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## Effects of Music on Emotional and Physiological Responses

**Jenifer Fritz**

*Past research has suggested that music with fast tempos and rhythms have different physiological and emotional effects than music with slow tempos and rhythms. If these beliefs and studies are accurate, an individual will have physiological changes and report different emotions and moods after listening to music, and these changes will depend on the style of music that was heard. Twenty-nine participants were asked to report current emotions, moods, and musical preferences before and after listening to one of four musical selections: rock, rap, classical, and no music. Emotion and mood state were not affected by any of the musical conditions, but heart rate significantly increased for those in the rock condition.*

Music, which is defined as the organization of sound that moves through time (Deckers, 2005), has been recognized through research to serve many important functions. Much of the previous research involving music has centered on the emotional and physiological effects of listening to music. Many of these studies have indicated that music can be arousing or relaxing, and evoke a wide range of emotions, including feelings of love, happiness, and warmth, as well as sadness, depression, anger, and restlessness. Individual elements of music such as mode (major or minor), tempo (speed), and texture (simple or complex harmonies) have different emotional effects. Minor modes, slow tempos, and complex textures have been associated with melancholy feelings, and major modes, faster tempos, and simple textures are associated with warm, happy feelings (Webster & Weir, 2005).

Music is designed to be either arousing or relaxing, to either heighten the senses or calm them. Arousing music increases physiological responses such as heart rate, blood pressure, muscle tension, and respiration, and calming music decreases these responses. The most important factors in the motivational or energizing quality of music are tempo, rhythm, and dynamic (loudness). When listening to music, a person's heart rate synchronizes with the beat of the music, so the faster the music, the faster the heartbeat. On the other hand, soft, slow music relaxes the body and slows the heart rate (Cole, 1993). Listening to music can be a helpful tool in coping with and reducing stress, aiding in relaxation, and calming anxiety.

A study by Burns, Labbe, Williams, and McCall (1999) tested the effects of four different types of music on relaxation: hard rock music, self-chosen relaxing music, classical music and silence. They hypothesized that classical and self-chosen relaxing music would have a greater increase on relaxation than hard rock music. Results showed that certain types of music produced self-reported feelings of greater relaxation, although there were no significant biological changes. The self chosen music and silence groups had the greatest increase in relaxation, and the hard rock group had the least amount of increase. Interestingly, this research concludes that listening to "relaxing" music is really not any more relaxing than just sitting in silence.

Some studies suggest that people have a biological predisposition to like music, and to prefer consonant sounds over dissonant sounds. Zentner and Kagan (as cited in Deckers, 2005) found that infants reacted positively toward melodic, musical sounds and reacted negatively toward dissonant, "noisy" sounds, indicating that there is a natural, innate tendency to like and enjoy music. Other biological and personality traits such as

sensation seeking, resting arousal, and musical preference also influence the emotional and physiological influence of music. McNamara and Ballard (1999) studied the correlation between these traits and also found a gender difference indicating that men and women high in sensation seeking and antisocial behaviors, as well as men with low resting arousal, are more likely to prefer highly arousing music like heavy metal and rap, but women with low resting arousal preferred less arousing music. Some people assume that highly arousing music such as rock and rap has direct effects on aggression, violence, drug use, and other delinquent behavior, but studies on this topic have shown no evidence of any such correlations. Instead, research has found that people who already portray these behaviors are more likely to prefer highly arousing music because it provides stimulation to high sensation seeking traits (McNamara & Ballard). Similarly, violent lyrics are believed to cause violent and aggressive behavior, but the majority of research has found no correlation between music lyrics and aggression. One study found significant evidence that aggressive lyrics influence aggressive and angry thoughts, but not necessarily behavior (Anderson, Carnegey, & Eubanks, 2003).

Familiarity and repeated exposure of music are also topics that have generated much research. Music that is unfamiliar is more arousing than music that is familiar, because unexpected music arouses suspense and excitement in the listener (Garver & Mandel, 1987). Repeated exposure to music that is initially liked or viewed as pleasant increases that positive view and music that is initially disliked or unpleasant is viewed as even more unpleasant with repeated exposure (Witvliet & Vrana, 2007). According to participant self-reports in a study by Witvliet and Vrana, highly arousing music is

generally liked more than low-arousal music, and negative, or unpleasant, music is more arousing than positive, or pleasant, music.

The hypothesis of the present study is that music with faster rhythms and tempos will increase heart rate and affect emotion, while softer, slower rhythms and tempos will decrease heart rate and relax the body, and also affect emotion. Personal preference for a certain type of music is also believed to have an effect on the physical and emotional responses to the musical conditions.

The purpose is to find out the effects of music on the physiological and emotional aspects of a person, and whether different styles of music produce different results in emotion and/or heart rate. The rationale of this topic is that music is a huge part of almost every society and culture in the world, but it does not appear to have any clear benefits to everyday life. If the proposed hypothesis is supported, this will show that music indeed provides important benefits such as mood regulation and relaxation assistance.

## Method

### *Participants*

Participants were 13 female and 16 male undergraduate students from Lindenwood University, ages 18-26, 20 of whom were recruited through the Human Subject Pool (HSP) and nine of whom were recruited through friends and acquaintances of the experimenter. Sign up sheets were posted on a bulletin board where students from the HSP could voluntarily sign up, and all HSP participants received extra credit toward a lower level undergraduate social science course for being a part of this study. The participants who were not recruited through HSP participated as a favor to the experimenter and did not receive any kind of compensation.

