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The Effects of Music on Concentration

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People have long speculated the effects of music on learning. According to the Mozart effect, classical music has a positive effect on learning. Researchers have found that other genres of music, as well as silence, can actually act as distracters rather than stimulators. In the present study, 32 participants were tested under four different conditions. The participants were required to read an excerpt and then answer questions about the excerpt. For three of the excerpts, the participant was required to read and then answer questions while listening to music, while the fourth reading comprehension task was completed in silence. Results were inconclusive, as some participants followed the Mozart effect and performed better while listening to classical music, while other participants performed better in the other experimental conditions. Thus, music may have an effect on the concentration of some people, but not on others.

The present study is designed for determining whether various musical genres have an effect on a person's ability to concentrate on a reading comprehension task. I chose to research this topic because I was curious in knowing whether different types of music act more as stimulators or distracters. In addition, from what I have found through personal experience, different types of music seem to have an effect on my concentration, and I wanted to see if research would support this observation.

It is widely believed that classical music has a positive effect on learning, and some propose that some classical music actually sharpens the brain (Holden, 1999). This

phenomenon is known as the Mozart effect (Holden, 1999). Researchers have found that college students scored significantly higher on spatial-temporal reasoning after listening to the first ten minutes of a Mozart Sonata, but not after listening to silence, a relaxation tape, minimalist music, dance music, or a short story (Grandin & Peterson, 1999).

Previous work done has indicated that the effects of music depend upon which cerebral hemisphere processes the music (McFarland & Kennison, 1987). Recent coherence analyses of surface brain wave recordings taken from subjects listening to the Mozart sonata (as compared with those listening to a short story) and then performing the spatial-temporal task show enhanced synchrony of neural firing activity of the right frontal and left temporo-parietal cortical areas (Grandin & Peterson, 1999). Wagner and Menzel (1977) demonstrated that listening to music stimulates both alpha and beta brainwave activity in humans (as cited in Brown & Wilson, 1997). Studies have found that listening to the patterned classical music of Mozart can enhance performance on some measure of spatial reasoning (Brown & Wilson, 1997). It appears that Mozart's music is sufficient to improve accuracy on this spatial-reasoning task relative to relaxation music or silence stimulus conditions (Brown & Wilson).

While there might be general trends in our responses to stimulating or relaxing music, they are overshadowed by individual cognitions. These individual cognitions may affect the immediate effects, such as associations of particular pieces of music with particular events, or dislike of particular musical genres (Hallam, Katsarou, & Price, 2002). The Yerkes-Dodson law states that the arousal level of the individual increases performance up to an optimal level beyond which over-arousal leads to deterioration in performance (Hallam; et al). Stimulating music is expected to increase arousal and

improve performance on simple tasks, but if the task is complex, the level of arousal may become too great and performance deteriorates. Research done has supported this theory, and researchers have found that music perceived as arousing, unpleasant and aggressive had a negative effect on performance on a memory task and also led to a lower level of reported pro-social behavior (Hallam; et al). Music may also provide a non-verbal distraction, which is less absorbing than other possible distracters. If concentration is lost, attention becomes focused on the background music rather than in developing behavior, which completely disrupts work (Hallam; et al).

There is still more evidence that suggests that background noise has a negative effect on concentration. Researchers have found that heard speech, even in a foreign language, has a deleterious effect on tasks such as the sequential recall of a series of digits, if the subject performing the task is asked to ignore such background speech (Pring & Walker, 1994). Music as well as speech is highly structured and one may therefore expect to find the same disruption with music as is apparent with speech (Pring & Walker). Salame and Baddeley (1987) ran a series of digit recall experiments to test this theory and found that silence and pink noise had no effect, but instrumental music proved to be disruptive and vocal music was even more so (as cited in Pring & Walker, 1994). This may be because when one hears familiar music, it evokes associated text, and the semantic processing of the lexical items has presumably occurred (Pring & Walker).

