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The Effects of Musical Genre on Variations in Heart-Rate and Subjective Emotional Analysis

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Abstract

Many studies have revealed that music has an effect on heart-rate and emotional state. Tempo and timbre have been studied and used in various experiments. While all seem to have an effect on variations in heart-rate, the area left commonly ignored is whether or not the results of these studies can be generalized into something as simple as musical genre association. This is an important distinction in terms of how deeply music can effect humans both psychologically and physiologically.

1. Background

Connections between music and emotional state have been made many times over. *The Power of Music* by Elena Manes best summarizes theories behind the effects of music on a psychological level by stating, "Studies measuring Western subjects' responses to music confirm that fast-tempo, major-key music does indeed induce happiness as we might expect it to, while slow, minor-key pieces invoke sadness" [1]. Altenmüller, Wiesendanger, and Kesserling touch on a more specific connection that differs between musicians and non-musicians. For musician, listening to music tends to incorporate memory and critique. "For non-musicians, hearing of music is mostly associated with strong emotional reactions"[2].

A study done by Sandra Garrido, Emery Schubert, and Daniel Bangert titled "Musical prescriptions for mood improvement: An experimental study" confirms the experimenters'' beliefs, with regard to emotional connection to music. This study involved participants being randomly assigned to a "happy" or "sad" music group and listening to a specific playlist for four weeks[3]. Participants were asked to make journal entries regarding their own moods each day. Results "…showed that response to the sad music playlist contained significantly more words about sadness and death…thematic analysis showed that there were sad memories, dissatisfaction with the present, or ruminative thinking were prompted by the music, the affective outcome tended to be negative" [4].In terms of emotional state, John Booth Davies states in his book *The Psychology of Music* that "So far as emotional responses to music are concerned, virtually all the evidence points to the central importance of some form of cognition…rather than simple sensation, or just hearing"[5].

Examining heart-rate in relation to music in general has been done by quite a few people in many different ways. Evelyn K. Orman discusses this relationship in her study titled "The Effect of Listening to Specific Musical Genre Selections on Measures of Heart Rate Variability". In this study university students individually listened to the Billboard top 100 songs from their favorite and least favorite genres[6] Two minutes of silence came before each listening condition, and heart rates across the board decreased during music listening of both conditions when compared to silence.[7] This studied concluded that, in terms of BPM, there were no significant differences found during the listening condition of preferred genres when compared with the listening condition of least preferred genres.[8]

"Adopting a music-to-heart rate alignment strategy to measure the impact of music and its tempo on human heart rate" was a study done by Edith Van Dyck in order to investigate the effect of tempo on human heart rate, and

additionally, the effect of listening to music on heart rate compared to silence. In this study subjects were evaluated under conditions of musician vs. non-musician, and female vs. male.[9] Conclusions from this study indicate that BPM increased significantly in the music condition compared to silence, and factors such as musical preference, gender, or training did not have a significant effect on heart rate.[10] This conclusion directly contradicts the information found in the Orman study, "The Effect of Listening to Specific Musical Genre Selections on Measures of Heart rate Variability."

2. Hypotheses

We proposed two hypotheses before we began our experimentation. The first was that genres such as classical, jazz, and reggae will lower heart-rate or cause heart-rate to remain unaffected. Their calming melodies and rhythms will create a calming bodily sensation. To contrast that, we proposed that rap/hip-hop, country, rock, metal, electronic dance music (EDM), and pop music will raise the subjects' heart-rates. These genres tend to create a sense of excitement. In terms of emotional state, we predicted that classical, heavy metal, and reggae genres will decrease mood levels. Their tendencies to have slower beats and emotional lyrics may have a negative emotional effect on the subjects. All others genres tested, jazz, rap/hip-hop, country, rock, EDM, and pop will increase mood levels in test subjects. These genres tend to have upbeat melodies and lyrics, which have been shown to improve mood.

3. Method

Prior to experimentation ten genres were chosen to be used. The genres chosen were classical, jazz, rap/hip-hop, country, indie, metal, electronic dance music (EDM), pop, rock, and reggae. Subsequently, the top three songs from the most popular playlist of each genre on Spotify were chosen for the experimentation playlists.

First the subjects met us in a sound proof, secluded room. Participants were asked to fill out a background information form (Figure 1.)

