding period Groups A and B and during the retrieval period Groups A and C had background music at 40 decibels, a rating between a whisper level of 20 and ordinary conversational level of 65 (Sears, Zemansky & Young, 1987), and two did not.

After the 30 minute period, the subjects were given a five-minute break while the study sheets were collected. The posttest was then given to all four groups. Each group was allowed to leave upon completion of the posttest. This experiment was completed on March 17, 1994, at 8:35 pm.

Design

This experiment used a four-group design. The groups were used in two phases, encoding and retrieval. Group A had music during the encoding and retrieval. Group B had music during the encoding but not during the retrieval period. Group C did not receive music during the encoding, but did during the retrieval. Group D did not receive music in either stage. Analysis of variance (ANOVA) was used to examine whether the mean differences between the four groups

were statistically significant.

Results

There were 46 subjects used in the study. The statistics for the entire sample yielded a mean of 22.9348 and a standard deviation of 4.8000. The means, standard deviations, and ns for each group are presented in Table 1.

The ANOVA procedure yielded results that were not statistically significant ($p. > .05$). The results are described in Table 2.

The null hypothesis for each hypothesis states that there will be no statistically significant difference between the scores of the control group and the experimental group. The three tested hypotheses are as follows:

- 1) Students in the group with music during encoding but not during retrieval (Group B) will have higher retrieval scores than the control group (Group D).
- 2) Students in the group with music during retrieval but not during encoding (Group C) will have higher retrieval scores than the

control group (Group D).

- 3) Students in the group with music during both encoding and retrieval (Group A) will have higher retrieval scores than any of the other three groups.

Due to the lack of conclusive evidence in Tables 1 and 2, the hypothesis of no difference (null hypothesis) could not be rejected.

It is interesting to note that although the mean differences were not statistically significant, examination of the means for each group shows that the average performance was not the same across groups.

For example, Group B (music - no music) had the highest average score while Group C (no music - music) had the lowest.

Group D (no music - no music) was the group with the fewest subjects ($n = 8$) and yielded a mean of 23.75, higher than that for Group A (music - music).

It may be questioned as to whether these results are indicative of a practical significance to the differing average performance across the groups. Implications are suggested in the following section.

Discussion

The results of this study show that music did not have a statistically significant effect on students' recall. There may be several reasons for these results.

1. Overall, this was a small sample. Although 120 students signed up to participate, only 46 actually showed up.
2. The students had just returned from a 10-day Spring Break and they did not appear to be motivated to study.
3. During the 30-minute study period, the students were noisy and talking very loud. The projected 30-minute period to take the test was reduced and the students were allowed to leave when everyone in the group was done. The students then complained to the Developmental Psychology teacher that I had kept them for almost 2 hours! Because of these reasons means of the groups, this study should be replicated in an attempt to get a more valid set of results. The question of music and memory is relevant to the issue of improving education in both time and

cost efficiency. Instead of spending thousands of dollars on computers or making individual plans for each student, tapes or compact discs could be bought and used on equipment already in the school. Or the teacher could bring his or her stereo system to school, as it is something that most people have.

It should be noted that this method may not be perfect for every class and every study. Nor would it be very practical in every situation, for example when a stereo system would need to be moved into the classroom each class period. The environment was not a normal classroom environment with a recognized authority figure.

This study is only one in the beginning of many others that could shed scientific light on methods of improving grades such as changing the music, study position or time of day. Small variations in this study could lead to large implications in the lives of American children.

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Appendix A

Informed Consent Form

My name is Tracy Krout and I'm a senior psychology major. If you have any questions, I may be contacted at 238-2240. I am doing this experiment to fulfill an independent study psychology course credit. I ask that you fill out the form below.

I,

_____ Please print your name

agree to participate in a learning experiment. I understand that I may drop out of the experiment at any time and will still receive course credit. Any information obtained will be kept confidential and only available to the researcher and the supervising professor, Dr. Ruth Williams-Morris (238-2758). I understand the researcher may not discuss the experiment now but it will be explained to me when the experiment is complete. Individual performance results will not be distributed, however I am free to obtain a copy of the results if I request it.

Signature of Subject

Date

Tracy L. Krout
Investigator

Appendix B

Selected Music

Johann Sebastian Bach

Brandenburg Concerto No. 4 in G major, BWV 1049

Andante

Antonio Vivaldi

Sonata No. 6 in g minor, Op. 13

Alla breve

Arcangelo Corelli

Sonata in C major, Op. 5, No. 9

Johann Sebastian Bach

Brandenburg Concerto No. 5 in D major, BWV 1050

Allegro

Antonio Vivaldi

"Spring" Concerto in E major, Op. 8, No. 1

Allegro

"Summer" Concerto in g minor, Op. 8, No. 2

Presto

"Autumn" Concerto in F major, Op. 8, No. 3

Georg Philipp Telemann

Concerto in C major for Treble Recorder

Appendix C

General Knowledge Quiz

Please write the letter of the correct answer on the line next to each question.

SECTION I; MULTIPLE CHOICE

- ___ 1. The phrase "Achilles' Heel" comes from the legend of Achilles, the main character in which of the following?
- a. The Odyssey c. Agammemon
b. The Aeneid d. The Iliad
- ___ 2. The sentence "God's heart was touched" is an example of
- a. Utilitarianism c. anthropomorphism
b. aphorism d. none of the above
- ___ 3. As a result of the Battle of Hastings,
- a. volunteer citizen armies were established.
b. knights were regarded as the ultimate soldiers.
c. military discipline became more strict.
d. Napoleon became emperor of France.

