Effects of Music on Puzzle Solving

Roberta Kerosevic
Lindenwood University

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The purpose of this study was to see how listening to different genres of music affects performance on puzzle solving, particularly word searches. Students completed puzzles of equal difficulty and under different genres of music and the absence of music. The three genres of music were instrumental and included classical, heavy metal, and pop music. There was also a round where no music was played. Students had four rounds to do four different word searches; each round consisted of a different word search topic and was given to each person in a different order. During each round, all participants listened to a genre of music or the silence condition. Students had 3 min each round to find as many words possible, for a total of 12 min. After the main experiment, students took a survey about how music affects their daily life and how they felt about the experiment, which took between 5-10 min. The results of this study were conducted using a one-way ANOVA to compare groups under the different order of music and silence presented, and how many words participants solved under each condition. I hypothesized that students would perform better under silence than with background music, and also that between the three genres of music, students would perform better with classical music than heavy metal or pop-- since classical is commonly thought to be used to boost intelligence, pop is used more for leisure, and heavy metal has strong percussion and emotional reactions.

There have been many studies conducted involving background music but not many have used word searches as a task to measure a dependent variable. Most of the studies were conducted to see differences in performance of individuals based on background music, noise, and the silent condition. The hypotheses proposed for this experiment were that participants will find more words under a silent condition and that between the three instrumental musical

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[2] Roberta Kerosevic, Psychology Department, Lindenwood University. Correspondence regarding this paper should be addressed to the Lindenwood Participant Pool, Lindenwood University, 209 South Kingshighway, St. Charles, MO. 63301 or email at lpp@lindenwood.edu

conditions, participants will find more words with classical music in the background rather than

heavy metal or pop. Similar findings in studies also show background music affects

performance, but different methods were used to collect the performance data.

Ransdell and Gilroy (2001) tested how different types of background music affect the

quality and speed of essay writing (using a computer) in college students. Forty-five participants

were chosen from a psychology research pool (with participation in psychology classes) and

offered extra credit (Ransdell & Gilroy, 2001). They also gave out a questionnaire after the

experiment to see if the participant had any musical experience and how often they listened to

music when doing school work. The study was a between-subjects design and the procedure

involved writing two 10 min essays in two different conditions: silence and then either

instrumental music, vocal, or both. The four topics of the essays were counterbalanced (two

college-related topics, relationships, and vacation). Afterwards, they were given a group of

words and had to write sentences using the words given. Results showed slower writing and

fewer words typed during both background music types compared to silence, and those with

musical interest wrote longer and more in-depth sentences than those not musically trained

(Ransdell & Gilroy, 2001). For the final results, silence yielded the best performance for both the

musically talented and non-musically talented participants.

In Singapore, music with lyrics and silence were also used to test performance on writing

and word lists, but with more music and test levels. Chew, Yu, Chua, and Gan (2016) wanted to

see if unfamiliar and familiar music (popular versus unknown), music with lyrics in someone's

first learned language and an unfamiliar language, silence, and performance on math, reading,

and word memory were correlated between one another. To do this, they first conducted a pilot

study before the actual study, in which they realized they needed to shorten the time for each task

and to take out breaks in between, but kept the between-subjects design to prevent negative

mood, lack of energy, and getting used to doing the tasks. The 165 participants came from James

Cook University (Singapore) and had over 20 more women than men in the study (Chew et al.

2016). There were groups of five participants for each trial, and each group went through a

randomized order of the music conditions: familiar English song, the same song sung in Italian,

unfamiliar English song, the same song sung in Italian, and silence. Each participant randomly

received one of the following tests for each condition: a reading test which involved reading a

story from a former SAT passage for 5 min and afterwards has 5 min to answer 7 forced-choice

questions, a 10 question math test from a past SAT test with a 15 min time limit (without using a

calculator), and a list of 20 words looked at for one minute and then five new words related to

the themes of the songs replacing five of the words from the original list (participants had to

point this out within three minutes) (Chew et al. 2016).

