TYNDALE UNIVERSITY

3377 Bayview Avenue
Toronto, ON
M2M 3S4

TEL:
416.226.6620
www.tyndale.ca

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Experiencing Music: Music's Influence on Emotion and Cognition

Department of Psychology, Tyndale University

PSYC 4993 01: Honours Thesis in Psychology (II)

Anastasia W. S. Madill

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Abstract

Music can be used to express emotions, thoughts and feelings. This study explores how music impacts emotions and memory, and whether Emotional Intelligence (EI) and the Highly Sensitive Person (HSP) construct interact with this. Participants were required to listen to five songs varying in emotion and they rated their emotions using the Positive and Negative Affect scale (PANAS) before and after each song. Additionally, EI and sensitivity were measured using the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) and the HSP scale, respectively. Research questions included: *Are those with a higher or lower emotional intelligence affected more by emotion in music? Does the Highly Sensitive Person (HSP) construct interact with emotional intelligence and emotion in music? Does emotional intelligence and emotion in music significantly impact performance on cognitive tasks?* Participants consisted of 52 Tyndale University students aged 18-54. Those with a higher EI felt more positive and negative emotions before any music was presented, and fewer positive emotions after a song which was intended to feel negative. The HSP did not experience significantly higher positive and negative emotions than those who were less sensitive throughout this study. Those who experienced higher positive emotions after the first song generally remembered less words correctly. Additionally, after two songs intended to feel negative, EI and sensitivity interacted to produce significantly different emotional responses between participants. Thus, music seems to have some effect on emotion and memory depending on EI, and the interaction between EI and sensitivity.

Keywords: EI, emotional intelligence, music, HSP, highly sensitive person, PANAS, positive and negative affect, memory, memorization

Introduction

Music is emotionally evocative; it can influence feelings of happiness, anger, fear, and sadness. It seems plausible that music influences mood, and that there could be a correlation between one's emotional intelligence (EI) and the extent to which music influences emotion. The following questions will be addressed throughout this study: *Are those with a higher or lower emotional intelligence affected more by emotion in music? Does the Highly Sensitive Person (HSP) construct interact with emotional intelligence and emotion in music? Does emotional intelligence and emotion in music significantly impact performance on cognitive tasks?* Since it has been established that emotional intelligence impacts one's ability to manage their emotions, and music has the ability to evoke and convey emotion, it seems reasonable to expect that the effects of music may be moderated by emotional intelligence.

Emotional Intelligence

There are two major types of emotional intelligence (EI). These are trait EI and ability EI. Petrides (2011) discusses the difference between these two. Ability EI, or cognitive-emotional ability, is a set of emotion-related cognitive abilities regarding the nature, causes, and outcomes of emotions. This must be measured using maximum-performance tests such as the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT). Trait EI, or trait emotional self-efficacy, addresses emotion-related self-perceptions measured by self-report (Petrides, 2011).

Trait Emotional Intelligence. Trait EI is a "set of emotion-related self-perceptions and adaptive emotional dispositions" (O'Conner et al., 2017, p. 304). Those who have higher trait EI tend to be optimistic, adaptable, and perceive that they have high levels of intrapersonal and interpersonal emotional competencies. Trait EI is a construct measuring one's self-perception of their emotional ability (Petrides, 2011). The trait emotional intelligence questionnaire (TEIQue)

is a well-known trait EI test consisting of 153 items, giving scores on 15 facets, 4 factors, and a global trait EI. These facets include emotion expression, self-esteem, and stress management (Petrides, 2011).

Ability Emotional Intelligence. Ability EI is a set of emotion-related cognitive abilities. Measuring one's Ability EI through a test such as the MSCEIT can assist in measuring the relationship between coping with task stressors and EI. The MSCEIT measures one's ability to perceive emotions and understand emotion regulation in theory (O'Connor et al., 2017). The MSCEIT measures four branches of emotional intelligence, including perception of emotion, facilitating thought, understanding emotions, and managing emotions (Brannick et al., 2011). Since the present study involves exploring the impact of EI on memory test performance, it was appropriate to use the EI measure associated with cognitive ability, so the MSCEIT was the EI measure used.

Music's Effect on Emotional Intelligence

Through studying musical activities and their effect on emotional intelligence, Lee et al. (2006) discovered that music can have many benefits. Musical activities can help people become more self-aware, improve their self-expression and communication, make it easier to get to know others, improve creative thinking, and boost self-encouragement and the ability to encourage others. Thus, their research demonstrated that musical activity could affect emotional intelligence (Lee et al., 2006). Some benefits which were mentioned such as boosted self-encouragement and self-awareness may also affect mood, especially depending on the type of music being used.

Emotional Responding to Music

A lot of research on music and emotion has addressed the emotion perceived in the music, but Kallinen and Ravaja (2006) addressed the relationship between perceived emotion and felt emotion. Perceived emotion refers to emotion that one recognizes in music, while felt emotion refers to the emotion that one feels as a result of hearing music. When comparing perceived and felt emotion, they found that participants were able to feel pleasure stronger than they were able to perceive it in music. However, participants perceived stronger arousal, positive relationship (perceived emotion being the same as felt emotion), and negative relationship (perceived emotion being the opposite of felt emotion) than they felt it in music. Within many categories of music, perceived and felt emotion were positively correlated. However, fearful music had a positive relationship for feeling, but a negative relationship for perceiving. Although perceived and felt emotion were mostly the same, they differed in extremity.

An overlap between perceived emotion and induced emotion was also found by Gabrielsson (2001). Although this overlap exists, the author found that musical, personal, and situational factors all influence emotion perception and emotional response (Gabrielsson, 2001). For example, a person feeling higher levels of stress might respond differently to a slow, relaxing song than a person who is already feeling calm. Differences between musical emotion and felt emotion can often be explained by differences in life experience and cultural knowledge as well as through highly individual connections (Schubert, 2013). For example, if someone associates a song with a strong memory, such as a wedding or a funeral, they may react differently than someone who does not have that association.

