Fall 2022

# How Lyrics Influence the Effect of Music on Emotions Regarding Differences in Musical Training

Keyan Ivy Wu
*Bard College*

*How Lyrics Influence the Effect of Music on Emotions Regarding Differences in Musical Training*

Senior Project Submitted to

The Division of Science, Mathematics, and Computing

of Bard College

by

Keyan Ivy Wu

Annandale-on-Hudson, New York

December 2022

**Acknowledgement**

As a musician, I have always felt the power of music and how my emotions change with it. Because it comes naturally for me, I did not think about why music is so powerful and therapeutic. The reason behind it fascinates me and one of the conversations that I had with my late piano professor made me question what music means for musicians.

He knew that I had an interest in music therapy. So, when he was recovering from his cancer, we had a conversation about whether he would use music therapy to ease his pain. He refused and his reason was that he has known, practiced, and taught music for his entire life. Due to the fact that he was a lifelong musician, he doubted music's therapeutic properties, as he had always known it in a completely different context. This short conversation prompted me to question whether an individual's past experience in music would change the way that they would possibly benefit from music therapy; or in another hand, would musicians respond to music differently compared to people who have no musical experiences.

I wish to express my deepest condolences to my beloved piano professor, Peter Serkin. This project was only possible to form in the memory of him. I now wish to thank two of my advisors, Prof. Thomas Hutcheon and Prof. Kristin Lane. The brainstorming sessions with Prof. Lane opened my mind about where research can go, and the emphasized suggestion about narrowing down my research focus led me to a feasible plan. The calmness and the confidence that Prof. Hutcheon expressed, influenced me to face the unexpected difficulties during the actual experiment process. He gave me hope when I was in a real time crunch in completing the project. I am grateful for Prof. Justin Hulbert's detailed answers and suggestions whenever I had any questions. The inspiration and knowledge that I learned from them will always guide me in my future research. I also want to thank my current piano professor Shai Wosner for supporting

my research work and for understanding my struggle of balancing between the research work and piano practice. Without whom, my last year at Bard would be impossible to manage.

I want to express my gratitude toward my peers. In a relatively isolated campus, I have never felt alone because of the support of my friends. Special thanks to Shaunessy Renker, Zihao Liu, Nita Vemuri, Mingxi Wang, Yijie Yin, who I can talk to whenever about whatever and always have a good time every time we are together. I also want to thank Yiwen (Irene) Hu, and Ziqian (Hebe) Huang; you have witnessed and accompanied me through all of my ups and downs. Whenever I am with you, I feel most like myself and the comfort of home. I wish to thank Lingtong (Jasmine) Su and Vivian Zhou for helping me adjust to the life living off campus and always finding a way to create healthy distractions for me so that I do not get over frustrated with my work. Your kind words empower me and keep me motivated; and to Sibei (Betty) Wang, and Beitong Liu, who have been my friends since my first year at Bard.

My gratitude also goes to my family, Chunhua Ni, Yichen Wu, Dixiang Wu, Meihua Mao, and my friend Chenye Zhu. Although we are unable to be together and don't even talk that much, I know you will always be my strongest supporter and trust me in accomplishing my goal, including this project.

Words can only say so much. There are still so many people in my life that I owe my gratitude to. I am appreciative of all the kindness, guidance and motivation that I received. They encourage me to move forward with determination, to a future where I could have the ability to provide assistance to those who need them.

Now, this project is the first step into that future.

# How Lyrics Influence the Effect of Music on Emotions Regarding Differences in Musical Training

Keyan Ivy Wu

Bard College

**Contents**

## Introduction

Lyrics refer to the written words of a song in music. On the other hand, emotions are mental states triggered by neurophysiological adjustments, which can be variously connected to ideas, feelings, behavioral reactions, and a level of pleasure or discomfort. They are thus particular feelings that emerge especially after an individual encounters something. Music is believed to be one of the major emotion influences in human beings. It can bring about negative or positive feelings depending on the type of music being sung and the individual perception of the person listening to the music. The growing accessibility of digital music over the internet has prompted the creation of sophisticated databases and tools for exploring and searching them, as well creating different feelings among the individuals. Nowadays, the scientific community is paying a lot of attention to music emotion identification. The process of evaluating a text passage to ascertain the intention or meaning of a song is known as "emotion analysis" in music lyrics. This paper will explore how lyrics elicited emotions in the context of music.

According to the study by Ali (2004), it is clear that most studies that present music to measure the resulting cognitive, perpetual, or effective responses use instrumental works. This instrumental work in the music industry is the work that is done in recording music, mainly without any vocals being involved. The main aim of using instrumental work when presenting music is to create a conducive environment for listening to music without any confounding influences around the activation of the language system in the music.

The response to music is based on the emotions of the type of music, whether happy or sad. Music lyrics hit differently according to the song's kind of song or genre (Susino & Schubert, 2019). For example, happy music with lyrics and sad music with lyrics have different emotions for the listener. The emotions that the listener will have when listening to lyrical music of jovial

or happiness differ from those that the same listener will have when listening to sad music with lyrics. When listening to music with lyrics of happiness or good mood, those wordings get in the mental consciousness of the listener with a good feeling of happiness, while when the listener is listening to sad songs with lyrics, those wordings get into the inner consciousness of the listener leaving the listener with a bad or sorrowful feeling (Susino & Schubert, 2019). There are many types of songs, and the emotions they pose are also in the listener's inner mind. Therefore, the type of song the listener listens to matters a lot about the emotions the listener will have when or even after listening to the music.

There is plenty of research done regarding the difference between these two groups. The way that musicians perceive music is more focused and shows activity using the dominant hemisphere. As for people with no musical experience, they use the non-dominant hemisphere (Bernardi et al., 2006). In this research, they looked into how musicians and non-musicians reacted to six different types of music, which includes slow classical, fast classical, dodecaphonic, techno, rap, and raga music (Bernardi et al., 2006). During the process of music listening, they also monitored heart rate, breath, and blood pressure. One thing that caught my attention is their analysis on the effect of music styles. They compared different music styles in structure and tempo speed. They assessed the music based on these two aspects in order to see which ones were connected to the physical responses they were measuring (Bernardi et al., 2006). They found that faster tempo music showed increases in most of the measures, and raga music had a significant fall in heart rate (Bernardi et al., 2006). They concluded that the results shown mostly relate to tempo speed. The other aspect of their analysis that interests me is the participants' music preference. Although there was no significant result found that could relate musical preference with the physical response, I am interested in researching how musical

preferences could possibly connect to emotional response. As for the difference between two groups (musician vs. non-musicians), musicians had lower breathing rate and increased their breathing more than non-musicians when encountering faster tempo (Bernardi et al., 2006). This could suggest that in general, musicians are more relaxed when music is presented, but their response to change of musical styles are more sensitive. The physical responses that they analyzed might also be a predictor of participants' emotional responses.

## Literature review

According to Schäfer & Eerola, (2020), there has been an increasing interest in musical training where the interaction between the song lyrics and humanity through the responses that are given through emotions. Most people in the world are using the most popular social media platforms or the streaming platforms like YouTube to create song lyrics that aim at reaching global listeners. In these songs which they Livestream, these platforms, they upload the songs together with their lyrics which helps their audience to have a better understanding of the songs and have inner feelings of the song's message. In musical training music students are taught how to capture the emotions of the audience. Streaming songs on these platforms with lyrics or live streaming of songs while including the lyrics will help in capturing all the attention of the audience as they will not only be listening to the music sound but also, they will be reading the wordings of the song. In many cases, musicians may decide to the airstream and upload their songs with lyrics in different languages so that those listening to the song but who cannot understand the language will also understand and feel what the song is about. This is mainly used by local musicians who sing using local languages and when they are streaming their songs, they add the lyrics using different languages like English as they know that many people in the world are conversant with the English language (Schäfer & Eerola, 2020). The idea of adding lyrics

using different languages is beneficial to the musician as they can attract the attention of audiences across the world while at the same time reaching those who cannot understand their local language.