The results showed that the music conditions affected performance on all the tasks, but the interaction between language versus music or tasks was not significant (Chew et al. 2016). Word memory was the most affected by the music conditions, as familiar music showed more words correctly remembered than in the unfamiliar condition. The math and reading tests showed similar results, yet they were not significant enough compared to the word memory task. However, the highest performance in math and reading was during the "no-song" condition, which was significant. An extra test was performed to see if gender has any relationship with any of the independent variables, and it was found that women did better on the reading exam while men did better on the math exam.

Most studies have provided the music for the participants, but there does not seem to be many studies that test the participant's choice against a given task. Lesiuk (2005) conducted a study to see if work performance in quality and speed for software designers increased positively with the addition of background music. The workers chose their genre of music, either from a music library with 65 CDs or they were allowed to listen to from their own music collection. Participants were asked how much musical training they had in years, which varied between 0 and 15 years. A background and trait questionnaire was given prior to the actual study to see how positive and negative their thinking was (mood during work) and their musical background. The results showed that listening to music did increase productivity if it was a genre they enjoyed

listening to, but older participants (the oldest was 55 years old) preferred no music (Lesiuk

2005). For example, during a certain week when music was not allowed during the trial, older

participants said they liked that part of the five-week trial the best, yet they performed the worst

during that time. Some participants also explained this dislike towards music in the mood section

of the questionnaire, but those who liked choosing their own genre to listen to expressed more of

a happy mood. This study shows that music one likes listening to can help in elevating mood, but

with choosing one's own music, the silent condition is still more effective with performance on

the task.

Background music seems to affect mood in a definite matter, and adding noises as

another independent variable could further test whether others feel and concentrate better on a

certain task. Schlittmeier and Hellbrück (2009) conducted a study to see what type of "noise"

people seemed to prefer while waiting in an office that is also full of sounds such as

conversations between employees, phone calls, and keyboard typing. Two types of music were

used and defined by whether they were staccato (short and choppy) or legato (long and flowing),

and then continuous noise was the second controlled independent variable added to the other

independent variable of office noise (Schlittmeier & Hellbrück, 2009). During the presentation of

these independent variables and their levels, one-person trials were conducted. A group of

numbers was presented on a computer screen and participants were told to click them in the

order they were presented after they disappeared in 10 s. After the task, four questions were

asked that pertained to how the background music made the participants feel, which one they

preferred while working (if any), and if they like a certain music style better than the other. This

was their main experiment, but they also reference a previous experiment within this study. In

the past study, they used the same variables but with the same types of music, silence, and office

noise as levels of one independent variable. The task was also the same, but they only measured

performance of the memory task rather than asking follow up questions.

The results for the main experiment had shown more noise with the office noise was less

distracting by opinion, but data displayed worse recall of the numbers compared to silence

(Schlittmeier & Hellbrück, 2009). Overall, participants preferred no background sound while

working, but with the music presented, staccato was preferred over legato music. The data

showed office noise was the most distracting to memory recall, and staccato being presented

with or without the office noise was second most distracting. The experiment referenced within

the main experiment had the same results, with the office noise by itself producing just as much

negative recall of the numbers as the office noise with or without the continuous noise and/or

background music added.

Another study also used noise, music, and silence as their conditions, but the researchers

were trying to see if there was a correlation between neuroticism, background conditions, and

intelligence measured using various tests (Reynolds, Mcclelland, & Furnham 2013). The study

was conducted at a college in London that included 70 students. The independent variables

included noise (everyday noise such as construction, car sirens), music (different dance music

remixes), and silence. There were three different and nearly equal groups who experienced the

background conditions in different orders (Latin Square Design) and each group's task was to

complete five different tests individually (Reynolds et al. 2013). The tests included a 12 min

algebra and geometry test (WPT), 12 min to define the correct pairing of sentences (Baddeley's

sentence checking test), 15 min of mental math (add, subtract, multiply, divide), 15 min to pick

the missing piece of an object from eight options (Raven's advanced progressive matrices), and

15 min to answer questions that have a scale that measures neuroticism (NEO-Five Factor

Inventory). All of the tests were during one condition except the mental math and Raven's were

done during one of the remaining two conditions. The results showed that neuroticism and

mental ability were negatively correlated, and that was the only significant relationship involving

neuroticism (Reynolds et al. 2013). In regards to the background conditions, silence was better

than sound or music as well as music just being better than sound for the WPT test. Otherwise,

none of the other tests reached significance or had no correlation.