Zentner et al. (2008) found that music associated with negative emotion was not encountered in daily life as often as music which induces positive emotion. They also studied

how emotion in music is perceived more often than it is felt. Often this is due to the proximity of the listener to the reality of that emotion. The listeners proximity to an emotion can be distant, or close. For example, if a person just received happy news then they listen to a sad song, it is not likely to negatively affect their mood as much as it would for someone who had just experienced a death in the family. This is because the person who experienced the death in the family has a closer proximity to the sad mood being portrayed through the music. It is often easier for the listener to see their life in a more positive light, so when they listen to positive music, they feel it more. Similarly, if someone listens to sad music and something sad is happening in their lives, it is easier for them to feel that emotion.

Elements of Music and Emotion

Research seems to suggest that there could be a correlation between emotional intelligence and the recognition of emotion in music. According to Resnicow et al. (2004), emotion is expressed through music without a need for words. They argue that there is a connection between emotional intelligence and emotional recognition in music. To conduct their research, they used the MSCEIT version 2.0 to assess emotional intelligence. The music test consisted of three piano pieces which were adjusted to simulate a happy, sad, angry, or fearful tone. Participants then rated these songs as happy, sad, angry and fearful on a scale from zero (this is not the emotion of this song) to 10 (this is definitely the emotion of this song). They found there was a significant correlation between scores on the MSCEIT and the total test scores for recognition of the emotion in the music. Throughout the music portion of their study, they found that slow tempos and minor keys were associated with sad music. They also found that major key and moderate tempo were associated with happiness. Likewise, other researchers have

found a relationship between the perception of emotion and the elements of music used in a particular piece.

Juslin (2000) demonstrated how different emotions can be expressed through tempo, volume, articulation and frequency. Anger can be expressed through a fast tempo, loud volume, legato (long) articulations, small articulation variability, and sharp timbre. Sadness was demonstrated though slow tempo, low volume, legato articulations, small articulation variability and sharp timbre. Happiness was demonstrated through fast tempo, loud volume, legato articulations, a lot of articulation variability, and some sharp timbre. Fear can be expressed through a slow tempo, low volume, staccato (short) articulation, and a lot of articulation variability and a softer timbre (Juslin, 2000). If a composer is able to use these elements of music well, music can have "emotion-specific patterns of acoustic cues that can be used to communicate discrete emotions in vocal and musical expression of emotion" (Juslin & Laukka, 2003, p. 799).

While music has the ability to exhibit emotion, understanding the relationship between music and experienced emotion is more complicated. Hunter et al. (2010) examined perception of emotion as well as emotional response to music. This music varied in tempo (fast or slow) and mode (major or minor). Similar to results in other studies, they found that happy music was fast and in a major key, while sad music was slow and in a minor key. Listeners would rate how happy or sad the music made them *feel*, and the happiness or sadness *expressed* in those musical excerpts. They would also rate whether or not they liked the music. The music was by J. S. Bach and was manipulated by a computer to differ in tempo and mode. Hunter et al. (2010) found that music evokes emotion in a two-stage process, the first stage being recognition. An example of recognition would be associating the sadness of a song with another sad image or thought, such

as the image of a weeping willow. The second stage is having emotional responding evoked contagiously. An example of this would be if one listened to sad music for a long amount of time and began feeling sad or depressed as a result of listening to this music.

While it is known that music can evoke emotion, Bigand et al. (2005) address the length of time music must be listened to for it to evoke an emotional response. All aspects of music such as key (major or minor), pitch (high or low sound), rhythm, and timbre (musical sounds or voices) work together to create emotion in music. In many cultures, these aspects of music are used consistently. Western cultures for example have been primed to understand and interpret certain elements of music such as those mentioned above to express emotion in music varying across many genres. After exploring the length of time music should be listened to for it to evoke an emotional response, Bigand et al. (2005) found that just one second of musical exposure is enough for one to perceive emotion, but it is not long enough to evoke a strong emotional response.

Dellacherie et al. (2011) compared the emotional reactions of those with high or low musical experience. They showed that sensory dissonance in music induces more unpleasant feelings and stronger physiological responses in those with high levels of musical experience. Dissonance refers to an unpleasant feeling caused by playing two sounds simultaneously whose frequencies resonate displeasingly when played together. Dissonance in music was found to have a varied effect on the defence or fight response in our sympathetic nervous system, based on music experience. Musical experience also had a role in autonomic and expressive responses to music. Dissonance created a more negative affect than listening to music with consonance, likely since dissonant music is easily associated with fear and unease by listeners (Dellacherie et al., 2011).

Ladinig and Schellenberg (2012) assessed how people tend to like music linked to strong or happy feelings, and dislike music that evokes sad feelings. As part of their study, they measured emotional response. This addresses the particular emotion that a participant feels and the intensity of this emotion. Those who liked the music played also had a more intense emotional response to music. The most intense emotional responding also happened with very happy or very sad music. Overall, tempo and mode were the musical dimensions most associated with emotional responding.

Trimmer and Cuddy (2008) found that both speech prosody (the rhythm, emphasis, and intonation of speech) and musical melody have the same characteristics of pitch, volume, tempo, rhythm and timbre. They also found that emotional intelligence predicted the identification of intended emotion in speech and melodic analogues. The experiential portion of the MSCEIT also predicted emotional prosody scores. Emotional speech prosody refers to the emotion conveyed in speech through the acoustic and structural aspects of speech such as tone, rhythm and speed. Speech prosody was not significantly related to music training. Trimmer and Cuddy (2008) suggest that the ability to perceive emotion in music is not linked to speech prosody, indicating that non-verbal music may have a different effect on people than music with lyrics.