- _____ 4. The Oedipus complex in Freud's theories is named for the Greek legend of King Oedipus, recorded in the play Oedipus Rex by
- a. Sophocles
 - b. Euripides
 - c. Aeschylus
 - d. Aristophanes
- _____ 5. Mary Baker Eddy was the founder of the
- a. Church of God
 - b. Church of Jesus Christ of Latter-day Saints
 - c. Disciples of Christ
 - d. Church of Christ, Scientist
- _____ 6. The story of the Trojan Horse is found in
- a. The Iliad
 - b. The Aeneid
 - c. The Odyssey
 - d. Othello
- _____ 7. Which of the following terms refers to censoring objectionable materials?
- a. parvenu
 - b. Stalinism
 - c. anthropomorphism
 - d. Bowdlerize

- ___ 8. Chou En-Lai was
 - a. emperor of the People's Republic of China after Mao Tse-tung.
 - b. a major battle of the Vietnam war.
 - c. Premier of the People's Republic of China under Mao Tse-tung.
 - d. None of the above.

- ___ 9. Which of the following was the site of a major conflict during the Vietnam War?
 - a. Dien Bien Phu c. Hoi Polloi
 - b. Taipei d. None of the above

- ___ 10. The Crimean War took place after the
 - a. American Revolution. c. Both (a) and (b)
 - b. defeat of Napoleon. d. None of the above

- ___ 11. Which of the following battles was misnamed?
 - a. Battle of Lexington
 - b. Battle of Bunker Hill
 - c. Battle of Concord
 - d. Battle of Cowpens

- _____ 12. After the conflict at Dien Bien Phu,
- a. France lost control of Indochina.
 - b. U.S. troops withdrew from Vietnam.
 - c. Vietnam was divided.
 - d. Both (a) and (c)
- _____ 13. Which of the following defines Eugenics?
- a. Science of miraculous solutions to problems.
 - b. Science of improving the genetic quality of a race by controlling mating and reproduction.
 - c. Ordinary people, the general public.
 - d. Science of improving life by doing what provides the greatest good for the greatest number.
- _____ 14. "Let the buyer beware" defines an example of
- a. caveat emptor
 - b. is an aphorism
 - c. Both (a) and (b)
 - d. None of the above

- ___ 15. Which battle destroyed Napoleon's navy?
- a. Battle of Trafalgar
 - b. Battle of Britain
 - c. Battle of Cannae
 - d. Battle of Hastings
- ___ 16. The defensive fortification built along the eastern border of France was known as
- a. Fin de siecle
 - b. Maginot Line
 - c. Suisse-Belge Line
 - d. None of the above
- ___ 17. The philosophy dealing with the processes of nature and the universe is
- a. cosmetology
 - b. naturalism
 - c. cosmology
 - d. existentialism
- ___ 18. In what year did William of Normandy conquer England?
- a. 1014
 - b. 1066
 - c. 1100
 - d. 1072
- ___ 19. In what year did the French Revolution start?
- a. 1844
 - b. 1789
 - c. 1748
 - d. 1924

Appendix D

Study Notes

1066 William of Normandy conquered England, Battle of Hastings

1776 American Revolution

1789 French Revolution

1844 The Great Disappointment

1853-1856 Crimean War, fought on peninsula in the Ukraine

1936-1939 Spanish Civil War

1941-1945 World War II

aphorism-a brief statement of a principle

Anthropomorphism-giving inanimate objects traits of living beings

Battle of Bunker Hill-not actually fought at Bunker Hill but Breed's Hill, north of Boston

Battle of Hastings-decisive battle of William of Normandy, the battle fought by knights that brought them military respect.

Battle of Trafalgar-this battle eventually destroyed Napoleon's navy

Bowlerize-the censoring of objectionable materials
caveat emptor-latin warning, "let the buyer beware"

Cooper, James Fenimore-19th century author, wrote Last of the Mohicans

Cosmology-the study of the processes in the universe and of nature

Dante-wrote religious satire, most famous is the Divine Comedy

Dien Bien Phu-town in Vietnam, major battle in the Vietnam War was fought here, 2 major results: 1) France lost Indochina, 2) division of Vietnam

Eddy, Mary Baker-founder of the Christian Science Church

En-Lai, Chou-Mao Tse-tung's premier in China

Eugenics-the science of controlling mating and reproduction to improve the genetic pool

Fin de siecle-fortification on eastern French border

Iliad-Greek classic by Homer, main character is Achilles

May Lai-city in Vietnam, U.S. soldiers killed many

civilians, William Calley was the commander of the attack

Odyssey-Greek classic by Homer, story of Trojan capture by using a large horse

Piaget-French psychologist, did much work in developmental psychology

Rousseau, Jean Jacques-18th century philosopher, ascribed to the blank slate theory, very controversial in his time

Shakespeare-English medieval author, wrote Othello, The Taming of the Shrew, Romeo and Juliet, and many other plays

Sophocles-Hellenistic Greek author, wrote Oedipus Rex

Tennyson, Alfred Lord-English author, wrote Charge of the Light Brigade

U.S. Senate-has two senators for each state

U.S. House of Representatives-number varies as population in individual state varies

Virgil-classical Greek author, most important work-Aeneid

Wilder, Thornton Niven-American Playwright, wrote Our Town

Wellington, Duke-defeated Napoleon in Spain & Portugal

Table 1

Group Means, Standard Deviations, and Sizes

Group	M	SD	<u>n</u>
Group A	22.9231	5.2195	13
Group B	24.5455	4.5905	11
Group C	21.2143	4.6769	14
Group D	23.7500	4.4641	8

Table 2

Analysis of Variance

Source	Sum of Squares	df	M Square	F	Sig.
Between Groups					
	75.2969	3	25.0990	1.0964	.3613*
R = -.0466			R Squared = .0022		
Within Groups					
	961.5075	42	22.8930		

*p < .05