Research has shown that classical music has a positive effect on spatial-learning tasks, but has a negative effect on concentration. Based upon such research, I expect to find that various genres of music will have different effects on one's concentration;

certain genres will have a positive effect, while other genres will have a negative effect. Participants will be required to do four reading comprehension exercises while listening to various genres of music for three conditions and in silence for one of the conditions. The participants will be timed while they are doing the comprehension exercises and their times and scores on the exercises will be compared.

Method

Participants

There were a total of 32 participants. The participants were all be recruited through Lindenwood University's Human Subject Pool and were mixture of both men and women, with no set number of either.

Materials

There was four different story excerpts taken from the book "American Dreams." Each story chosen ("Rosa Parks," "The Company Man," "The Enormous Radio," and "The Castro") was accompanied by a set of four questions pertaining to the story (see Appendix 1 for a copy of the stories and questions). Sample questions include "How old was the man who died?" (taken from "The Company Man"), "What are the first names of the Westcotts?" (taken from "The Enormous Radio"), "What holiday is celebrated in the second gay center?" (taken from "The Castro"), and "What is the date that this story takes place"? (taken from "Rosa Parks").

Some of the equipment that was required for this experiment included desks and chairs for the participants, blue ink pens for the participants, informed consent forms, copies of the stories and questions, CD or tape containing a classical song, an R & B song, and a rock song, CD or tape player, time keeping device (such as a stopwatch),

participant receipts, and debriefing slips. The study was conducted in Roemer 315 at Lindenwood University.

Procedure

Before the starting of the experiment, the researcher prepared the story/question packages. Thirty-two copies of each story and corresponding set of questions was required. A Latin Square design was used to match up the four stories with the four testing conditions (three with music, one in silence) so that sixteen combinations resulted. To make the study more reliable, the combinations were repeated so that more participants could be used (see Appendix 2 for a copy of the combinations and the results). Each package was numbered 1-32, with every four packages corresponding to a predetermined order of testing conditions. For example, packages 1-4 followed the order of no music, classical, rock, and R & B.

No more than four students could be tested at once since the Latin Square design was used. Upon arrival, the students were asked to sign in. They were then seated in desks and given a numbered package containing four sets of stories and questions, as well as a blue ink pen, and told that they were not to begin until asked to do so. The researcher needed to know which package number each subject had so that she could record the proper data. The participants were then be given the following information:

- Read the excerpt, making sure to pay attention to details.
- Answer the set of questions that follow the story, but do not refer back to the reading when answering the questions.
- Once you've finished answering the questions, stop & raise your hand, so your time can be recorded. Don't move on to the next story until the researcher instructs you to.

- While you are reading and answering the questions, there will be music playing for three of the stories, and silence for one of the stories.
- It is not a race, so take your time.
- Please do not speak to the other participants about the study until it has been completed.
- Any questions?

The researcher then told the participants to begin. At this time, the researcher started the timing device as well as began playing the music, if there was music to be played for that particular experimental condition. As each participant completed the reading and questions, the researcher recorded the times of each participant until all participants had completed the first reading and question set. The researcher then stopped the music and moved on to the next experimental condition, and so on until all four conditions were satisfied.

This is a within-subjects design, as the experiment is designed to see whether the different types of background music will make a difference on the participant's concentration. Everything in the testing environment was kept as consistent as possible between the participants. The door to the classroom was closed during the time of testing so that distractions from the outside could be kept to a minimum. The participants were seated scattered around the room so that other participants would not distract them while they were reading and answering questions. All of the participants were tested in the afternoon, but at various times depending on the day of the week. If the participant was tested on a Monday, Wednesday or Friday, s/he was tested between the hours of 12:00 noon and 3:00 p.m. If the participant was tested on a Tuesday or Thursday, s/he

was tested between the hours of 3:00 p.m. and 5:00 p.m.

Results

Four one-way analysis of variance (ANOVA) tests were performed on the data to determine whether there was a significant effect of music on a person's ability to concentrate during a reading comprehension task. Concentration was measured based upon four factors: 1.) the average amount of time required to finish the comprehension task depending on the musical condition, 2.) the average amount of time required to finish the comprehension task depending on the story, 3.) the number of correct answers depending on the musical condition, and 4.) the number of correct answers depending on the story.