Personality and Music

Researchers Chamorro-Premuzic et al. (2010) studied the interaction between higher emotional intelligence, use of music, and personality type. They examined how trait EI related to the way music was used. According to Chamorro-Premuzic et al. (2010), trait EI "refers to a person's emotional self-efficacy or their perceived ability to recognize and control their own and others' emotions" (p. 205). To analyse personality, they used the Big Five which assesses five aspects of personality: extraversion, agreeableness, conscientiousness, neuroticism and openness

to experience/intellect (Chamorro-Premuzic et al., 2010, p. 207). A correlation was found between emotional intelligence and several of the Big Five factors, especially emotional stability (neuroticism), extraversion and openness. EI was positively linked to extraversion and openness, while EI was negatively correlated with emotional stability. They also found that trait EI was negatively correlated with the emotional use of music.

Cultural Similarities Between Music and Emotion

In many cultures, there is a relationship between the type of music and the emotions portrayed. Musicians often use aspects such as tempo, mode and timbre to convey emotions in a similar way. An example of this is seen in how in Western cultures, violins are used to convey sadness, or a quickening tempo is used to convey the feeling of unease or distress. This similarity between the type of music and the emotion portrayed seems to span cross-culturally as well. Balkwill et al. (2004) found that Japanese listeners were sensitive to the intended emotion in music from Japanese, Western, and Hindustani cultures. They were asked to rate the expression of joy, anger, and sadness found in this music, as well as rating tempo, volume, and complexity. Joy was associated with fast tempos and simple melodies, while sad music was associated with slow tempos and complex melodies. Anger was also associated with music that was louder and more complex. This study reinforced that musical cues are not necessarily culturally specific but can cross cultural boundaries. Similar results were found by Balkwill and Thompson (1999), showing that western listeners were sensitive to music from Hindustani ragas. They also found that music indicated feeling cross culturally better than language and vocal expression.

Testing Emotional Response to Music

Vuoskoski and Eerola (2011) compared three different scales for measuring music-induced emotions. These were the Geneva Emotional Music Scale (GEMS), discrete emotion

model, and the three-dimensional model. The three-dimensional model had the most consistency of these three. This is because it assessed the valence (pleasant/unpleasant), energy (awake/tired) and tension (tense/relaxed) of each musical piece. The three-dimensional model is often used to measure perceived emotion in music, and it has also been very consistent and reliable (Vuoskoski & Eerola, 2011).

Younger people (aged 18-35) tend to show a wider range of emotional reactivity than older people (aged 60-80), though both age groups can like music equally (Pearce & Halpern, 2015). Older people tended to find the emotions behind music to be milder than younger people did, while young people found music more emotionally evocative (Pearce & Halpern, 2015). For the purpose of this study, a majority of participants were young adults, therefore they are likely to fit into the younger age category and show a wider range of emotional reactivity to the music they hear.

Emotional Intelligence and Mood

The relationship between emotional intelligence and mood is analyzed by Schutte et al. (2002). Emotional intelligence is one's ability to manage their own emotions and the emotions of those around them. Schutte et al. (2002) found that a higher emotional intelligence consistently related to a higher positive mood. They also found that when researchers attempted to induce a higher negative state in participants, the positive moods of those higher in emotional intelligence had a tendency to decrease less than those lower in emotional intelligence.

Mood, or affect, can be measured by an instrument called the Positive and Negative Affect Schedule (PANAS). Wedderhoff et al. (2021) investigate how dimensional and applicable this scale is cross-nationally. The PANAS is a self-report measure used to evaluate both positive and negative state and trait affect. Wedderhoff et al. (2021) found that the emotions and scale of

the PANAS questionnaire are largely based on how Western society experiences positive and negative emotions, noting that items on this questionnaire such as excitement and pride can be ambiguous to some cultures. However, this measurement tool is used commonly in many areas of psychology and has proven to measure overall positive and negative affect effectively.

Highly Sensitive Person

Another characteristic that contributes to the experience of music is the Highly Sensitive Person scale (HSPS). Rinn et al. (2018) state that the HSPS may have three constructs: ease of excitation, low sensory threshold, and aesthetic sensitivity. High sensitivity is an innate trait for the highly sensitive person (HSP), as the HSPS measures sensory processing sensitivity (SPS). A person's life outcomes can be affected by this highly sensitive trait through positive and negative childhood experiences, stress management, emotional awareness, and emotion regulation strategies. A correlation has also been found between the HSP and giftedness in areas such as math, music, language, painting, or sports (Rinn et. al., 2018).

McManus (2012) also states that the highly sensitive person is likely to be aware of details in stimuli and can become overwhelmed easily by too many stimuli. Although neuroticism, shyness and introversion are related to the highly sensitive person, the HSPS is a construct independent from these (Rinn et. al., 2018). Since highly sensitive people have a higher degree of aesthetic sensitivity, they might be expected to feel more emotion in response to music.

Music and Memory

Word memory can be studied using a variety of methods, including by presenting participants with lists or single words, and by testing recall immediately or after a period of time. Duckworth et al. (2021) analyzed word memory by presenting a random list of 75 words to participants as they competed physical tasks such as sitting or rowing. Participants would take

three minutes to memorize as many words from this list as possible, and after this time they would orally recall as many words as they remembered. This process was repeated multiple times with different words while randomly alternating with a Paced Auditory Serial Addition Test, which was another cognitive test that assessed mathematical ability. To assess accuracy, they looked at total number of words correctly recalled.

Aka (2020) also studied word memory. To assess memory, they used random lists of 24 words which were presented individually, and after 24 seconds of distraction they were given a free recall test. Aka (2020) found that generally, people find it easier to remember words that are positively or negatively emotionally arousing, rather than neutral words. People also have the tendency to think of words that relate to the word they are attempting to memorize. Another finding was that as people attempt to memorize a series of words, they tend to recall words which are serially adjacent to the words they can initially recall.

Martins and Martins (2010) used the Word Memory Test (WMT) to test memory for the purpose of assessing memory malingering. Memory malingering refers to those who may be feigning issues with memory to avoid responsibilities. Participants were to attempt to memorize a list of 20 words, and recall was tested both immediately after and 30 minutes after seeing this list. To assess memory, participants were presented with 40 pairs of words and had to choose which word they had seen previously for each pair.