According to Cotter et al., (2019), through the creation of the lyrics in the songs by the musicians, the well-being of the audience is improved especially. Listening to music with lyrics makes the artists or the musicians talk to the audience directly giving the relevant messages that the song contains. Most of the songs, especially those inspirational songs which are meant to inspire and change the lives of people in the world, are well understood and felt when they listen to the lyrics (Cotter et al., 2019). The listener gets a chance to listen and read the words of the song and some of the listeners even write down these songs. By doing this, the emotional health of the listeners is improved and those with mental problems recover. Additionally, music is well known for creating good therapy, especially for those with mental illnesses like depression, stress, and other mental problems. Those with mental problems and illness, may find themselves listening to the songs but their mind is not there or they are not understanding what the song is saying, but with the help of lyrics, they get to concentrate easily and understand what the song is all about and acquire the message displayed by the song (Cotter et al., 2019). This is evident by the fact that most people concentrate more when they are reading and concentrate less when they are listening.

## Theory of language evolution that explains song lyrics

Theory of language evolution that explains song lyrics was established by Phillip Dorrell in his explanation of how the language evolved to an extent that it is presented in songs. The theory explains the development of proto-music which is a language that is well expressed using emotional meanings. This language was presented and supplemented in the communication

through songs where the artists used the first word-based language (Culler, 2017). This type of language looked like lyrics. Then later the word-based language developed and evolved and replaced the proto-music which later involved the music itself. The theory explains that music and proto-music are one kind of communication that artists and musicians use to deliver messages to the audience. This is evident during political campaigns and political rallies where the songs used are meant to deliver a certain message to the audience. Even when companies or businesses are advertising their products, they use songs as a means of communication with their potential customers intending to deliver information to them.

The evolution of word-based language in the musical industry is one kind of important to the musicians who create their content and air it to their customers in both vocal sounds and written documents. The artists during this stage did not only record the music but also create videos with wordings of the songs that they presented to their audience. Each word in the recordings seen by the audience created a special impact on them, especially an emotional impact. The evolution of word-based language evolved from simple wording to complex wordings which are done using the available technological advancements in the music industry (Culler, 2017). Therefore, the combination of the music's vocals, instruments, and lyrics makes the songs and music in general sweet and admirable to listen to.

Dalya. et al., (2014), did an EEG study on music and emotions. Compared to past research, they used rather large stimuli samples. Instead of just a few sets of different styles, they used 110 excerpts from film scores with different styles and they were also rated on induced emotion by 116 participants (Dalya. et al., 2014). Although they did not give specific information about which music styles and difference between the music, the intention to conclude more musical stimuli is a great attempt to further understand the emotional changes

when encountering various musical styles. During the research process, every participant went through 4 intervening runs which contained 10 trials each. For each trial, they were first shown a fixation, followed by a short piece of music which is selected randomly (Dalya. et al., 2014). The music would be played for about 12 seconds, and a pause would be presented for about 0.5 seconds. After the break, there would be 8 questions for participants to answer about their feelings about the music that was presented (Dalya. et al., 2014). The subject of the feelings are "pleasantness, energy, tension, anger, fear, happiness, sadness, and tenderness", and it is on a scale of 1–9 (Dalya. et al., 2014). The main analysis that they did are asymmetry and coherence measures. The brain correlation of induced emotional changes during music listening was examined as asymmetry (Dalya. et al., 2014). As for the coherence measures, they examined the connections across channel pairs between groups of high vs. low principal component (PC) value trials (Dalya. et al., 2014). The principal components model that they used to further investigate is the Schimmack and Grob three dimensional model of emotional responses. "Valence" as PC1 means pleasant–unpleasant, "Energy arousal" as PC2 means wakefulness–tiredness, and "Tension arousal" as PC3 means relaxation–tension; these are the three components in their model (Dalya. et al., 2014).

The results, regarding the 8 questions about feelings, found that participants' responses to the music in terms of pleasantness, anger, fear, and happiness are correlated with PC1. PC2 is linked to feelings of energy, sadness, and tenderness, and tension is linked to PC3 (Dalya. et al., 2014). They also investigated the relationship between participants' demographic information projected along the PCs. However, I thought that they were too broad of an investigation and they did not specific on a hypothesis regarding these comparisons which concludes age, gender, handedness, and musical training. I am intrigued about the musical training aspect for its

relationship to emotional response. There was a significant negative correlation found between PC1 (valence) and musical training, and a negative correlation was also found between musical training and PC3 (tension) (Dalya. et al., 2014). For my understanding, this could suggest a desensitization to emotional response due to musical training. As for the asymmetry measures, prefrontal cortex asymmetry was observed that could suggest neural correlates of musical stimuli-induced emotion (Dalya. et al., 2014). I believe that the emotional responses involve a large range of cortical networks and need further research.

One of the most important things that was lacking in the last research is that they did not give any analysis regarding the music used. Music has many forms and what I am used to is classical music. It includes a wide range of variety in its style, genre, and musicality. However, except for operas and pieces of songs, there are no words used in instrumental music. Also, the language used in operas and songs in classical music are often in German, French, and Italian. It might be hard for people who are not multilingual to connect with the words; so, instead of words they tend to focus on the plot and music in the operas and songs. The special element of music that I intend to investigate is the lyrics. Song is the form that combines music and lyrics. In a way, the lyrics make what the music tries to express more defined and specific.

There has been some research done regarding the lyrics in songs and how they related to people's emotional response. Mihalcea, et al., 2012, examined the emotional response for each line in popular songs. They used a MIDI format which means all the songs are produced using a computer and does not contain any audio signal. The way that they use to annotate peoples' emotional responses is the "six basic emotions proposed by (Ekman, 1993): ANGER, DISGUST, FEAR, JOY, SADNESS, SURPRISE" (Mihalcea, et al., 2012). They asked the annotators to grade each line of the lyrics, and what they found is that the most observed emotions are JOY

and SADNESS. It is interesting that these emotions could also overlap with each other. They did three experiments focusing on different aspects of songs. In the first experiment, they only focused on the lyrics and the words used in the songs. They used unigrams as the indicator of different emotions; also, "Linguistic Inquiry and Word Count (LIWC) and Word- Net Affect (WA) was used as a resource for psycholinguistic analysis" (Mihalcea, et al., 2012). The second experiment focused on the music used in songs. They analyzed two elements in music which are the notes and the keys. Notes are the basic component of every musical melody. It is also associated with its value and tempo. As for key, it is the classification of the whole melody and it could have a strong emotional direction by itself. The last experiment examined songs as a whole with both the music and the lyrics. The results stated that lyrics itself is considered more useful and music added clear improvements (Mihalcea, et al., 2012). When the music and lyrics are represented together, people's emotion classification becomes more clear (Mihalcea, et al., 2012).

The separate analysis of music and lyrics made me consider the possibility that lyrics could be the thing that enhances the power of music or lyrics itself could contribute more to people's emotional response. Ali., 2006, researched in a subject that is exactly aligned with my thought. Their idea was to analyze the emotion induced by lyrics and music separately in order to compare whether they had the similar emotional response, also they intended to find which component was more effective in emotional arousal (Ali., 2006). The emotions that they used are "happy, sad, calm, and angry" (Ali., 2006). There were four experiences done; first is about emotional response regarding instrumental music with and without lyrics. The emotional categories of the music and lyrics are congruent. They also adapted the lyrics to fit the choosing of classical music instead of using preexisting songs which made me wonder how they managed that. This attempt could lead to either a more accurate finding because of its innovativeness, or it

could go the other way because that the stimuli is basically made up and hard to analyze musically. The result for the first experiment stated that the participants gave higher ratings for the happy music than the other three categories and they also gave higher ratings to music that express positive emotions than negative emotions (Ali., 2006). Regarding the lyrics element, participants rated that the positive emotional responses are more intense when there are only melodies presented than when the same melodies are presented with lyrics; however, it is the opposite for negative emotions (Ali., 2006). They tried to explain this by saying that usually positive emotions proceed in the left hemisphere and negative emotions proceed in the right. The meaning of the lyrics is also being processed in the left hemisphere, but the negative emotional responses of the lyrics are processed in the right hemisphere; so, by adding to the negative of the emotions induced by both music and lyrics both in the right hemisphere, it could have a strong intensity (Ali., 2006).