The average amount of time that each participant needed to finish the reading comprehension task for the assorted musical conditions are as follows: for no music, the average time was 3:23:22 (standard deviation=56.53 seconds), for the classical condition (Mozart), the average time was 3:17:47 (standard deviation=40.19 seconds), for the rock condition (Ozzy Osbourne), the average time was 3:11:45 (standard deviation=57.43 seconds), for the R&B condition (Fabolous), the average time was 3:06:58 (standard deviation=49.30 seconds). These results revealed that there was no statistically significant effect of music on the amount of time used to complete the comprehension task, $F(3, 93)=0.10$, $p=0.958$.

The average number of questions that the participants answered correctly for the assorted musical conditions are as follows: for no music, the average number of questions answered correctly was 2.69 (standard deviation=1.14), for the classical condition (Mozart), the average number of questions answered correctly was 2.63 (standard

deviation= 1.10), for the rock condition (Ozzy Osbourne), the average number of questions answered correctly was 2.72 (standard deviation=1.06), and for the R&B condition, the average number of questions answered correctly was 2.72 (standard deviation=1.14). These results indicated that there was no statistically significant effect of music and the number of questions answered correctly, $F(3, 93)=0.05$, $p=0.983$.

The average amount of time that each participant needed to finish each story is as follows: the average amount of time the participants took to read "The Castro" was 3:29:05.7 (standard deviation=56.97 seconds), the average amount of time the participants took to read "Rosa Parks" was 2:30:50 (standard deviation=38.07 seconds), the average amount of time the participants took to read "The Company Man" was 3:09:41 (standard deviation=45.99 seconds), and the average amount of time the participants took to read "The Enormous Radio" was 3:05:49 (standard deviation=44.66 seconds). These results indicated that there was a significant effect of the story and the amount of time that the participants took to read it, $F(3, 93)=25.33$, $p<0.01$. After performing t-tests and using the Bonferroni correction (0.05/6), the following stories have a significant relationship: there was a significant difference in the amount of time it took to read "The Castro" and "Rosa Parks", $t(31)=7.45$, $p<0.05$, there was a significant difference in the amount of time it took to read "The Castro" and "The Enormous Radio", $t(31)=3.63$, $p<0.05$, there was a significant difference in the amount of time it took to read "Rosa Parks" and "The Company Man", $t(31)=-6.10$, $p<0.05$, and there was also a significant difference in the amount of time it took to read "Rosa Parks" and "The Enormous Radio", $t(31)=-5.103$, $p<0.05$.

The average number of questions that the participants answered correctly is as

follows: the average number of questions that were answered correctly for "The Castro" was 2.06 (standard deviation=1.16), the average number of questions that were answered correctly for "The Company Man" was 2.47 (standard deviation=0.95), the average number of questions answered correctly for "Rosa Parks" was 3.63 (standard deviation=0.56), and the average number of questions answered correctly for "The Enormous Radio" was 2.59 (standard deviation=0.67). These results indicated that there was a significant effect of the story and the number of questions that were answered correctly on the comprehension portion, $F(3, 93)=20.38, p<0.01$. After performing t-test and using the Bonferroni correction ($0.05/6$), the following stories have a significant relationship: there was a significant difference in the number of questions answered correctly between "The Castro" and "Rosa Parks", $t(31)=-7.27, p<0.05$, there was a significant difference in the number of questions answered correctly between "Rosa Parks" and "The Company Man", $t(31)=6.63, p<0.05$, and there was also a significant difference in the number of questions answered correctly between "Rosa Parks" and "The Enormous Radio", $t(31)=6.25, p<0.05$.

Discussion

The results of my study did not support my hypothesis that various musical genres would have an effect on one's concentration. There was no significant difference in the average amount of time that the participants took to answer the questions in the various musical conditions. There was also no significant difference in the average number of questions answered correctly in the various musical conditions. These results do not support the Mozart theory or the idea that background music has a negative effect on concentration, but rather they support the idea that there is no effect of noise on retention

(Pring & Walker, 1994).