In a study on music's ability to impact the memorization of nonsense syllables, numbers and rhyming poems, Musliu (2017) suggests that music hinders the ability to memorize whether it is lyrical or relaxing. Of three groups, the group which completed these memory tasks in silence were able to memorize better than the other two who listened to lyrical or relaxing music.

They also found that silence helped participants memorize nonsense syllables significantly better than when participants listened to music.

Carr and Rickard (2016) performed a study to address whether emotional music enhanced memory. To test memory, they used five arrays of moderately stimulating images and tested participants' free recall of these images. Stimuli was heard through closed headphones and the volume was within a controlled range. Three stimuli controls were used in this study, the first being music a participant enjoyed, the second being music another participant enjoyed that was neutral to the participant hearing it, and the third was a five-minute non-musical radio excerpt. They used the I-PANAS-SF, a form of the PANAS scale, to test positive and negative affect. I-PANAS-SF responses before and after each condition were compared, and they found that participants generally felt a higher positive affect than negative affect before the experiment. They also found that participants generally enjoyed their chosen music over the music enjoyed by others and the non-music portions. Overall, they found that increased arousal had a positive correlation to memory performance in each of these three conditions. After participants listened to the music that they selected and enjoyed, they were more emotionally aroused, and this aided their memory for the images that followed shortly afterward.

The Present Study

The purpose of the present study was to explore emotional responses to music and the relationship between EI, the HSP construct, and memory. Emotional intelligence is linked to one's ability to manage their own emotions and the emotions of those around them. Therefore, emotional intelligence must play a role in how one manages and feels the emotions induced and portrayed through music.

To measure EI, the MSCEIT was used as this study looks at one's ability to manage their emotions as they listen to music and complete cognitive tasks. The cognitive nature of the memory test meant it was more likely to be related to this ability EI measure, rather than a trait measure of EI. The MSCEIT is often used when measuring the relationship between coping with task stressors and EI. Ability EI is also not based on one's self-perceptions; rather it is based on one's ability to reason with and about their emotions. Therefore, this should indicate whether someone can reason with emotions brought on as a result of music rather than events or circumstances.

The HSPS was used to measure sensory processing sensitivity in participants. This was likely to indicate whether participants reactions were swayed due to their sensitivity to the music being played or the environments around them. The HSPS measures ease of excitation, low sensory threshold, and aesthetic sensitivity.

To measure emotional responses to music, the PANAS was used. This measured the extent to which participants felt positive or negative emotions in response to music. PANAS scores were then compared with EI, HSP scores, and word memorization to measure the correlation between each. Many people play music in the background while studying, so this may help demonstrate if music is helpful or distracting for those higher or lower in EI or HSP. It may also reveal a correlation between EI, the HSP, and memory when music is played.

Memory test performance was measured using a test designed by this researcher. Participants studied lists of 30 words before playing each song. They would then rewrite as many words as they could remember over the duration of each piece. There was a new list of words for each song. For the purpose of this study, participants listened to music without English lyrics, as speech or words in music can guide one's emotions (Trimmer & Cuddy, 2008). The use of

instrumental music also ensures that speech in music would not contribute to distraction or confusion when memorising words.

To determine whether music preferences impacted results, the Short Test of Music Preferences (STOMP) was used. People may respond differently to this music depending on what music they prefer to listen to. Those scoring higher on the HSPS were likely to have a stronger emotional response to the music played in this study, resulting in higher scores on the PANAS.

Given previous research on music and its relationship to each of these constructs, my hypotheses are as follows: 1) Those with higher emotional intelligence will have lower scores on the PANAS; 2) The highly sensitive person will score higher on the PANAS; 3) Those with higher scores on the PANAS will perform worse on memory tasks while listening to highly emotional music.

Method

Participants

Participants consisted of 52 Tyndale University students aged 18-54. Out of the 52 students, there were 11 males (21.2%), 40 females (76.9%), and one participant (1.9%) who preferred not to identify as either male or female. There were 29 (55.8%) Caucasian participants, 11 Asian participants (21.2%), eight African American participants (15.4%), and four participants identified as other (7.7%). Each participant was offered 2% extra credit in a psychology course, or they could enter a draw for a $25 gift card to Tim Hortons or Starbucks.

Apparatus

Informed Consent Form. The informed consent form was used to ensure participants agreed to and understood the procedure, and were aware of any risks that might be involved (See

Appendix A for a copy of the form). This form also ensured that participants knew their participation was voluntary and that they may leave without penalty at any time.

Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT). The MSCEIT is an emotional intelligence scale used to assess ability EI (See Appendix B for an example of part of the test). This scale has a reliability of $\alpha = .85$ (Brannick et al., 2009). This took between 30-45 minutes to complete on average. The MSCEIT tests four branches of Emotional Intelligence including perceiving emotions, facilitating thought, understanding emotions, and managing emotions (Mayer, et al., 2002). Tasks include indicating the effectiveness of various solutions to problems involving other people, responding to multiple-choice questions about how emotions change over time, and identifying emotions in complex landscapes and designs. Specific examples of questions can be found in Appendix B.

Highly Sensitive Person (HSP) Scale. The HSP scale is a 27-item scale that assesses one's "positive and negative cognitive and emotional responses to various environmental stimuli, including caffeine, art, loud noises, smells and fabrics" (Greven, et al., 2019, p. 288). Participants respond to these 27 questions on a scale of one to seven, where one means not at all, four means moderately, and seven means extremely. Examples of questions on the HSPS include "Do you startle easily?" or "Do changes in your life shake you up?" This scale has a reliability of $\alpha = .87$ and $\alpha = .85$ in 2 studies (See Appendix C for a copy of the scale) (Aron & Aron, 1997).