Cassidy and Macdonald (2007) conducted a similar study, but they wanted to see if there

was a difference in cognition between introverted and extroverted individuals. They used four

different background noise conditions in which the participants listened to music that causes high

arousal and negative affect (such as metal music), music that causes low arousal and positive

affect (such as classical music), and also noise and silence. Participants completed five cognitive

tests during one of these four conditions in groups of ten. Questionnaires were given to see if

they were more introverted or extroverted, what kind of music they liked, and how music

influenced their studying. The extroverted individuals performed worse on all the tests except for

the Stroop (which involved reading the names of colors printed in the incorrect color) and said

they liked the high arousal music more, while the introverted individuals were the opposite and

performed the best with the Stroop (Cassidy & Macdonald, 2007). Participants defined as

introverted performed better than those defined as extroverted in all the conditions except for the

high arousal music. In conclusion, introverted people prefer silence or slower music when

studying compared to extroverted people who preferred intense music and some kind of

background noise when studying.

Patston and Tippett (2011) also did a similar experiment about how background sound

affects musicians and nonmusicians, but they used incorrect piano playing, correct piano playing,

and silence as testing conditions. The two activities completed under each condition were

correcting sentences grammatically and identifying differences in two images with an 8 min time

limit. Participants had to identify the number of sentences that were incorrect and correctly state

differences between the images (Patston & Tippett, 2011). After just the two piano playing

conditions, the question of whether the piano music played was correct or incorrect during that

trial was asked. In conclusion, musicians performed better on both tasks under nearly all the

background conditions, except for when the piano was played incorrectly (Patston & Tippett,

2011). Silence was the best choice for their performance in both tasks, with incorrect music

being the worst. In regards to whether the piano was played correctly or not, nonmusicians had a

harder time telling the difference between the two conditions or were more incorrect with their

guesses. However some musicians even could not recognize the differences between the two

conditions correctly, although far less often than the nonmusicians.

My study involves different conditions of instrumental background music and silence and

the amount of words found in a word search puzzle is the measure for the dependent variable.

The genres of music used were heavy metal, pop, and silence, and the order of these conditions

presented varied by group and their time and date the experiment took place. The four topics of

the word searches were animals, college, ice cream flavors, and summer as they mostly provoke

good emotions or feel related to the participant. Each participant got a different order of the word

searches and did one during one of the music conditions (or silence). The word searches had 20

words to find in 4 directions and the time limit was 3 min. A survey was taken afterwards to see

what music the participants liked, what activities they used it for, where they got their music

from, and their opinions on the music presented in the study.

Method

Participants

Seven Lindenwood University students between the ages of 18 and 29 participated in this

study. Participants came from two sources: the Lindenwood Participant Pool (LPP) program,

which is offered to the majority of social sciences students, or by flyers (see Appendix A) posted

in three classroom buildings and one dormitory building on campus. The majority of participants

came from the LPP, and each received one extra credit towards a class participating in the

program while those recruited through the flyer received no compensation. LPP participants

signed up for the study through an online portal called Sona Systems, and got to choose the date

and time they wished to participate in the study. There were different dates and times for

participants to sign up for online, with a maximum of 12 students possible per timeslot (date and

time available). Both groups could contact the researcher through the researcher's email address

provided from the source they signed up through (Sona Systems for LPP participants), but flyer

participants had to contact the researcher directly through email or by phone number in order to

set up their appointment.

Materials and Procedure

A room booking request form in the form of an Excel spreadsheet (see Appendix B) was emailed to the LPP office to secure a place for the study. A classroom that can fit up to 30 students and 1 computer was secured. A group of students (two groups of two; different days and one participant was ill and could not show up during a group of three) showed up at their appropriate room and timeslot when signed up through flyer or Sona Systems. When they arrived, students signed in on a participant sign-in sheet (see Appendix C) to show they were present during the experiment. Each student sat down in a desk, with at least one unoccupied desk between each student. When all of the students showed up, each were given two consent forms (see Appendix D) to fill out before beginning the experiment, and one was given to the researcher while the other was kept by the student. The experiment commenced after the consent form was given to the researcher.