In the second experiment, they used disorganized music and lyrics with the intention to see which element is more prominent. The congruence showed to be an important factor. The results found that the participants rated higher when the music and lyrics were congruent, which also indicates that music and lyrics both have power in inducing emotions (Ali., 2006). They also found that the music itself had a more dominant part in inducing targeted emotions (Ali., 2006). When the emotions presented are incongruent between music and lyrics, the ratings on emotions are more aligned with the music compared to the ratings aligned with the lyrics (Ali., 2006). This is the opposite to the findings in Mihalcea, et al., 2012. One explanation for this is the musical stimuli used are different and Ali., 2006, definitely used a more innovative approach which might raise problems in future studies that would intend to replicate the research.

The third and forth tried to make the association between the emotional responses induced by music with or without lyrics to another stimuli to see whether the emotion would transfer to the third stimuli (Ali., 2006). The result found that music affected the ratings of the pictures in general; for pictures with both music and lyrics, and pictures with only music,the ratings were higher compared to pictures with no music (Ali., 2006). Overall, they concluded that lyrics expressing similar emotions as the music would only help to induce emotional responses when it was associated with negative emotions. However, when positive music is presented, lyrics do not influence the emotional response (Ali., 2006). The possible reason for this was proposed in the article to be that the music and lyrics selected for the positive emotions was more effective. Besides that, I also consider the possibility that positive emotions are easier to receive and admit than negative emotions. People might not be willing to let themselves feel sad just by listening to music, but with the lyrics which added a more direct expression of the sadness, the emotional responses are easier to convey.

Regarding the negative emotions, Park, et al., 2014 researched whether musical training could influence people's emotional responses. They found that musicians felt more stimulation with sadness and fear than non-musicians. Also, they researched the neural activities associated with musical training (Park, et al., 2014). Musical training is a process for people to learn how to express their emotions through music and in order to do that, people need to learn how to recognize the emotional component in the music. This would make musicians more connected to music in a way; on the other hand, with the music they are already familiar with, there might be an opposite effect. To further research the possible difference on a neural aspect, they used functional magnetic resonance imaging (fMRI) to scan participants, who are either musicians or non-musicians, while listening to music and see their emotional responses in three levels:

happiness, sadness, and fear (Park, et al., 2014). The compositions of the music chosen were listed and the features were aligned with the emotion they tried to convey. The participants were asked to listen to the music with their eyes closed which would help them to focus on the music and they were asked to self report on emotions using the "self-assessment manikin, a five-point pictorial, non-verbal affective rating system" (Park, et al., 2014). They found that musicians rated higher arousal for fear and sadness; as for the neural level differences, they found increased activation for musicians located in the right hemisphere for sadness and fear (Park, et al., 2014). This finding has a similar statement as Ali., 2006, which is that the right hemisphere has the dominant ability to perceive emotions that are induced by music, especially negative emotions. Another interesting aspect that was mentioned in the discussion was that musicians showed increased activation in the right prefrontal cortex regarding sad music, and "right prefrontal activity – specifically in the middle frontal gyrus – has been related to processing of emotional prosody in speech, which uses similar acoustic elements to convey effective messages as music" (Park, et al., 2014). This made me think about the possibility of induced activity in the right prefrontal cortex when lyrics are added as a linguistic component.

Park, et al., 2015 did a research similar to the thought that I have. Their goal was to identify whether musical training could make a difference on a neural level of speech prosody that expresses different emotions (Park, et al., 2015). As for what emotional prosody is, it was defined as the ability to express emotions through different ways of speech (Besson, et al. 2002). They acknowledged the strong connection between music and speech, and similar brain networks active have been found during processing of both music and language (Park, et al., 2015). They also used fMRI and the three emotions, which are happiness, sadness, fear and a control condition, which means the content of the speech was neutral (Park, et al., 2015). In this

research, participants were asked “to choose an emotion after each sentence by selecting from a list (happiness, fear, anger, disgust, sadness, surprise, neutral) or by choosing an individual label.” (Park, et al., 2015). The result stated that there is no difference between musicians and non-musicians, but both groups are better at identifying sadness compared to the other two emotions (Park, et al., 2015). It was the same for the neural level assessment, regarding the sadness, “musicians showed an increase of activity in the frontal cortex, posterior cingulate and retrosplenial cortex” (Park, et al., 2015). The possible reasoning for this was proposed to be that the speech given in sad tones might have higher effectiveness (Park, et al., 2015). They also discussed the possible connection to empathic processes, because they found activity in both the medial prefrontal cortex and the anterior cingulate cortex , which also have usually been connected with empathic processes and perspective taking (Park, et al., 2015). This would suggest that musicians could be more empathetic in communications. Another aspect of the research that I have noticed is that the speech was read to the participants instead of presented to them and asked them to read. I wonder if the difference in individual comprehension would affect the results or possibly provide more diversity.

In this study, a qualitative research design was applied in answering the research questions. According to Kothari (2004), qualitative design is majorly known for a qualitative phenomenon for example when one is interested in investigating the reasons for human behavior. This type of research is important since it aims at finding the underlying motives and opinions using questionnaires and interviews (Kothari, 2004). I predicted that people with musical training would have stronger emotional responses to music alone compared to people without musical training. People without musical training have stronger emotional responses to lyrics alone. The combination of music and lyrics would induce emotional responses compared to any of them

alone for both musicians and non-musicians, although musicians would have a stronger response in general. It is a 3 x 2 study with three different musical conditions; the first condition is listening to music alone without lyrics, the second condition is listening to the lyrics alone without music presented, and the last condition is listening to music with the lyrics. The two groups would be participants who are musicians and had extensive musical training and people who would be considered non-musicians. I expected to find a difference in emotional responses between two populations regarding the first two conditions.

## Method

### Participants

The study involved 40 participants from the Bard Conservatory of music and online platforms. Within the participants, 15 of them are from the conservatory and 25 are from ProlificTM online data collection platform. For the participants in the musicians group, I recruited in the Bard Conservatory of Music and online. The requirement for this group is to have a consistency of musical training, practice and performance for the past five years. As for the non-musician group, I recruited participants through the ProlificTM online data collection platform. The requirements were the lack of musical training and practice in the past five years. If musical training was concluded in the past five years, the duration of the training time can not be longer than 1 year. The age range would be 18-26 because it fits the age range for a college student and young professional musicians.However, due to the lack of participants, I was reluctant in excluding people because of their age, which is not a big research focus. So, I have expanded the age requirements to all that is above 18.

**Materials**

PANAS The Positive and Negative Affect Schedule (PANAS) is a self-report measure of emotional affect (Watson, Clark, & Tellegen, 1988). The self-report form is a questionnaire comprising the Ten-item scales used to measure both negative and positive emotional affect. Each measured item or variable is rated and ranked using a scale of 5 points. Many researchers have used PANAS widely, and it has been validated using several languages that can be understood easily by a researcher from different parts of the world (Díaz-García et al., 2020). The PANAS is validated because it has shown excellent psychometric properties in all the aspects that it has been used, such as in the collection of clinical samples, while getting forensic samples and investigating the substance users. Per the PANAS, it is evident that Positive Affectivity (PA) and Negative Affectivity (NA) do not depend on each other. Using PANAS helps prove that an individual can be high in positive and negative affectivity (Díaz-García et al., 2020).