However, there was a significant difference in the average amount of time it took to read each story, and also a significant difference in the average number of questions answered correctly for each story. These results could be because the difficulty levels of each reading differed. In general, it was found that participants took the least amount of time to answer questions for the story "Rosa Parks" (2:30:50). In addition, "Rosa Parks" had the highest average number of questions answered correctly compared to the other stories (3.63). On the other end of the spectrum, participants took the most time to read "The Castro" (3:29:05), and it also had the least number of questions answered correctly when compared to the other stories (2.06). Since all of the stories were approximately the same length, a possible explanation for these results is that the content of "The Castro" may have been more difficult than that of "Rosa Parks", so it required the participants to take more time to read the story. A possible explanation for the difference in number of questions answered correctly could be that "Rosa Parks" had questions that were easier than those for "The Castro" were.

Results of "The Company Man" and "The Enormous Radio" fell almost exactly in the middle of "Rosa Parks" and "The Castro". The average amount of time that the participants took to read "The Company Man" was 3:09:41, and for "The Enormous Radio", the average amount of needed was 3:05:49. The average number of questions answered correctly for "The Company Man" was 2.47, and the average number of questions answered correctly for "The Enormous Radio" was 2.59. These results suggest that the difficulty level of each of these two readings was on a similar level.

One possible explanation for why the music did not have an effect on the

concentration of the participants could have to do with the population in which the participant sample was obtained. All of the participants were recruited through Lindenwood University's Human Subject Pool, and from their physical appearances, seemed to be of college age (18-24). College student may be more accustomed to reading and trying to concentrate with background sounds, so the presentation of the various musical conditions did not bother them when trying to complete the reading comprehension task. If the participant age was more varied, it could have a different effect on the results of the study.

Despite all attempts to keep testing conditions consistent for each participant, there were irregularities. Since the volume of the music could not be controlled digitally (music was played off of a lap top computer), the participants may have been presented with different volumes of music depending on the song that was playing, and also when they were tested. The songs that were used in the study may have had a significant meaning to some of the participants. In one instance, one of the participants made a comment after the experiment, saying that the R&B song ("Can't Let You Go" by Fabolous) had an emotional effect on her because it reminded her of the current situation between her and her boyfriend. During one of the conditions, the experiment was interrupted twice by a walk-in participant who wanted to take part in the experiment. The participants who were being tested at this particular time may have been distracted by the interruption, which could have affected the amount of time they took to do the comprehension task, and also their ability to answer the questions correctly. On occasion, there was also external noise from outside, such as a lawn mower, conversation, and vehicles that were driving by. Finally, the lapse between each story

varied from trial to trial. There were some trials where there would only be one participant, so the lapse of time from one story to the next was very short. There were other trials where there were several participants and some participants had to wait for several minutes before they could move on to the next story because they had to wait for the other people in the trial to complete their story.

Other confounding variables may have affected the outcome of the experiment. The reading ability of each individual participant may have made a difference for time s/he took to read each story. There were several instances where the participants misunderstood the instructions and forgot to answer the questions after reading the story. One individual had to be continuously reminded to answer the questions before raising his hand to let the experimenter know that he was finished. The time of day that the experiment was conducted may have also affected the results. Some of the participants may have already had several tests that day and could have been stressed out before coming to participate in the study, thus affecting their performance on the reading comprehension exercise.

For future replications of this study, precautions should be taken to keep testing environment as consistent as possible. The type of classroom that will be used should not have windows, or should have soundproof windows so as to keep external noise down to a minimum. The music should be played on a device that has digital volume control so that each song is played at exactly the same volume. The stories used in the reading comprehension task should also be changed so that each story and the set of questions that accompany it are on a more balanced scale.