Four different word search puzzles, each with 20 words total that could go across, diagonal, backwards, vertical, and horizontal (see Appendices E-H), were created using https://www.superteacherworksheets.com/generator-word-search.html. A different theme was incorporated into each puzzle, which included animals, ice cream flavors, college life, and summer. Students were asked to bring a writing utensil such as a pen or pencil with them to the experiment, as one would not be provided by the experimenter. Each student did one puzzle at a

time in a 3-min span, which meant each student did all four puzzles. Even though students were

spaced out, they were all given a different order of the puzzles to account for possible order

effects because of slight differences in difficulty level in each of the puzzles.

Meanwhile, a different genre of instrumental music was played which was either heavy

metal (Barnes, 2013), classical (MacLeod), or pop (Sweet, 2012). Each song was accompanied

with one puzzle, as well as one puzzle being done in complete silence. All students listened to

the same music at the same time, or for the one round, no music at all at the same time. After

time was up with the puzzles, students were given a paper survey (see Appendix I) that asked

them about how music affects their daily life and their thoughts on the experiment. This took 5 to

10 min depending on the responses of each student. After the survey was filled out, the student

turned in their puzzles and survey, received a thank you letter for their participation (see

Appendix J), and was free to leave. If the student was part of the LPP, they filled out a

participant receipt (see Appendix K) after turning in their papers, and then were allowed to leave.

Results

Each participant received the four word searches in different order, with each word

search containing 20 words to find. They had a 3 min time limit for each word search. There

were also four different groups, each tested during a certain date and time but all having 30 min

to partake in the word searches and time to finish the survey. Each group had a different order of

the background music conditions, and two participants in each group (except group three just had

one person). Group one was classical, heavy metal, pop, and then silence; group two was heavy

metal, silence, classical, and pop; group three was pop, classical, silence and heavy metal; group

four was silence, pop, heavy metal, and then classical music.

A one-way ANOVA was conducted through SPSS to see if there was an effect of music

genres (and silence) in the amount of words found for the word searches. The first hypothesis

was that silence would show better performance than the other three genres of music in amount

of words found by participants. Other than metal music, pop and classical proved to be better

than the silence condition, so the first hypothesis was shown to be false $F(3,24) = .03$, $p > .05$; n^2

$= .004$. The second hypothesis stated that classical (M = 7.29) would result in more words found

in the word searches than metal (M = 6.85) and pop (M = 7.14) out of all the genres, and that

was supported by the data collected.

The survey results indicated that music is a very important part in a college student's

daily life, and certain genres are preferred for certain activities. Music is played a lot at the place

of residence-- whether a commuter or a campus resident (57%), and rap is a very popular genre

to listen to for a variety of activities (71%). Music is most often used during homework (71%)

and any kind of physical workout (86%). All use music applications, and most of them are found

on smart phones. All participants tend to use their phones as their main source of music, while

computers are used slightly less. The only solid opinion about the music heard during the study

was that the majority enjoyed the pop music played, while classical and heavy metal had mixed

reviews.

Discussion

The results of the study support that silence is not a good background sound compared to

two out of the three genres, but classical music did produce the most words found out of the

three genres of music (Cassidy & Macdonald 2007). The word searches might have been slightly

different in difficulty, since certain lists had longer or shorter words than others, so this could

have skewed the data. The word search topics were also randomly generated by the

experimenter, and may have evoked different emotions in each participant that affected their

ability to find the words; the same for the different background conditions (Cassidy &

Macdonald 2007; Lesiuk 2005). The 3-min time limit during the word searches may have made

some participants nervous, and the opposite may have occurred during the survey. The survey

was not timed and some students might have rushed to finish or they gave false answers.

However, the other studies presented in the background information did present silence as a

more favorable condition, which was not the case for my experiment (Cassidy & Macdonald

2007; Chew et al. 2016; Lesiuk 2005; Patston & Tippett 2011; Randsell & Gilroy 2001;

Reynolds et al. 2013; Schlittmeier & Hellbrück 2009).