The classification for the songs based on the lyrics and the conveyed emotions would follow the rules proposed by Kim, et al,. 2011. They proposed four kinds of syntactic analysis rules. The first rule is the “negative word combination” (Kim, et al,. 2011), which means that sentences formed with negative adverbs such as ‘not’ or rejective words could be interpreted for negative emotions. The second one is the “time of emotions” (Kim, et al,. 2011). The indication of the time (the present, past and future) can be a description of the emotions of the different situations; it could be a feeling that was felt, or what the speaker is currently feeling, or it is a anticipation and guesses of a future emotion. The third rule is the “emotion condition change” (Kim, et al,. 2011). Verbs like “pass, leave, and disappear” have the underlying meaning of the changing of emotional condition. This would imply the emotion change of the speaker. The last

one is the “interrogative sentence” (Kim, et al,. 2011). Interrogative sentences used in lyrics do not express the emotion of the speaker; in turn, it asks about the emotion, and requires answers.

**Procedure**

First, participants completed a demographic questionnaire regarding their age and music training levels. Then, they were randomly assigned to three different conditions. Each person listened to 5 song excerpts in one of the conditions and each song excerpt is about 90 seconds. Condition one would be the music only condition. Participants would hear the music of a sad song without the lyrics. Condition two would be the lyrics only condition. Participants would listen to the lyrics of the songs read by a computer generated sound. The last condition is the combined condition. The complete songs would be heard by the participants. They would also need to complete the PANAS (briefly describe what this is) form both before listening to the music and after the 5 songs (see in Appendix A) . The songs used were reduced to two because of difficulty in recruiting participants. The final version of the used songs are the first two, “TV” by Billie Eilish, and “Ashes” by Celine Dion. The Positive and Negative Affect Schedule (PANAS) is a self-report measure of emotional affect (Watson, Clark, & Tellegen, 1988). After completing the PANAS, participants will be debriefed about the purpose of the study and given information about where they will be able to access the results of this study.

A debriefing process will be included at the very end of the experiment which involves listening to happy songs to balance the negative effect that the previous music listening might have as well as the overall purposes of the study. The music used in the debriefing will be “One Life” by Ed Sheeran. The selection of songs follows the rules proposed by Kim, et al,. 2011. There won’t be a PANAS form after the debriefing and the reason for this is that three PANAS forms in one experiment would be too much for the participant. Also, I believe that the

debriefing process would be efficient. There would also be the mental help information provided for the participants.

**Data Analysis**

The study uses a wide range of Statistical techniques, which include; descriptive statistics, correlation Matrix, analysis of variance(ANOVA), and independent T-test.

In the between subject ANOVA test, the dependent variable is the positive/negative score differences. The independent variables are the musician/non-musician groups and the three different musical conditions.

## Result

**Descriptive Statistics**

Table 1 & 2 below shows the descriptive statistics and correlation matrix for age, music training total, positive score difference, and negative score difference.

***Table 1:Descriptive statistics***

| Variable | Mean | St. Deviation | Min | Max |
|---|---|---|---|---|
| Age | 24.07 | 5.71 | 16 | 50 |
| Music training total | 4.75 | 5.41 | 0 | 20 |
| Positive score difference | -3.39 | 6.67 | -19 | 9 |
| Negative score difference | -4.37 | 5.49 | -19 | 4 |

The descriptive statistics above show the mean, standard deviation, minimum and maximum. The output reveals that on average the age of the participants was 24.07 years with a standard deviation of 5.71 years. Further, the minimum age of the participants is g 16 years whereas the maximum age is 50 years. On the other hand, the music training total is 4.75 on

average with a standard deviation of 5.41. Further, the results indicated that the mean of both positive and negative scores is negative but with a positive standard deviation as shown above.

**Correlation Matrix**

The table below displays the correlation matrix for music training, positive score difference, and negative and negative score difference. The main objective of this is to assess the existing relationship between the variables. In this correlation matrix, the music training total is used as the dependent variable.

***Table 2:Correlation Matrix***

| | **Music Training Total** | **Positive score difference** | **Negative score difference** |
|---|---|---|---|
| Music Training Total | 1.00 | -0.30(0.0645) | -0.02(0.9127) |
| Positive score difference | -0.30(0.0645) | 1.00 | -0.14(0.3811) |
| Negative score difference | -0.02(0.9127) | -0.14(0.3811) | 1.00 |

**Correlation coefficient(p-value)

From the correlation results above it's evident that there is a negative relationship between the variables. For instance, there is a low negative correlation between music training total and positive score difference $(r = -0.30)$. This a clear indication that there is a negative relationship between music training total and positive score difference, but the relationship is not statistically significant($p = 0.0645 > 0.05$).However, I would consider it as a marginally significant result because the reason for only marginally significance in the results might be due to the lack of participants and the change I made because of that by decreasing the songs used from 5 to 2.

On the other hand, there is a very low negative correlation between music training scores and negative score difference $(r = -0.02)$. Nevertheless, the relationship between music training score and negative score difference is not statistically significant as well since $p =$

*0.9127 > 0.05*. Also between the two scores there exists a very low correlation(r=-0.14) indicating a negative relationship between the two. The relationships between the two scores and music totals are visualized using the scatterplots as shown in figures 3&4 below.

**Histograms**

***Figures 1 & 2 below show the histograms for age and music training total.***

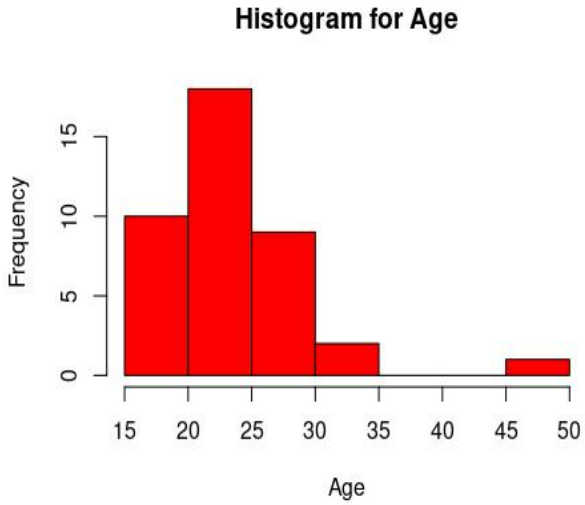


Figure 1:Histogram for age

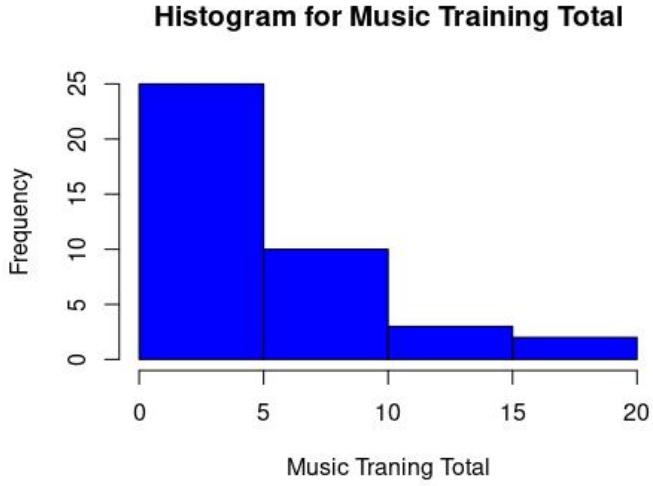


Figure 2:Histogram for music training total

From the histograms above it's evident that age and music training total are not symmetrical but rather right-skewed (positively skewness). This means that mode>median>mean which is a clear indication that age and music train total are non-normal.

**Scatter Plots**

The scatterplots below show the existing relationship between positive score difference and music total training, negative score difference, and music total training. Figures 3 & 4 show that there is a negative relationship between the two variables.