Short Test of Music Preference (STOMP). *STOMP* is a 14-item scale that assesses an individual's preferences of music genres. The STOMP identified four music preference dimensions. The first dimension is called Reflective and Complex, this includes classical, blues, folk and jazz. The second dimension is labeled Intense and Rebellious, it includes alternative, rock and heavy metal. The third is Upbeat and Conventional, which refers to country, religious,

pop and soundtrack themed songs. The fourth is Energetic and Rhythmic, which includes dance/electronic, rap/hip-hop and soul/funk. (Rentfrow & Gosling, 2003). Participants rated their preference level for these genres of music on a 7-point Likert scale where 1 means *strongly dislike*, 4 means *neither like nor dislike*, and 7 means *strongly like*. Participants were given 14 items to rate such as classical, blues, and country (See Appendix D for a copy of the inventory). Retest reliabilities for each of the four STOMP categories are as follows: Reflective and Complex $\alpha = .77$, Intense and Rebellious $\alpha = .80$, Upbeat and Conventional $\alpha = .89$, and Energetic and Rhythmic $\alpha = .82$ (Rentfrow & Gosling, 2003).

Positive and Negative Affective Schedule (PANAS). The PANAS scale was used to determine the extent to which a person felt both positive and negative emotions (See Appendix E for a copy of the inventory). This scale can be used to assess how someone has felt over a short period of time (momentary) to a long period of time (a year / in general) (Mulder, 2018). For this study, it was used to assess the momentary changes in emotion in response to each song. This scale has a reliability of $\alpha = .89$ for positive affect and $\alpha = .85$ for negative affect (Crawford & Henry, 2004).

Music. Throughout history, music has been known to evoke emotion. During the classical and romantic era, orchestral music was composed specifically to evoke different emotions or tell stories (Bigliassi, et al., 2015). Five classical songs were included in this study to affect the participants' moods (see Appendix F for excerpts). These songs ranged in tempo, mode, key, and timbre. Two songs were intended to influence higher positive affect scores on the PANAS for the listener. The first was Prokofiev's "Symphony in D major" Op.25 (Brezova, 2015). Another was Grieg's "Holberg Suite" Op. 40 (Norwegian Chamber Orchestra, 2013). Mussorgsky's "Ballet of the chicks in their shells" from Pictures at an Exhibition was intended to influence higher scores

for both aspects of the PANAS (Toronto Symphony Orchestra, 2015). This song is dissonant, and its rhythms are sporadic which can create a light, energetic, chaotic atmosphere for the listener. Two songs were also intended to influence higher negative affect scores on the PANAS. The first was Berlioz's "Symphonie Fantastique - Dream Of A Witches Sabbath" (Henrik Parsamyan, 2017). The second one was Mussorgsky's "The Hut on Fowl's Legs (Baba-Yagá)" from Pictures at an Exhibition (Fledermaus1990, 2011).

Word Memory. For this particular study, participants completed a word memory test during each song that was played. This was done to assess if there was a correlation between memory and emotion in music. For the purpose of this study, participants were given a list of 30 words which they attempted to memorize before the song was played. Then, they wrote down as many as they could remember during the song.

Procedure

Approval from the Tyndale Research Ethics Board was obtained prior to data collection. Participants were recruited from Tyndale University using online class announcements, professors' emails, and social media announcements. Since more than one link was used to access aspects of the study and this required some explanation, participants were invited to provide their contact information (name and email address) so that they could be sent details about the study. All participants were informed that their participation was voluntary, that their responses would remain confidential, and if at any time during the study they felt uncomfortable, they could withdraw without any penalty. Upon signing the consent form, participants completed the MSCEIT, the HSP scale, the STOMP, and the PANAS. Participants were then shown the first of a series of lists of 30 words (see Appendix G for a copy of the list) and told to memorize as many as possible. When they were ready for the words to disappear, a song played. During

each song, participants wrote down as many words as they could remember. After the song, they filled out the PANAS. They repeated this process for each song that was played. Once participants listened to all five songs, they completed the demographics survey (see Appendix H for an example of this form).

Results

Descriptive Statistics

Table 1 presents the responses to the PANAS questionnaire before music and after each song. In this table, it is clear that positive affect remains higher than negative affect in general. Positive affect scores between songs also vary more, and consistently have a higher standard deviation. This means that positive responses generally varied more drastically than negative responses.

Table 1

Descriptive Statistics for PANAS Before Music and After Songs 1 to 5

Descriptive Statistics	Mean	Standard Deviation	N	Alpha
Positive Emotions Before Music	26.8462	7.27171	52	.822
Negative Emotions Before Music	16.1400	6.63943	50	.866
Positive Emotions After Song 1	26.2500	8.38737	52	.884
Negative Emotions After Song 1	14.1246	5.56610	52	.887
Positive Emotions After Song 2	23.7500	8.14302	52	.894
Negative Emotions After Song 2	16.0385	5.99333	52	.857
Positive Emotions After Song 3	23.6731	8.15709	52	.906
Negative Emotions After Song 3	14.3529	5.93236	51	.888
Positive Emotions After Song 4	21.8846	8.21203	52	.897
Negative Emotions After Song 4	14.9600	5.69267	50	.855
Positive Emotions After Song 5	23.2308	8.45893	52	.904
Negative Emotions After Song 5	15.3725	6.46826	51	.882

Note. The PANAS scale lists 20 emotions and participants indicate how much they are experiencing each one. Participants rated their emotions on a 5-point Likert scale where 1 meant very slightly or not at all, 2 meant a little, 3 meant moderately, 4 meant quite a bit, and 5 meant extremely. For both categories, lowest possible scores are 10 while highest possible scores are 50. Songs 1 and 3 were intended to have a higher positive affect, Songs 2 and 4 were intended to have a higher negative affect, and song 5 was intended to create a chaotic affect where both positive and negative affect were higher.

Responses to the STOMP are found in Table 2. Participants generally preferred upbeat and conventional music, while intense and rebellious music was the least favoured. One category (Reflexive and Complex) included classical music, which is the genre of music used in this study. Reflexive and complex music usually scored just above the neither like nor dislike

category, where seven meant strongly like and one meant strongly dislike, M=4.6763. Thus, music preference likely had little to no influence on participants emotional responses to each song, as this category also had the lowest standard deviation in responses.