There was also an issue of having a lack of participation which led to a small sample size.

If there were more trials with larger groups of people, the results might have agreed with the

studies presented in the introduction. Even with flyers posted in three campus buildings with

classes and one dormitory building, the reception on the flyers was very low, as only two

participants were obtained by the researcher through email. If this experiment were planned and

conducted earlier, then more timeslots and better advertising could have been possible.

However, it was interesting to see the results even with a small number of participants, as

performance and survey opinions differed between each participant and group. Once larger

groups of participants are obtained, this study could provide more favorable data. As mentioned

previously, mood might have influenced the performance, as well as how distracted they were by

the music, so scales (possibly Likert) or questions could be used to measure this in the future.

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Appendix A

Recruitment Flyer

Appendix B

Adult Consent Form
Consent form signed by all participants

Informed Consent Form

I, _____ (print name), understand that I will be taking part in a research project that requires me to complete word

search puzzles while listening or not listening to music, and taking a survey about music's effect on my lifestyle. I understand that I should be

able to complete this project within 20 minutes. I am aware that I am free to refuse to listen to the music, not do the word search puzzles, and

skip any questions in the survey in the unlikely event that I feel uncomfortable. I am aware that my participation in this study is voluntary and

that I may choose to withdraw from the study at any time without any penalty or prejudice. I should not incur any penalty or prejudice because I

cannot complete the study. I understand that the information obtained from my responses will be analyzed only as part of aggregate data and that

all identifying information will be absent from the data in order to ensure anonymity. I am also aware that my responses will be kept confidential

and that data obtained from this study will only be available for research and educational purposes. I understand that any questions I may have

regarding this study shall be answered by the researcher(s) involved to my satisfaction. Finally, I verify that I am at least 18 years of age and am

legally able to give consent. If not, I realize I will still receive LPP credit if I am enrolled in an LPP participating class and have a parental

consent form filed with the LPP office, but will not be able to actively participate in this experiment.

_____   Date: _____

(Signature of participant)

_____ Date: _____

(Signature of researcher obtaining consent)

Student Researcher Name and Number:

Roberta Kerosevic

Psychology Student

(314) 835-8121

rk585@lionmail.lindenwood.edu

Supervisor:

Dr. Michiko Nohara-LeClair

Course Instructor

(636)-949-4371

mnohara-leclair@lindenwood.edu

Appendix C

Word Search: Animals

Animals

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S G N R V G V W A L R U S X D Z O H O L U Y F
P A R R O T K C P U Y T S V I Z F T J B O S R
S O F Y V L N R X R L G Y Q P E N G U I N L O
C Z L L K I E F F O C V E V K U I Q M A J R G
O W F A N N A L E O P A R D R O D U C K E A N
N L W K R A F O R G O D E I R I A R P C L Y E
N P V T K B U F F A L O O K W D B L O V I V K
V S Y I J Q E E I M C L J L A U E N A V D I C
X J B B N E J A D Z L Q O Z P N N E X A O P I
U O O B R H Z F R W N X A O B H G C R Q C B H
W K B A M N O H T Y P C S L J E I A R P O Z C
F A V R W G R E F F A R I G V N U N R W R G F
E L E P H A N T V U L V P T R Z L Y O O C M Y
M O L V U K E M L G U C G F L A M I N G O B V
N M A A Y Y P S W Z N O N P G D J O R W Y Z V
P N Z X E G G A O K G S Y S I I K G V U N S J
```

Find the following words in the puzzle.
Words are hidden ↑ ↓ → ← and ↘ .

PRAIRIE DOG	LEOPARD	WALRUS
POLAR BEAR	DOLPHIN	RABBIT
CROCODILE	BUFFALO	KOALA
KANGAROO	GIRAFFE	FROG
ELEPHANT	CHICKEN	DEER
FLAMINGO	PYTHON	DUCK
PENGUIN	PARROT	

Appendix D

Word Search: Ice Cream Flavors

Ice Cream Flavors

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J K Z D M Q J F H S W M J R E G Z H T B C M I
U S Y S E R O M S F C H P L N W O A D P H I M
Y L E M A R A C Y O O E T I R A M I S U O I Z
J L U A K M A K J N O B R N S Z U T E N C Y N
B A I C D N D C O B K U U A D T M U O S O T P
H T B G Z K W I L O I F S T M X A L Q D L V S
R J J I R A H Y B C E K J I T E Y C L I A U E
N T O P E Y V A B A D B S L Z E R Q H Y T H S
A O J S T M A N H P O N R O L A R K W I E L E
D F I Y T I N Y K O U O N P V A E P E N O V E
E Y U R A N I R I Q G M I O M C B A E O J A R
P H N R B T L R J I H E T E Q I W Z F C J N C
V A O E E N L E G Y P L N N Y P A Z F I A A Q
S T C H K Q A B X T H Q P F M E R M O I K N P
X U O C A Y R R E B P S A R B P T I C Y Z A Z
K J C B C E O W L M Z Q B A Z Z S S I I H B C
```