Alterations to the experimental design could also be made for future replications

of this experiment. Most, if not all of the previous experiments that were designed to test the Mozart effect used spatial-learning tasks such as mazes and math problems, so this study could be replicated using a maze or a set of math problems rather than a reading comprehension exercise. Another alteration that could be made would be to use different songs for the various genres, rather than Ozzy Osbourne's "The Ultimate Sin", Fabolous's "Can't Let You Go", and Mozart's "A Little Night Music". Rather than using rock, R&B and classical, the genres of music could also be changed.

In conclusion, one can conclude from the results of this research, that various musical genres do not have an effect on a person's ability to concentrate while trying to complete a reading comprehension task.

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Appendix A

Rosa Parks

On the evening of December 1, 1955, Mrs. Rosa Parks's entire body ached—her feet, neck, and shoulders were especially sore. Parks was a tailor's assistant in a Montgomery, Alabama department store. Hers was an exhausting job that paid a minimal salary; she made alterations and had to handle a large commercial steam press as well. On this particular day, she finished work and walked a few blocks as usual to the bus stop. The first bus on her route was so crowded she realized that there would be no place left to sit, and she desperately needed to get off her feet. She decided to wait for a less crowded bus. That gave her a little time to waste, so Parks walked over to a nearby drugstore to look for a heating pad, which might help ease the pain in her sore muscles. Not finding anything to her liking, she returned to the bus stop. Eventually, a bus arrived that had a fair number of seats available. She paid her ten cents, boarded the bus, and took a seat in the rear, or black, section of the bus, near the dividing line between the white and black sections. On Montgomery's public buses, the first ten rows were for white people, the last twenty-six for blacks. In many cities in the South, the line dividing the sections on buses was fixed. This was not true in Montgomery; by custom, the driver had the power, if need be, to expand the white section and shrink the black section by ordering blacks to give up their seats to whites. First come, first serve might have been the rule of public transportation in most of America, but it was not true in Montgomery, Alabama, in 1955. To the blacks, it was just one additional humiliation to be suffered, because the system did not even guarantee the minimal courtesies and rights of traditional segregation. (Excerpt taken from "Rosa Parks", written by David Halberstam)

Questions for "Rosa Parks"

- 1.) What is the date that this story takes place?

- 2.) Where does this story take place? Please state the city and state.

- 3.) What is Rosa Parks looking for in the drugstore?

- 4.) How much is the bus fare?

The Castro

The oldest gay center in the city lay in the Tenderloin-the triangle of sleazy bars and cheap hotels bordered by the business district, the theater district, and Market Street. The Tenderloin, like its counterparts in other cities, was far from exclusively gay. The home of winos and bums, it was the transit station of sailors and other impecunious travelers, and it harbored most of the prostitution, both gay and straight, for the entire city. In the late afternoon female prostitutes, male hustlers, and transvestite whores could be seen performing a complicated street corner ballet as they tried at once to evade the police and sort out their initially undifferentiated customers. In the fifties the district had harbored most of the gay bars in the city-but now only hustler and drag queen bars were left. The Kokpit, owned by a queen called Sweet Lips, had been in operation for about a decade. Now lined with trophies and photographs of countless drag balls, it had become a kind of Toots Shor's of drag San Francisco. A few blocks away there was a bar of professional and much more highly specialized nature, where six-to seven-foot-tall black transvestites hustled white men in business suits, who were, necessarily, shorter.

Chronologically speaking, Polk Street, Or Polk Gulch, was the second gay center of the city. It was the decorators' district, and in the sixties a number of gay bars had moved into the blocks lined with antique shops and furniture stores. Since then it had been the major site of the Halloween festivities. On that one night a year the police stood by, leaving the street to a carnival of witches, clowns, nuns on roller skates, and Jackie Kennedy look-alikes or Patty Hearst look-alikes with toy machine guns. Polk Street was a mixed neighborhood-both gay and straight people lived there, and its restaurants catered to both crowds. Its gay bars were thus not conspicuous except at night when

groups of young hustlers stood out on the sidewalks around them.