Table 2

Descriptive Statistics for the Short Test of Music Preferences

Descriptive Statistics	Mean	Standard Deviation	N	Alpha
Reflexive & Complex[a]	4.6763	.84060	51	n/a
Intense & Rebellious	3.6154	1.21247	51	n/a
Upbeat & Conventional	5.0817	.90981	52	n/a
Energetic & Rhythmic	4.7179	1.34210	52	n/a

Note. The STOMP consists of 14 genres of music broken into four categories, and participants rated their preferences on a 7-point Likert scale where 1 meant strongly dislike, 4 meant neither like nor dislike, and 7 meant strongly like.

[a]For the purpose of this study, classical music was the main interest behind using the STOMP because this study only utilised classical music. The STOMP was included in this study to determine if those who did not like classical music created problems in the data, but this was not necessary. Participants generally indicated that they liked classical music.

Table 3 displays the average response to the HSP scale. The average score for the HSPS indicates that participants were moderately sensitive to external stimuli, M=4.6098. The standard deviation indicates that there was a fairly wide variety of responses, where some participants were moderately sensitive while others were closer to being extremely sensitive.

Table 3

Descriptive Statistics for the Highly Sensitive Person Scale

Descriptive Statistics	Mean	Standard Deviation	N	Alpha
Highly Sensitive Person Score	4.6098	.81354	52	.873

Note. The HSPS is a 27-item questionnaire where participants responded using a 7-point Likert scale where 1 meant not at all, 4 meant moderately, and 7 meant extremely.

Results for the MSCEIT are presented in Table 4. The Managing Emotions branch score had the lowest average branch score M = .4050, while the Perceiving Emotions and Understanding Emotions branch scores were the highest, being M = .5271 and M = .5309 respectively.

Table 4

Descriptive Statistics for the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT)

Descriptive Statistics	Mean	Standard deviation	N	Alpha
Branch 1 Perceiving Emotions	.5271	.08727	52	.834
Branch 2 Using Emotions	.4672	.08630	52	.777
Branch 3 Understanding Emotions	.5309	.07623	52	.736
Branch 4 Managing Emotions	.4050	.07227	52	.753
Area 1 Emotional Experiencing Area	.4972	.07816	52	n/a
Area 2 Emotional Reasoning Area	.4680	.06338	52	n/a
Overall Emotional Intelligence	.4826	.06123	52	.913

Note. The MSCEIT report consists of four branch scores, two area scores, and an overall score. Independent branch scores do not indicate emotional intelligence, the overall emotional intelligence score indicates emotional intelligence. The four branches are perceiving, using,

understanding and managing emotion. The two area scores are emotional experiencing and emotional reasoning. Each score is reported as a fractional value.

Hypothesis Testing

A series of independent samples t-tests was carried out to test the hypothesis that higher EI would be related to lower PANAS scores, both before music was presented, and after each song. Higher EI was related to lower PANAS scores for both positive and negative emotions before any music was presented, $t(40.434) = 2.481$, $p = .009$ and $t(38.602) = 1.832$, $p = .038$ respectively. Higher EI was also related to lower PANAS scores for positive emotions after song 2 was presented, $t(44.765) = 1.979$, $p = .025$. No other songs produced significant differences in PANAS scores based on EI differences. Those who had a lower EI consistently had higher positive affect (PA) scores, while those higher in EI consistently had lower PA scores. However, the standard deviation was consistently higher for PA responses for those higher in EI. See Table 5 for a comparison of the means of PANAS responses for participants with high and low EI.

Table 5

Comparing PANAS Responses and Emotional Intelligence

Song	Emotional Intelligence	Mean	Standard Deviation	N
Pre-Music PA[a]	Low	28.994	4.96635	26
	High	24.473	8.44858	26
Pre-Music NA[a]	Low	18.119	7.78469	24
	High	14.470	4.98197	26
Song 1 PA	Low	27.718	5.78499	26
	High	24.339	10.22185	26
Song 1 NA	Low	14.567	5.82369	26
	High	14.030	5.40313	26
Song 2 PA[a]	Low	25.630	6.42447	26
	High	21.076	9.17463	26
Song 2 NA	Low	15.879	5.84308	26
	High	16.539	6.23588	26
Song 3 PA	Low	23.561	6.50645	26
	High	23.509	9.66357	26
Song 3 NA	Low	15.532	6.65833	25
	High	13.373	5.06709	26
Song 4 PA	Low	21.524	6.15505	26
	High	21.439	9.98191	26
Song 4 NA	Low	15.078	5.53022	25
	High	15.026	5.96462	25
Song 5 PA	Low	24.003	7.42605	26
	High	21.864	9.44433	26
Song 5 NA	Low	14.861	6.25017	26
	High	15.951	6.75771	25

Note. PA refers to the Positive Affect score, and NA refers to the Negative Affect score on the PANAS. Song 1 and 3 were intended to produce a higher PA, songs 2 and 4 were intended to produce a higher NA, and song 5 was intended to produce both a higher PA and NA.
[a]There was a significance for pre-music PA and NA scores, as well as the song 2 PA scores.

A series of independent samples t-test was carried out to test the hypothesis that higher HSP scores would be related to higher PANAS scores, both before music was presented, and after each song. None of the comparisons produced a significant difference. See Table 6 for a comparison of the means of PANAS responses for participants with high and low HSP scores.