Find the following words in the puzzle.
Words are hidden ↑ ↓ → ← and ↘ .

COOKIE DOUGH	RASPBERRY	CHERRY
BUTTER PECAN	TIRAMISU	SMORES
CAKE BATTER	VANILLA	REESES
NEOPOLITAN	CARAMEL	LEMON
STRAWBERRY	COCONUT	BERRY
CHOCOLATE	COFFEE	MINT
PISTACHIO	BANANA	

Appendix E

Word Search: College Life

College

```
J  H  C  N  U  L  H  B  E  V  F  I  N  A  L  D  J  S  F  R  G  F  R
E  K  I  H  L  P  O  T  T  M  M  N  T  F  H  E  W  W  C  O  T  F  T
B  S  P  W  L  R  M  U  E  I  K  Z  M  A  C  G  A  B  O  K  C  S  A
V  M  S  C  W  O  E  Q  Z  X  A  J  R  S  G  R  U  D  F  A  E  F  R
O  U  B  A  V  F  W  T  K  F  T  K  O  T  D  E  X  P  F  F  J  W  C
I  E  M  X  Y  E  O  B  B  L  Z  B  D  F  E  E  A  Q  E  Q  O  C  A
C  Z  Z  G  Z  S  R  O  P  E  P  C  O  O  C  K  S  R  E  W  R  D  F
H  U  A  H  B  S  K  N  Y  A  A  G  N  O  V  V  T  R  S  Y  P  E  F
L  X  Y  K  I  O  H  E  A  R  R  X  P  D  K  X  U  Q  H  K  J  E  E
C  L  C  X  Q  R  Y  B  M  N  K  G  G  P  K  M  D  V  O  B  B  T  I
P  V  G  R  M  L  E  F  O  I  I  K  T  D  Z  C  E  D  P  V  S  E  N
L  D  L  O  G  Q  P  D  N  N  N  H  W  O  D  K  N  P  P  O  A  L  E
A  J  B  T  O  Y  A  N  E  G  G  L  K  M  Y  Y  T  R  I  D  Q  H  T
E  A  D  C  X  K  G  B  Y  F  J  M  L  E  Z  S  T  O  N  H  U  T  Q
R  L  K  O  K  Z  I  Y  B  Y  Z  O  J  H  B  Z  L  J  G  L  L  A  S
O  S  K  D  K  U  O  O  A  L  A  R  M  C  L  O  C  K  O  O  G  C  F
```

Find the following words in the puzzle.
Words are hidden ↑ ↓ → ← and ↘ .

ALARM CLOCK	SHOPPING	DEGREE
FAST FOOD	STUDENT	LUNCH
PROFESSOR	ATHLETE	MONEY
HOMEWORK	PARKING	FINAL
LEARNING	PROJECT	ESSAY
TEXTBOOK	DOCTOR	DORM
CAFFEINE	COFFEE	