1. Do you suffer from any sort of psychological issues? Yes No

If so, please specify: _____

2. Do you suffer from any sort of physical ailment (such as heart disease, diabetes, epilepsy, high blood pressure, etc.)? Yes No

If so, please specify: _____

3. Have you taken any medication in the last twelve hours? Yes No

If so, please specify: _____

4. when was the last time you listened to music? (Day and amount of time)

_____

5. Are you currently studying music and/or performing music in any way?

_____

Figure 1. Pre-Experiment Background

Next, using an Apple Watch with heart-rate measurement capabilities, resting rates were measured before experimentation began. The test subjects then listened to three minutes of music from a specific genre, and assessed their own mood. Mood surveys consisted of three different observational inquiries (Figure 2). The questions were rated on the scale presented in the questions, one being mostly negative, three being neutral, and five being mostly positive. The last task on the form asked participants to describe in their own words how the songs from the genre made them feel. There was rest period between the playing of each genre so that heart-rate would return to the original resting BPM. This was then repeated with all of the genres of music chosen.

1. On a scale from 1-5, how much do you enjoy this genre of music for recreational purposes?

1	2	3	4	5
Mostly Negative	Negative	Neutral	Positive	Mostly Positive

2. On a scale from 1-10, how much did the music from this genre affect your mood? 1 being extremely negative, 3 being neutral, and 5 being majorly positive.

1	2	3	4	5
Mostly Negative	Negative	Neutral	Positive	Mostly Positive

3. Describe in your own words how the songs from this genre made you feel.

_____

Figure 2. Emotional Analysis

4. Results

Results regarding emotional had a large range (Figure 3.) The largest percentage of positive emotional response from participants came in the pop genre at a rate of 69.2%. The genre with the most neutral emotional responses was jazz at a rate of 38.5%. Lastly, the highest reported percentage of negative emotional responses was country at 30.8% of participants. In terms of variations in heart-rate, there was a difference when comparing resting heart-rates to those measured at specified genres Table 1 and Figure 4.) The average resting heart-rate (of 13 participants) was 82 BPM.averages across genres ranged from 78.2 BPM to 83 BPM. After running an ANOVA analysis $F_{critical}$ values ranged from the highest being between resting heart-rates and heart-rates while listening to reggae at 4.64 with a P value of 0.052262 to the lowest being between resting heart-rate and heart-rate while listening to pop at 0.02 with a P value of 0.889883.