(Excerpt taken from "The Castro", written by Frances FitzGerald)

Questions for "The Castro"

- 1.) Where is the oldest gay center of the city located?
- 2.) Who owns The Kokpit?
- 3.) Where is the second gay center of the city located?
- 4.) What holiday is celebrated in the second gay center?

The Company Man

This man who worked himself to death finally and precisely at 3:00 a.m. Sunday morning-on his day off-was fifty-one years old and a vice-president. He was, however, one of six vice-presidents, and one of three who might conceivable-if the president dies or retired soon enough-have moved to the top spot. Phil knew that.

He worked six days a week, five of them until eight or nine at night, during a time when his own company had begun the four-day week for everyone by the executives. He worked like the Important People. He had no outside "extracurricular interests," unless, of course, you think about a monthly golf game that way. To Phil, it was work. He always ate egg salad sandwiches at his desk. He was, of course, overweight, by 20 or 25 pounds. He thought he was okay, though, because he didn't smoke.

On Saturdays, Phil wore a sports jacket to the office instead of a suit, because it was the weekend.

He had a lot of people working for him, maybe sixty, and most of them like him most of the time. Three of them will be seriously considered for his job. The obituary didn't mention that.

But it did list his "survivors" quite accurately. He is survived by his wife, Helen, forty-eight years old, a good woman of no particular marketable skills, who worked in an office before marrying and mothering. She had, according to her daughter, given up trying to compete with his work years ago, when the children were small. A company friend said, "I know how much you will miss him." And she answered, "I already have."

"Missing him all these years," she must have given up part of herself which had cared too much for the man. She would be "well taken care of."

His "dearly beloved" eldest of the "dearly beloved" children is a hard-working executive in a manufacturing firm down South. In the day and a half before the funeral, he went around the neighborhood researching his father, asking the neighbors what he was like. They were embarrassed.

(Excerpt taken from "The Company Man", written by Ellen Goodman)

Questions for "The Company Man"

- 1.) How old was the man who died?

- 2.) What kind of sandwich did he always eat at his desk?

- 3.) What kind of jacket did Phil wear to the office on Saturdays, "because it was the weekend"?

- 4.) What was the name of Phil's wife?

The Enormous Radio

Jim and Irene Westcott were the kind of people who seem to strike that satisfactory average of income, endeavor, and respectability that is reached by the statistical reports in college alumni bulletins. They were the parents of two young children, they had been married nine years, they lived on the twelfth floor of an apartment house near Sutton Place, they went to the theatre on an average of 10.3 times a year, and they hoped someday to live in Westchester. Irene Westcott was a pleasant, rather plain girl with soft brown hair and a wide, fine forehead upon which nothing at all had been written, and in the cold weather she wore a coat of fitch skins dyed to resemble mink. You could not say that Jim Westcott looked younger than he was, but you could at least say of him that he seemed to feel younger. He wore his graying hair cut very short, he dressed in the kind of clothes his class had worn at Andover, and his manner was earnest, vehement, and intentionally naive. The Westcotts differed from their friends, their classmates, and their neighbors only in an interest they shared in serious music. They went to a great many concerts-although they seldom mentioned this to anyone-and they spent a good deal of time listening to music on the radio.

Their radio was an old instrument, sensitive, unpredictable, and beyond repair. Neither of them understood the mechanics of radio-or of any of the other appliances that surrounded them-and when the instrument faltered, Jim would strike the side of the cabinet with his hand. This sometimes helped. One Sunday afternoon, in the middle of a Schubert quartet, the music faded away altogether. Jim struck the cabinet repeatedly, but there was no response; the Schubert was lost to them forever. He promised to buy Irene a new radio, and on Monday when he came home from work he told her that he had got

one. He refused to describe it, and said it would be a surprise for her when it came.

(Excerpt taken from "The Enormous Radio", written by John Cheever)

Questions for "The Enormous Radio"

- 1.) What are the first names of the Westcotts?
- 2.) On average, how many times a year do the Westcotts go to the theatre?
- 3.) What were the Westcotts listening to on the radio before it stopped working?
- 4.) What day of the week is it when the radio stops working?