Appendix F

Word Search: Summer

Summer

```
O  X  N  U  N  S  Y  Q  R  K  S  U  N  N  Y  O  Y  O  J  N  W  M  N
G  S  W  C  M  T  I  O  L  J  I  B  G  U  F  C  T  Q  Z  J  N  N  C
T  U  E  N  Y  H  Y  W  W  D  E  P  L  X  C  E  C  J  R  R  S  V  O
I  R  D  B  E  A  C  H  W  H  C  D  W  N  S  A  A  F  G  Y  U  Q  O
U  F  A  D  U  W  E  U  C  E  B  R  A  B  H  N  U  L  D  J  N  I  D
S  I  N  I  J  D  F  Q  G  N  I  E  E  S  T  H  G  I  S  Y  S  B  Y
M  N  O  V  T  N  P  Q  D  B  X  G  N  I  N  N  A  T  E  Q  C  S  J
I  G  M  I  R  V  A  V  R  E  L  A  X  A  T  I  O  N  U  E  R  W  I
W  W  E  N  A  F  L  I  P  F  L  O  P  S  P  S  Z  Y  T  T  E  I  C
S  H  L  G  V  O  J  Q  Q  C  V  A  C  A  T  I  O  N  G  W  E  M  E
O  O  C  E  E  A  L  L  E  R  B  M  U  Y  E  H  K  O  D  S  N  M  C
C  D  E  O  L  H  F  U  R  J  S  N  O  T  K  J  W  B  I  F  Q  I  R
D  Z  T  O  I  N  E  L  T  S  A  C  D  N  A  S  L  K  V  Z  Y  N  E
Q  M  W  T  N  G  Y  U  C  K  O  M  S  H  S  A  N  D  A  L  S  G  A
B  I  F  T  G  H  U  W  X  F  C  D  R  Z  E  X  C  W  H  F  Z  I  M
Z  Q  A  Q  P  K  Z  F  P  X  N  E  M  R  Q  V  O  C  Q  C  C  D  Y
```

Find the following words in the puzzle.
Words are hidden ↑ ↓ → ← and ↘ .

SIGHTSEEING	VACATION	SURFING
RELAXATION	UMBRELLA	TANNING
FLIP FLOPS	VACATION	DIVING
SANDCASTLE	LEMONADE	OCEAN
ICE CREAM	SWIMSUIT	BEACH
SUNSCREEN	SWIMMING	SUNNY
TRAVELING	SANDALS	

Appendix G

Music Survey

Survey taken after word puzzles are complete.

1. How old are you? _____

2. What is your favorite genre of music? Why?

3. Where do you listen to music the most (in the car, bedroom, outside, etc.)?

4.   Do you use music for specific activities?

              YES   NO (please skip to question 6)

5.   If yes, please list the activities you participate in while listening to music and include

     what genre of music you listen to for each activity.

Activities	Genre of Music

6. What devices do you use to listen to music (phone, radio, etc.)?

7. What sources do you get your music from (radio, apps, CDs, etc.)?

8. Did you like the heavy metal music you heard today?

                        YES   NO

        Please state why you liked or disliked the heavy metal music you heard.

9. Did you like the classical music you heard today?

YES   NO

Please state why you liked or disliked the classical music you heard.

10. Did you like the pop music you heard today?

YES   NO

Please state why you liked or disliked the pop music you heard.

Appendix H

Thank You Letter

Letter thanking all participants for being in the study.

Thank you for participating in this study. The present study was conducted in order to determine whether different genres of music and if the presence of music affect a person's performance on word puzzle solving. The hypothesis is that having no background music will produce more positive results than any background music, and that more words would be found during classical music over pop and heavy metal. This information can help us and others figure out if music is a useful tool in increasing productivity in learning and working at jobs.

Please note that we are not interested in your individual results; rather, we are only interested in the overall findings based on aggregate data. No identifying information about you will be associated with any of the findings, nor will it be possible for us to trace your responses on an individual basis.

If you are interested in obtaining the final results of this study based on aggregate data, or if you have any questions or concerns regarding any portion of this study, do not hesitate to let us know now or in the future. If you would like to see the results of this study, please visit this URL (http://mnlresearch.weebly.com/). Results will be posted by the end of August. Our contact information is found at the bottom of this letter.

Thank you again for your valuable contribution to this study.

Sincerely,

Principal Investigator:

Roberta Kerosevic 314-835-8121 (rk585@lionmail.lindenwood.edu)

Supervisor:
Dr. Michiko Nohara-LeClair 636-949-4371 (mnohara-leclair@lindenwood.edu)