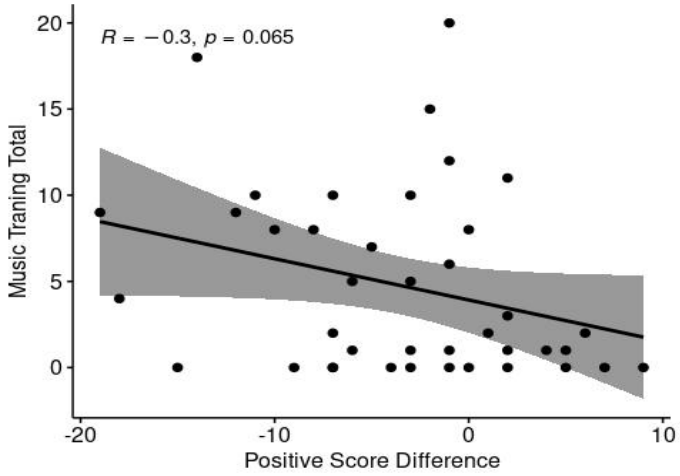


Figure 3:Scatter plot between positive score difference and music training total

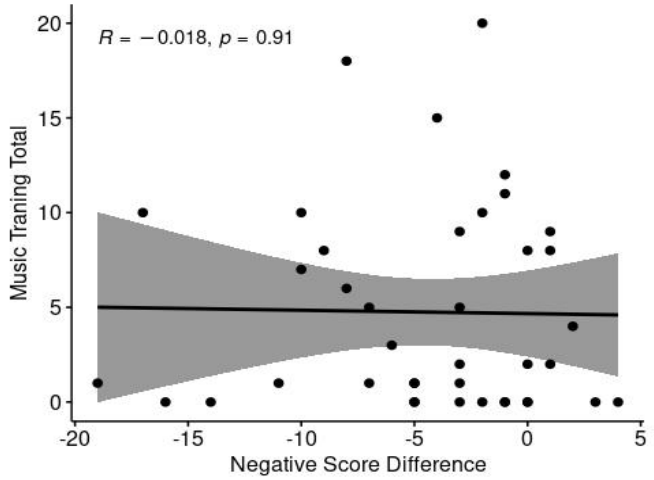


Figure 4:Scatter plot between negative score difference and music training total

**Analysis of Variance (ANOVA)**

A 3 Music Condition X 2 Music Experience Between Subjects ANOVA was used to evaluate the effect of the condition on both positive and negative differences. The results of the ANOVA are presented in Tables 5&6 below. However, the normality and homogeneity of variance assumptions for the ANOVA are shown in Tables 3&4 below.

Shapiro-Wilk Test was used to test the normality test for both positive and negative score differences as shown in Table 3 below.

***Table 3:Normality Test***

| Variable | Statistic | p-value |
|---|---|---|
| Positive score difference | 0.975 | 0.484 |
| Negative score difference | 0.922 | 0.00798 |

The table above shows the Shapiro-Wilk test statistic and p-value for each score. From the output, the Shapiro-wilk test for positive score difference is 0.975 with a p-value of 0.484. On the other hand, the Shapiro-Wilk test for negative score difference is 0.922 with a p-value of 0.00798. Based on the two p-values it's evident that the normality assumption for positive score difference is met since p>0.05. However, for the negative score difference p-value is statistically significant $(p = 0.00798 < 0.005)$, the null hypothesis of normality is rejected, and conclude that the data is non-normal. Therefore, ANOVA was carried out only on positive score difference as shown below in Table 5.

Levene's test was used to assess the homogeneity assumption in both positive and negative score differences.

***Table 4:Homogeneity Test***

| | Df1 | Df2 | Statistic | p-value |
|---|---|---|---|---|
| Positive difference score | 5 | 34 | 0.291 | 0.915 |
| Negative difference score | 5 | 34 | 0.543 | 0.742 |

From Levene's test output above it is evident that in both positive and negative score differences the p-values are greater than 0.05 level of significance, meaning the p-values are not statistically significant. Therefore, this is a clear indication that there is no significant difference between variances across the groups. Hence, we conclude that homogeneity of variance is not violated in the groups.

Based on the above assumptions ANOVA was computed for a positive score difference as shown below.

***Table 5:ANOVA for positive score difference (conducted in R)***

| **Effect** | **DFn** | **DFd** | **F** | **p** | **ges** |
|---|---|---|---|---|---|
| Condition | 2 | 34 | 4.489 | 0.019* | 0.209 |
| Musician.Non. musician | 1 | 34 | 0.457 | 0.503 | 0.013 |
| Condition: musician.Non. musician | 2 | 34 | 1.357 | 0.271 | 0.074 |

*p<.05

The ANOVA was conducted in R studio to evaluate if the positive score difference was different for the 3 conditions(song, music, and lyrics), whether positive scores differed by musician status and whether there was an interaction.. From the ANOVA result above its evident that there is a significant difference between the conditions $F\,(2,34) = 4.49, P = 0.02$, generalized eta squared=0.21.However, there was no statistically significant two-way interaction between condition and Musician/non-musician, $F\,(2,34) = 1.357, P = 0.271$

As for the between subject ANOVA conducted in JASP, there is one marginally significant result shown. It is the main effect of music conditions in the positive score difference which shows below in Table 6. It means that participants' scores decreased after listening to the music, which concludes the three conditions (F=2.53,p=0.094).

***Table 6 ANOVA- Positive Score Differencec (Conducted in JASP)***

| Cases | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Musician /Non-musician | 10.645 | 1 | 10.645 | 0.281 | 0.599 |
| condition | 191.457 | 2 | 95.729 | 2.531 | 0.094 |
| Musician/Non-musician*condition | 102.688 | 2 | 51.344 | 1.357 | 0.271 |
| Residuals | 1286.022 | 34 | 37.824 | | |

Within these three conditions, the most drastic difference is in the lyrics conditions in the negative score difference test for both musician and non-musician groups shown below in Figure 5.

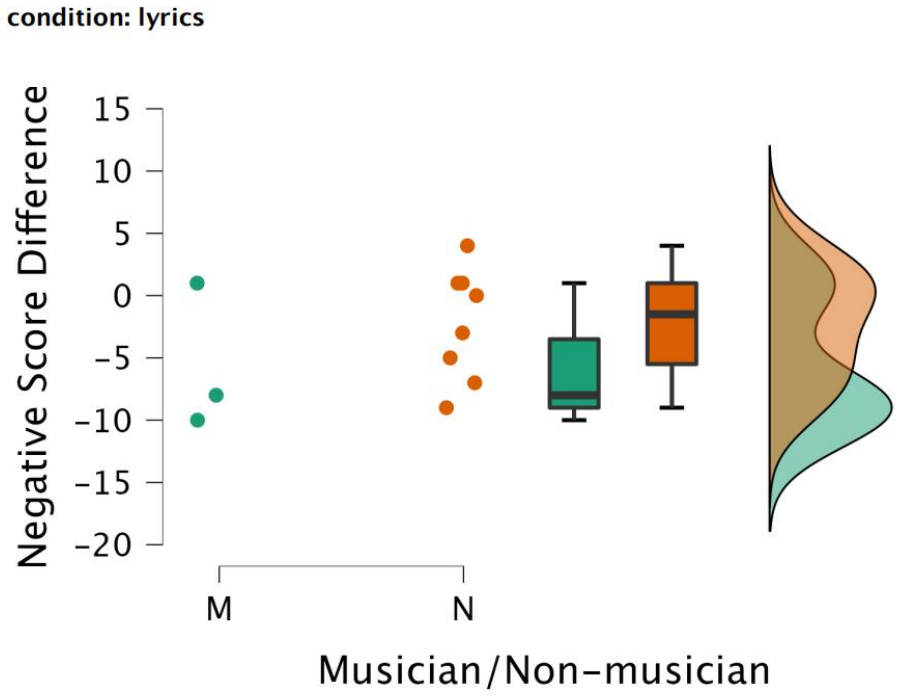


***Figure 5. Raincloud plot between Negative Score Difference and Conditions.***

**Independent sample T-test**

In this case an independent sample t-test is used to compare means for the two independent groups (Music and Non-Music) to determine if the population means are significantly different.

Our hypothesis is set as;

$H_0: \mu_1 = \mu_1$; the two population means are equal

$H_1: \mu_1 \neq \mu_2$; the two population means are not equal

The table below shows the mean in both groups and the independent t-test for both positive score differences.