Table 6

Comparing PANAS Responses and HSP Scores

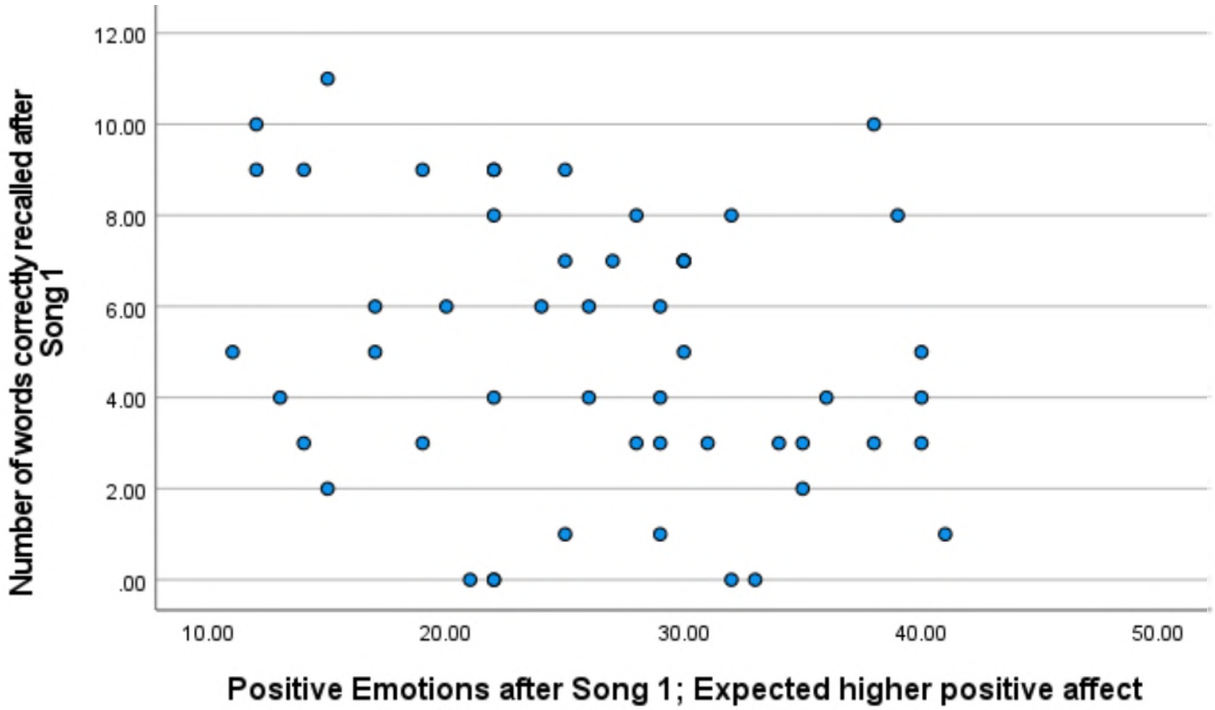
Song	HSP	Mean	Standard Deviation	N
Pre-Music PA	Low	27.539	7.92465	26
	High	25.927	6.50396	26
Pre-Music NA	Low	14.983	4.57288	24
	High	17.606	8.05825	26
Song 1 PA	Low	25.673	8.33159	26
	High	26.385	8.60671	26
Song 1 NA	Low	13.930	4.02014	26
	High	14.667	6.84240	26
Song 2 PA	Low	22.676	8.07055	26
	High	24.030	8.36145	26
Song 2 NA	Low	16.106	6.17949	26
	High	16.312	5.91959	26
Song 3 PA	Low	22.742	7.55951	26
	High	24.327	8.79195	26
Song 3 NA	Low	13.987	5.67509	25
	High	14.918	6.26701	26
Song 4 PA	Low	20.206	6.75323	26
	High	22.758	9.41357	26
Song 4 NA	Low	15.169	6.62646	25
	High	14.935	4.71416	25
Song 5 PA	Low	21.730	7.45664	26
	High	24.136	9.38747	26
Song 5 NA	Low	14.906	6.56061	26
	High	15.906	6.45161	25

Note. PA refers to the Positive Affect score, and NA refers to the Negative Affect score on the PANAS. Song 1 and 3 were intended to produce a higher PA, songs 2 and 4 were intended to produce a higher NA, and song 5 was intended to produce both a higher PA and NA. None of the comparisons produced a significant difference.

A series of Pearson correlations was computed to test the hypothesis that higher PANAS scores would be related to lower memory test performance. In only one case, higher PANAS scores were related to lower memory test performance as measured by the number of words correctly recalled. This was true for the positive emotions for Song 1 (where positive affect was expected), memory test performance was negatively related to the PANAS score, $r(n=52) = -0.247$, $p = .039$. See Figure 1 for an illustration of the relationship between the number of words correctly recalled after song 1 and the positive emotions after song 1 where a higher positive affect was expected. See Table 7 for the means of words correctly memorized for those with high and low PANAS scores.

Figure 1

Number of Words Correctly Recalled and Positive Emotions After Song 1



Note. After song 1, a higher positive affect was expected. More words were correctly recalled if positive emotions were lower, and less words were correctly recalled if positive emotions were higher.

Table 7

Means for Words Correctly Memorized Compared with High/Low PANAS Scores

Song	PANAS Score	Means for Memorized Words	Standard Deviation	N
Song 1 PA[a]	Low	5.5769	3.32473	26
	High	4.4231	2.70071	26
Song 1 NA	Low	5.0000	3.25813	27
	High	5.0000	2.88675	25
Song 2 PA	Low	7.1538	4.37897	26
	High	7.0385	3.43489	26
Song 2 NA	Low	7.6667	3.42201	24
	High	6.6071	4.26301	28
Song 3 PA	Low	8.0400	3.67967	25
	High	8.2963	4.95995	27
Song 3 NA	Low	9.3077	4.84784	26
	High	6.9200	3.54636	25
Song 4 PA	Low	8.8261	5.61372	23
	High	6.1379	3.74856	29
Song 4 NA	Low	8.2308	5.48677	26
	High	6.6667	3.98548	24
Song 5 PA	Low	8.0000	4.65618	26
	High	7.0769	3.46321	26
Song 5 NA	Low	7.6000	4.14327	25
	High	7.6538	4.09822	26

Note. PA refers to the Positive Affect score, and NA refers to the Negative Affect score on the PANAS. Due to variance in PANAS responses, it was not possible to split groups evenly as scores fell on whole numbers.