*Materials and Procedure*

Participants were randomly assigned to one of four experimental groups: no music (control group), hard rock music (Smells Like Teen Spirit by Nirvana), rap music (Hate Me Now by Nas and Puff Daddy), and classical music (Moonlight Sonata by Beethoven). There were seven participants in each musical group and eight in the control group. The musical selections were instrumental in order to control for any possible effects of lyrics. Once a participant arrived, they were told that this was a study involving the influence of music on certain physical and psychological factors, and that they would be asked to listen to a musical selection for five minutes, fill out two questionnaires about current mood states and musical preferences, and take their pulse. They were then given a consent form to sign, and the first questionnaire to fill out. They were instructed to find their pulse either in their neck or wrist, and count the beats while the experimenter timed them for 20 seconds and then recorded the number of heartbeats. A pair of headphones, which were plugged into an Apple ipod media player containing the musical selections, was given to the participant, and he/she was instructed to close their eyes and listen to the selected song (or sit in silence in the no music group) for five minutes. After listening to musical selection, the participant again took their pulse for 20 seconds and filled out the second questionnaire. Finally, the participants were fully debriefed and were given a feedback letter.

The dependent measures consisted of four positive affect traits (happy, joyful, pleased, and enjoyment/fun) and five negative affect traits (depressed/blue, frustrated, angry/aggressive, worried/anxious, and unhappy). The participant rated themselves on each of these traits on a scale of 1 (not at all) to 7 (extremely) both before and after the musical condition was presented. Four other factors (relaxed, restless, calm/peaceful, and

alert) were also self-rated on a scale of 1 (not at all) to 5 (very much). Musical preference was determined by providing a list of different musical genres and asking the participant to circle all the styles that they liked. The three experimental conditions, rap, rock, and classical, were included in the list, and only the answers for these three styles were examined. On the post-test questionnaire, the participant rated on a scale of 1 (not at all) to 5 (loved it) how well they enjoyed the musical selection, and this response was compared with their preference and whether or not this preference matched the condition group they were in.

### Results

The means of the self-ratings of positive and negative affect from the second questionnaire were subtracted from the means of the positive and negative affect from the first questionnaire to find the changes in positive and negative affect. A 4 (musical condition) X 2 (affect change) multivariate analysis of variance (MANOVA) was then performed on the positive affect change and the negative affect change, but no significant results were found among any of these conditions.

For each of the four mood state changes, independent t-tests were conducted and there was no significance found. A one-way ANOVA was performed on the heart rate change for each condition, and significant results were found,  $F(3,25) = 4.475, p < .05$ . Post-hoc tests on these data revealed a significant increase in heart rate for the rock group compared to all other groups: rock and classical,  $t(13) = 3.936, p < .05$ ; rock and rap,  $t(12) = -3.361, p < .05$ ; and rock and no music,  $t(12) = -2.390, p < .05$ .

Preference of music had no significant effect on how well the music was enjoyed. However, for those participants whose musical condition did not match their musical preference, there was a significant increase in negative affect,  $t(20) = -2.735$ ,  $p < .05$ .

### Discussion

The hypothesis was partially supported in that music did have effect on physiological responses, and the music with faster tempo and rhythm (rock) produced an increase in heart rate as predicted. Contrary to the hypotheses, however, there were no significant changes in any emotion or mood state for any of the music groups. Participants showed significantly more negative emotion after hearing a type of music that they did not prefer, but there were no other effects of preference. These results are concurrent with past research findings that arousing music increases heart rate (Cole, 1993).

Alternatively, these heart rate change results could be due to the participants' nervousness during the experiment. Several individuals claimed to be nervous and unsure, and this could have caused an increase in heart rate. If this were the case, however, we would expect to see an increase in heart rate among all conditions and not just rock. Another possible explanation for the heart rate increase in the rock condition is that participants in this condition were moving around more than those in other groups. Although the experimenter asked all groups to sit quietly, those in the rock group were more likely to tap their foot and bob their head to the music, and were generally more restless and fidgety than all other groups. This could have caused an elevation in heart rate.



The statistically non-significant results for the effect of music on emotion and mood states could also be due to a number of other factors. The number of participants ( $n=29$ ) was not large enough to sufficiently test the conditions. All participants were also recruited from the same institution, with the majority of them from the same types of classes, and all were between the ages of 18 and 26. This group is not representative of a general population, nor is it even representative of the student population. The scales used to measure positive and negative affect may not have been valid or reliable. The time each participant spent listening to the musical selection was only five minutes, which may not have been adequate time to have any emotional effect. Any further research on this topic should take all of these factors into account. It would also be interesting to test the different effects of music without lyrics versus music with lyrics.

As predicted in the hypothesis, listening to different styles of music does have an effect on physiological responses. The fact that these significant results were found after only five minutes of listening to a song leads one to wonder how much greater the effects would be with longer time periods. One interesting result is that the participants' musical preference did not significantly affect how well the experimental music was enjoyed. When asked how well they enjoyed the music they listened to in the experiment, 62% of participants reported that they liked it quite a lot or loved it, and 34.5% reported that they liked it somewhat. Only three people stated that they would not be likely to listen to the musical selection on their own, all others were either somewhat, moderately, or very likely to listen to that particular music on their own. Participants were also asked how much they believed music affects emotion and mood, and all but one person believed that it affects emotion quite a lot (51.7%) or completely (44.8%). So although there were no

significant effects of music on emotion found in this study, most participants strongly believed that music does indeed affect emotion.

In conclusion, this study shows that certain types of music can affect physiological arousal, which can often be beneficial, and it also strengthens the belief that people like and enjoy listening to music, even when it is not their preferred style of music.

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