***Table 7 Independent sample T-test***

| **Dependent Variable** | **Mean in group** | | **t** | **df** | **p-value** |
|---|---|---|---|---|---|
| | M | N | | | |
| Positive score difference | -4.071 | -3.154 | -0.4104 | 38 | 0.6838 |

From the table above in both cases the group means is negative. For instance, group M reports a mean of -4.071 and -3.154 for group N. Based on the result, the positive score difference reports a p-value of 0.6838. Therefore, the null hypothesis is rejected and concludes that the mean of positive score difference for music and non-music is not statistically different. In general, there was no significant difference in the mean of positive score difference between music and non-music ($t_{38} = -0.4104, p = 0.6838$).

## Discussion

There are a number of issues with the current thesis that need to be addressed. First, only self-reports were used as the basis for Studies in this research. As a result, individuals have the typical issues with this kind of action. Participants only provide information that they can or are willing to provide, therefore their responses may be influenced by demand characteristics and social desirability in particular. Self-reports by themselves are not sufficient to prove a causal relationship, but they can be one of several types of evidence that, put together, provide significant support. Additionally, as noted by Juslin and Laukka (2004), there are some concerns that common listeners seem to be well-suited to address, including inquiries into the applications and experiences of music in daily life. There is no actual reason to believe that listeners won't be able to accurately describe their routines and experiences in relation to these topics. Comparing Juslin and Laukka (2004) to other survey research on musical emotions, a strength was the use of a randomized and representative sample of the public. But it should be emphasized that just 51% of people responded. Although this is not a low response rate in comparison to other research of a similar nature (Scherer et al., 2004), it may have had some impact on the outcomes. Smith (017) provided some evidence that suggested those who do not respond to mail surveys have unique demographic traits (such as living in large cities and working long hours), but our own comparison of our sample to the population data suggested that people in their 20s and highly educated individuals were having difficulties in commiting to a time consuming task. The first stage of the experiment, I used my original plan which is using 5 song excerpts. However, people are dropping out during the middle of it and leaving the experiment early. After checking on the programming problem and excluding that, the concern of young people’s focusing length was in my mind. Even if it was not a high demanding task to participate in, the relatively long duration

of the research still led to people dropping out of the study. Future research could find a way for people to be willing to focus on the listening task better. Because the more music excerpts participants listen to, the chance of finding significant results might be greater. The way of distributing the experiment was also an influence to the efficient recruitment process. If the experiment can be conducted in-person, I would predict that people would be more reluctant to drop out in the middle and more focused. This also influenced the significant limitation of the inadequate sample size. The sample size was small in size which in turn reduced the significance and precision of the findings. For future studies, I recommend an adequate sample size since this could improve the significance of the result. Overall, though, the sample did a good job of reflecting the characteristics of the two populations, so the response rate shouldn't have had a significant impact on the sample's representativeness.

Another drawback was the construction of the research and music stimulations. In the lyrics condition, the concern is that I used a computer generated voice, which can be very different compared to the other two conditions. My consideration was that if I read the lyrics by myself or ask other people to do that, me or their tones in reading can be influential to participants' emotional response. The possibility of an insufficient response was the thing I am trying to avoid. Similar limitation regarding this was also found in North et al., 2009, participants only responded to some signals, yielding a 74% overall response rate. Missed trials were mostly caused by individuals being unable to respond (for example, when in the shower or lifting heavy furniture), being unable to hear the beep (for instance, due to noisy traffic), or forgetting to bring the palmtop. However, the present response rate was deemed satisfactory when compared to comparable ESM investigations (North et al., 2009). Few of the missed trials involved music, according to participant interviews, but the estimations may have been

somewhat impacted. The similarity of the estimations of music occurrence—that is, whether or not emotions are evoked—across three investigations that were conducted at various times, in various countries, and with various listener groups, is somewhat comforting (Juslin and Laukka 2004; see also Sloboda et al., 2001).

Furthermore, another shortcoming was that both the participants and the music that this thesis examines are products of western culture. It is also challenging to extrapolate the results to other cultures. Depending on the culture, different people are likely to utilize music differently and respond to it emotionally in different ways (Becker, 2004). However, some of the by Juslin and Västfjäll (2008) described processes (such as brain stem reflexes implicated in emotion induction by music) are unlikely to be culturally dependent. In this way, it's possible that some musical emotions are elicited universally throughout civilizations. Future research should examine how music affects emotions in non-Western societies. The sample of participants used in a study will probably have an impact on how people feel about music.

On another account, most of the participants in Studies were students. It's possible that their daily routines and musical preferences are not typical of the general population at large. Therefore, these studies require replication using larger, more diverse participant samples. But in many ways, the three data analyses came to identical conclusions (e.g., regarding which condition that emotions are most responsive to music). Finally, it may seem strange that musical factor analyses (such as genre analysis) did not yield more results than they did in the present studies. For instance, the predictors relating to musical genre were disappointingly ineffective at differentiating between distinct emotions when I first attempted to predict musical feelings. And, my intentionally simplified song choices made the genre relatively unitary. There is little comparison that can be done between the songs. This could also be the result of a number of

factors. First, it's likely that musical features vary so widely, even within a single genre, that it is hard to forecast an emotion from a genre alone. Another reasonable argument is that the musical qualities are always "mediated" by underlying mechanisms. These mechanisms may cause various emotional reactions in listeners depending on their unique learning histories (Juslin & Västfjäll, 2008). Finally, it's possible that the listener's musical preferences have some bearing on the feelings that have been evoked. Given the wide range of musical preferences among people, it is typically difficult to predict how a listener would react to a piece of music based just on musical elements like tempo or musical genres like pop. The question of whether the music "matches" the listener's musical preferences is likely more significant than the musical genre itself.

Therefore, as demonstrated in the Study, a piece of music's ability to evoke emotions may depend in part on whether or not the listener selected it. In any event, improved methods for gathering more specific information on the music played in specific episodes would be especially helpful for future field studies. Although it is challenging to find direct connections between acoustic parameters and emotions, this could include questions about the specific acoustic characteristics of the stimulus in each episode or at the very least, more details about the musician or song. However, this method may have the drawback of recording participants' private conversations, which they might not want to share with others. However, it may be argued that it is largely accepted that musical elements contribute to how we feel when we hear music, supporting the present study. (A separate set of experimental studies that concentrate on underlying mechanisms and look at musical factors are currently being conducted; see, for example, Juslin & Liljeström, 2010). The notion that musical emotions are strongly influenced

by multiple contextual and individual elements, which must be better taken into consideration in future studies, is maybe a far more innovative conclusion.

## Conclusion

The findings of this study indicated that there is a negative relationship between music total training, positive score difference, and negative score difference. Based on the correlation coefficient's p-values the relationship is not statistically significant at a 5% level of significance. Further, an Analysis of variance was used to evaluate the effect of the three conditions in positive score differences. First, normality and homogeneity of variance assumptions were conducted before the Analysis of variance (ANOVA). From the assumption output, the negative score difference violated the two assumptions. Therefore, based on the two assumptions the dependent variable positive score difference was used in both ANOVA and independent T-test.

From the ANOVA test, there was a significant difference between the conditions (song, music, and lyrics) since the p-value associated with the predictor was less than 0.05 level of significance. However, there was no statistically significant two-way interaction between condition and Musician/non-musician since the p-value was greater than 0.05 level of significance. The significance shown in the conditions did not indicate which condition was more influential compared to the other ones. The one marginally significant result found showed that people's positive emotion response was decreased.

Based on the independent T-test the result was not statistically significant. Therefore, the results indicate that there was no significant difference in the mean of positive score difference between music and non-music groups.