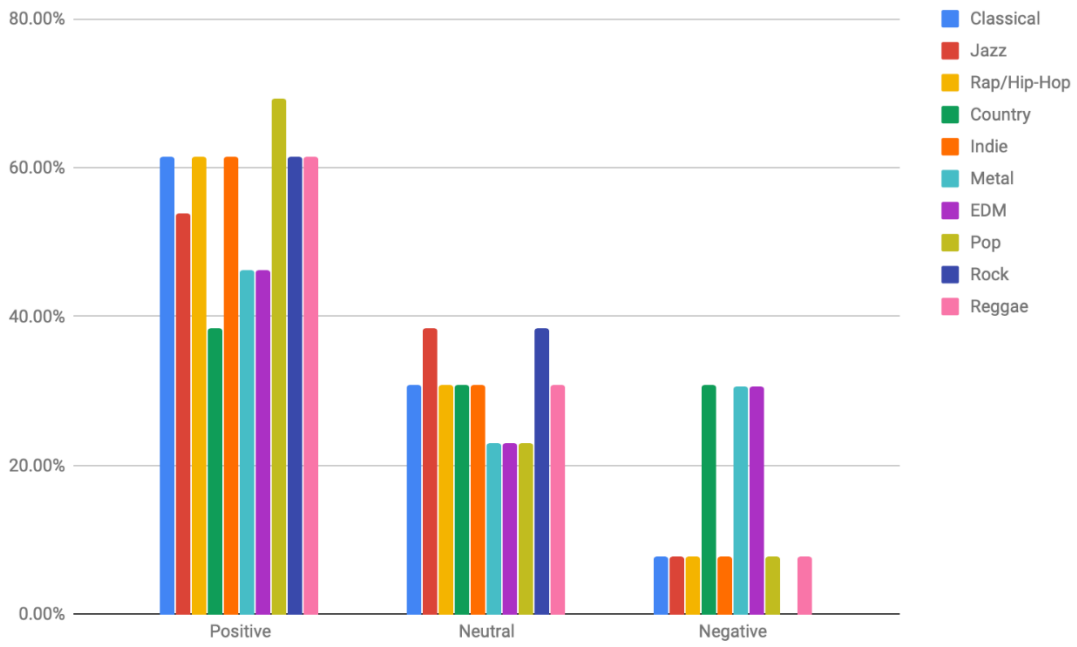

Figure 3. Percentage of Emotional Response to Genre

Table 1. Average Heart-rates for 13 Participants

Genre:	Resting	Classical	Jazz	Rap/Hip-Hop	Country	Indie	Metal	EDM	Pop	Rock	Reggae
Averages:	82	83	82.6	81	81.6	79.5	81	80.6	81.7	80.5	78.2

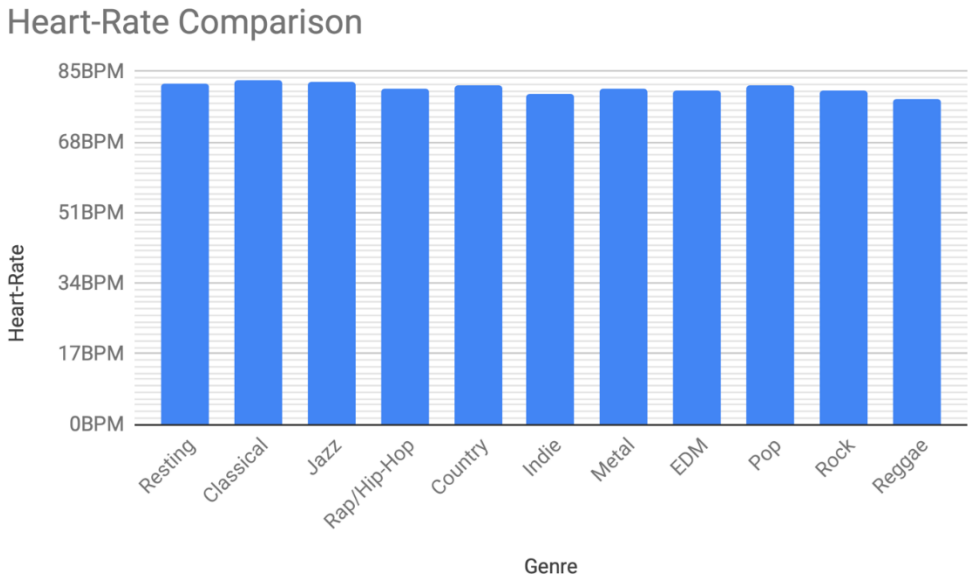

Figure 4. Average Heart-Rates for 13 Participants Visually Graphed

5. Discussion

Genres across the board had significantly higher rates of positive emotional reporting than negative. In the metal, country, and EDM listening conditions there were significantly higher reports of negative emotional evaluation when compared to the other listening conditions. The pop listening condition had the highest number of positive emotional evaluation reported. In terms of variations in heart-rate, there were no truly significant differences when comparing the average resting heart-rate to any of the listening conditions. Perhaps this was due to the short listening time of three minutes. In all of the listening conditions except jazz and classical heart-rates, on average, decreased. However, there were no significant decreases. This data did not support the original hypothesis. Rather, it confirmed the conclusions of many other studies. Most experiments have found that heart-rates, on average, decrease when listening to music of any kind. However this directly contradicts the finding from the Van Dyck study. Generalizing the physiological effects of music to genre specifications is not accurate. Rather, it has more to do with the matter that makes up the music (tempo and timbre).The hypothesis surrounding the emotional effects was also not accurate to the results of this study. Participants, according to their responses on the Emotional Analysis (Figure 2.), determined emotional evaluations on past experience with the music and lyrical content. Comparing both sets of results, in most genres there seems to be a relationship between positive emotional reports and decreased heart-rate. However, there is not a relationship present between increased heart-rate and negative emotional response. Some listening conditions showed an increased heart-rate while participants reported feelings of neutrality towards the genre.

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8. Endnotes

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