The results of the current research have significant implications for future research despite the different restrictions mentioned above. First off, the literature analysis has demonstrated that a wide range of emotional states, including simple arousal, "chills," and "basic" emotions (such as happy, melancholy), as well as more "complicated" emotions (such as nostalgia, pride), as well as "mixed" emotions, can be evoked by music. This disproves the claim made by some studies that musical feelings are confined to a subset of emotions or even only aesthetic amazement. Empirical evidence from the analysis, which are consistent across three different methodologies, settle a previous debate over what feelings music may provoke. In order to create new reporting schemes for the musical domain, prevalence data from open-ended formats may be particularly helpful (Juslin, 2011).

Another significant discovery of this research is that, to a certain extent, musical emotions can be predicted from knowledge of the specific details of the setting in which the music occurred. This study is the first one to make the attempt (and to some extent succeed) to predict how people will feel in response to music in daily life regarding their music training levels. Even though the prediction regarding the musical background was far from accurate, it demonstrated that musical emotions are, in general, not too subjective or variable to be adequately modeled: There are numerous causative elements and systematic correlations between musical feelings. However, what stands out is how fragile the majority of the relationships are. This could appear frustrating at first. This outcome, however, is just what one would anticipate given that emotions are multiply determined; if an emotion is determined by a number of variables, each component can only account for a certain amount of the variance. Finally, how much more research a research approach encourages is sometimes used to determine how valuable it is. Given the enormous number of speculative hypotheses that, in

particular, investigations give rise to, it could be argued that the current study provides a rich soil for subsequent studies. This can assist musicologists in acquiring a more useful set of musical emotion predictions based on the length of people's music training time. Many of the emotions we experience on a daily basis come from music, which has the potential to impact both our subjective well-being and health. Understanding the nature of musical emotions is crucial for practical uses like music therapy.

In-depth descriptions of the nature and pervasiveness of musical emotions in daily life are provided in this research. The findings of the literature analysis suggest that musical emotions occur quite frequently, may be more frequent on weekends and evenings, are moderately intense, and are generally of a positive nature. They also suggest that musical emotions depend on situational (such as the social context) and individual factors (such as age, gender, and openness to experience), becoming more intense and positive with self-selected music and in the presence of a close friend or partner. Based on mine findings, music total training time reported a negative relationship with both positive and negative score differences. This is aligned with my hypothesis that people with longer musical training had more influence by sad music. They would be able to perceive the emotions in music easier and deeper than those with less musical training backgrounds. I intend to have future research to further investigate the relationship between the populations in more diverse musical elements and improved methodology. These results are encouraging, but they also imply that a thorough analysis of the origins of musical emotions will be as challenging as it is fascinating.

Annotated Bibliography:

Ali, S. O. (2004). *Music and emotion: The effects of lyrics and familiarity on emotional responses to music*. American University.

Ali, S. O., & Peynircioğlu, Z. F. (2006). Songs and emotions: are lyrics and melodies equal partners?. *Psychology of music*, *34*(4), 511-534.

Becker, J. O., & Becker, J. (2004). Deep listeners: Music, emotion, and trancing (Vol. 1). Indiana University Press.

Bernardi, L., Porta, C., & Sleight, P. (2006). Cardiovascular, cerebrovascular, and respiratory changes induced by different types of music in musicians and non-musicians: the importance of silence. *Heart*, *92*(4), 445-452.

Besson, M., Magne, C., & Schön, D. (2002). Emotional prosody: sex differences in sensitivity to speech melody. *Trends in cognitive sciences*, *6*(10), 405-407.

Botella, C. (2020). Positive and Negative Affect Schedule (PANAS): psychometric properties of the online Spanish version in a clinical sample with emotional disorders. *BMC psychiatry*, *20*(1), 1-13.

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: the self-assessment manikin and the semantic differential. *Journal of behavior therapy and experimental psychiatry*, *25*(1), 49-59.

Cotter, K. N., Prince, A. N., Christensen, A. P., & Silvia, P. J. (2019). Feeling like crying when listening to music: Exploring musical and contextual features. *Empirical Studies of the Arts*, *37*(2), 119-137.

Culler, J. (2017). Theory of the Lyric. *Nordisk poesi*, *2*(2), 119-133.

Daly, I., Malik, A., Hwang, F., Roesch, E., Weaver, J., Kirke, A., ... & Nasuto, S. J. (2014). Neural correlates of emotional responses to music: an EEG study. *Neuroscience letters*, *573*, 52-57.

Díaz-García, A., González-Robles, A., Mor, S., Mira, A., Quero, S., García-Palacios, A., ... & Botella, C. (2020). Positive and Negative Affect Schedule (PANAS): psychometric properties of the online Spanish version in a clinical sample with emotional disorders. *BMC psychiatry*, *20*(1), 1-13.

Dorrell, P. (2021). A Theory Of Language Evolution That Explains Song Lyrics. https://whatismusic.info/blog/ATheoryOfLanguageEvolutionThatExplainsSongLyrics.html

Gaser, C., & Schlaug, G. (2003). Brain structures differ between musicians and non-musicians. *Journal of neuroscience*, *23*(27), 9240-9245.

Juslin, P. N., & Sloboda, J. A. (2001). Music and emotion. Theory and research.

Juslin, P. N., & Laukka, P. (2004). Expression, perception, and induction of musical emotions: A review and a questionnaire study of everyday listening. Journal of new music research, 33(3), 217-238.

Juslin, P. N., & Västfjäll, D. (2008). Emotional responses to music: The need to consider underlying mechanisms. Behavioral and brain sciences, 31(5), 559-575.

Juslin, P. N., Liljeström, S., Västfjäll, D., & Lundqvist, L. O. (2010). How does music evoke

emotions? Exploring the underlying mechanisms.

Juslin, P. N. (2011). Music and emotion: Seven questions, seven answers. Music and the mind: Essays in honour of John Sloboda, 113-135.

Kim, M., & Kwon, H. C. (2011, November). Lyrics-based emotion classification using feature selection by partial syntactic analysis. In *2011 IEEE 23rd International Conference on Tools with Artificial Intelligence* (pp. 960-964). IEEE.

Kothari, C. R. (2004). Research methodology.

Mihalcea R., Strapparava C. (2012). Lyrics, Music, and Emotions. In Proceedings of the 2012 Joint Conference on Empirical Methods in Natural Language Processing and Computational Natural Language Learning, pages 590–599, Jeju Island, Korea. Association for Computational Linguistics.

North, A. C., Hargreaves, D. J., & Krause, A. E. (2009). Music and consumer behaviour. Oxford handbook of music psychology, 481-490.

Park, M., Gutyrchik, E., Bao, Y., Zaytseva, Y., Carl, P., Welker, L., ... & Meindl, T. (2014). Differences between musicians and non-musicians in neuro-affective processing of sadness and fear expressed in music. *Neuroscience letters*, *566*, 120-124.

Park, M., Gutyrchik, E., Welker, L., Carl, P., Pöppel, E., Zaytseva, Y., ... & Bao, Y. (2015). Sadness is unique: neural processing of emotions in speech prosody in musicians and non-musicians. *Frontiers in Human Neuroscience*, *8*, 1049.

Schäfer, K., & Eerola, T. (2020). How listening to music and engagement with other media provide a sense of belonging: an exploratory study of social surrogacy. *Psychology of*

*Music*, *48*(2), 232-251.

Scherer, K. R. (2004). Which emotions can be induced by music? What are the underlying mechanisms? And how

Smith, H. (2017). There's a Place for Us: The Musical Theatre Works of Leonard Bernstein. Routledge.

Susino, M., & Schubert, E. (2019). Negative emotion responses to heavy-metal and hip-hop music with positive lyrics. *Empirical Musicology Review*, *14*(1-2), 2-15.

## Appendix A Song list and links

The songs used in the research are as follow:

1. “TV” by Billie Eilish,

Billie Eilish - TV (Official Lyric Video)

2. “Ashes” by Celine Dion,

Céline Dion - Ashes (from "Deadpool 2" Motion Picture Soundtrack)

3. “Don’t Watch Me Cry” by Jorja Smith,

Don't Watch Me Cry

4. “Say Something” by A Great Big World & Christina Aguilera,

A Great Big World, Christina Aguilera - Say Something

5. “Lonely” by Justin Bieber & benny blanco,

Justin Bieber & benny blanco - Lonely (Official Music Video)

6. “One Life” by Ed Sheeran,

Ed Sheeran - One Life (Official Audio)

The use of the songs was changed due to a recruiment issue. The final songs used are the first two, “TV” by Billie Eilish, and “Ashes” by Celine Dion The last song was used in the debriefing process.

## Appendix B Other plots formed in Data Analysis

***Table 8 ANOVA- Negative Score Difference (Conducted in JASP)***

| Cases | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Musician /Non-musician | 9.744 | 1 | 9.744 | 0.306 | 0.584 |
| condition | 43.547 | 2 | 21.773 | 0.684 | 0.511 |
| Musician/Non-musician*condition | 31.773 | 2 | 15.886 | 0.499 | 0.611 |
| Residuals | 1081.944 | 34 | 31.822 | | |

***Figure 6 Positive Score Difference Descriptive***

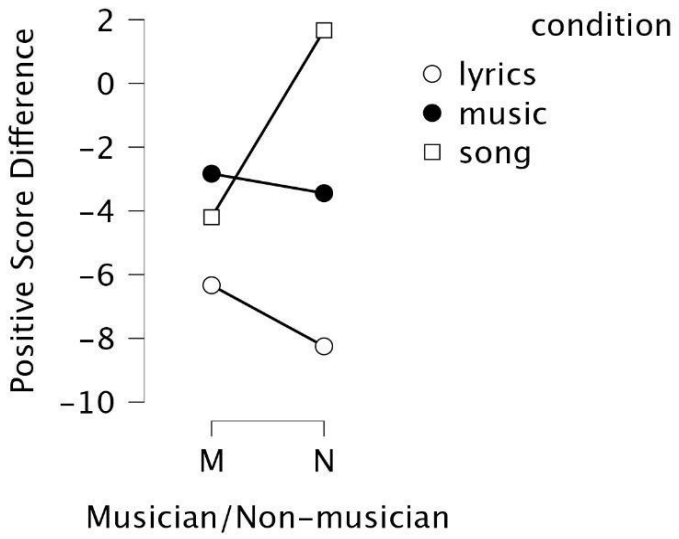

***Figure 7 Negative Score Difference Descriptive***

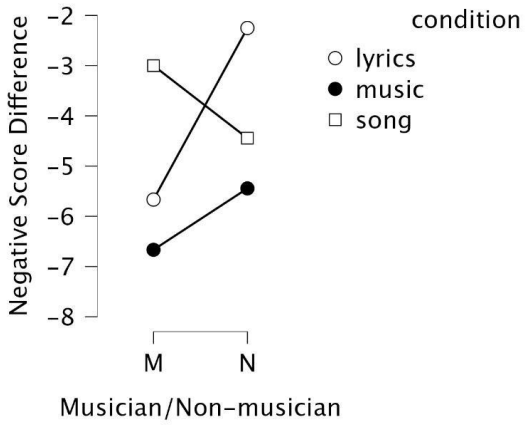


**Figure 8-10** ***Raincloud plot between Positive Score Difference and Conditions***

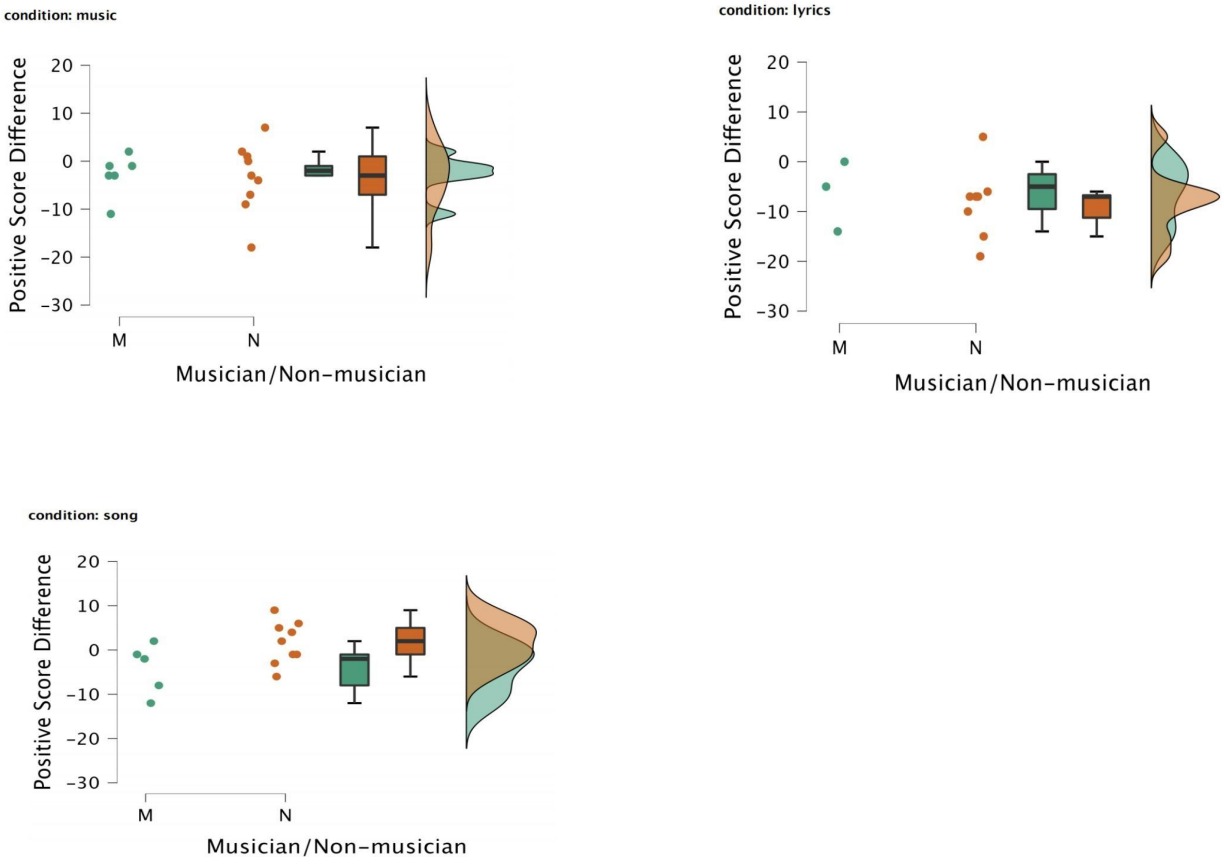

**Figure 11** ***Raincloud plot between Negative Score Difference and music***

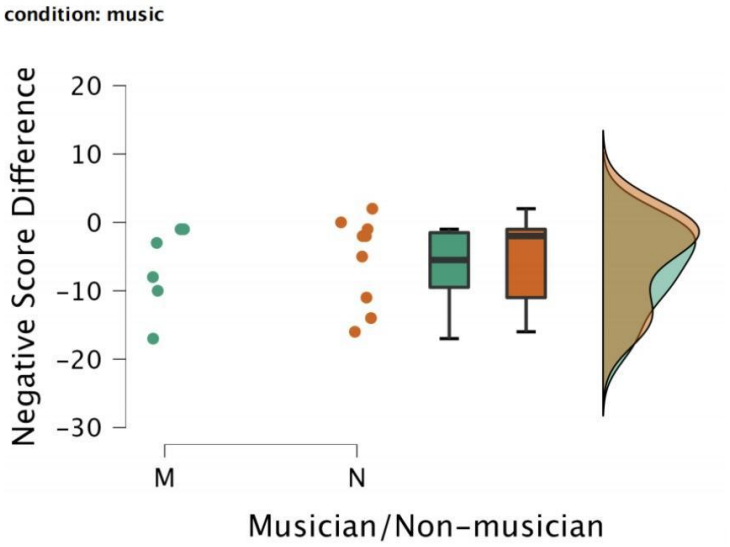


**Figure 12** ***Raincloud plot between Negative Score Difference and song***