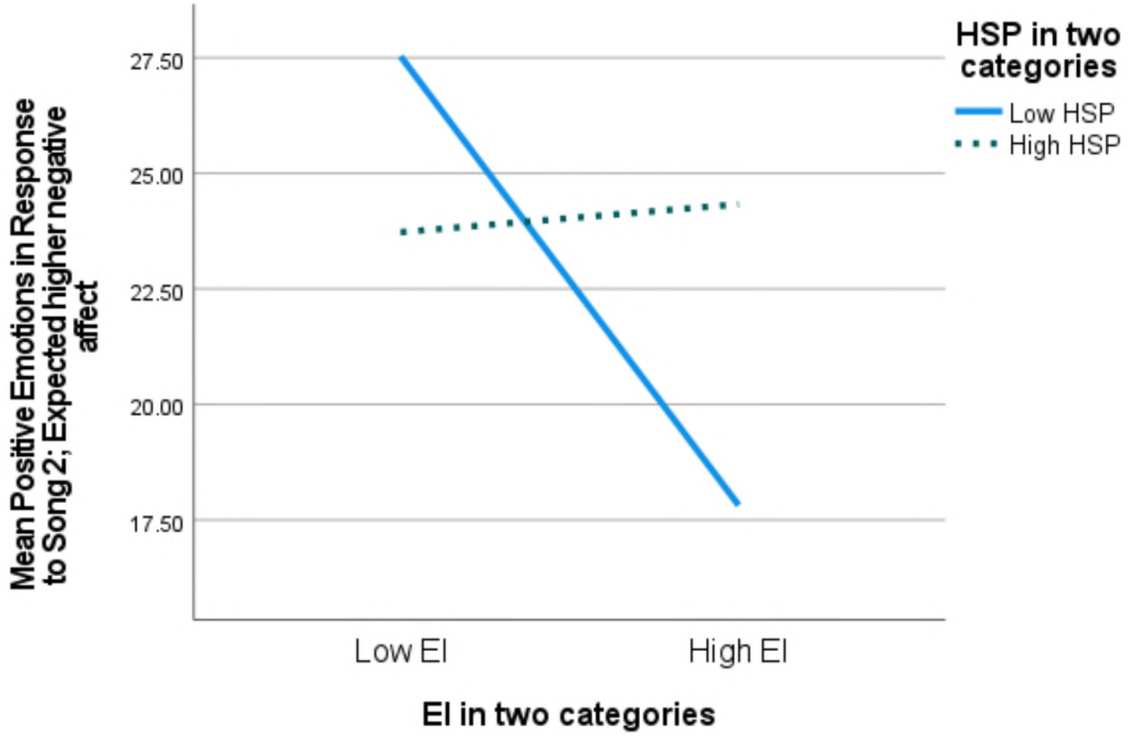
[a]Word memorization results were significant for PA after Song 1.

Additional Hypothesis Testing

A series of two-way ANOVAs was carried out to test the hypothesis that EI interacts with HSP scores in their impact on PANAS scores both before music was presented, and after each song. Significant interactions were found in only two cases, and in both cases, the interaction occurred for positive emotions after hearing a song intended to induce negative affect. Thus for Song 2, the result was $F(1, 48) = 5.847$, $p = .019$, and for Song 4, the result was $F(1, 48) = 5.555$, $p = .023$. See Figures 2 and 3 for an illustration of each interaction.

Figure 2

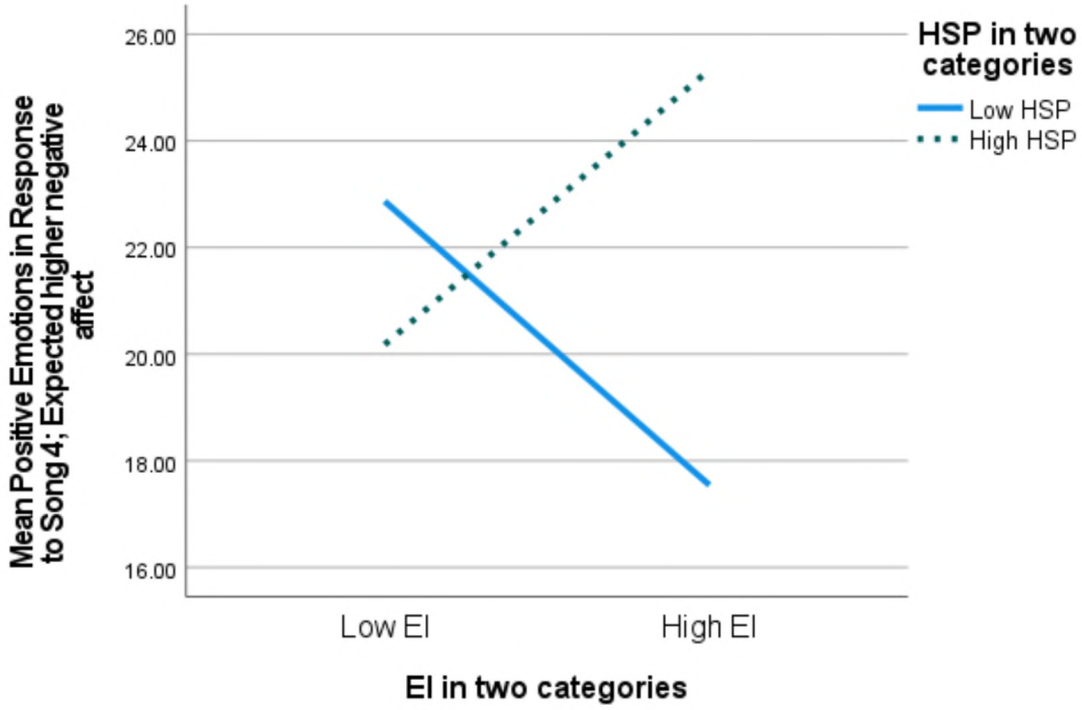
Relationship Between HSP, EI and Positive Emotions in Response to Song 2



Note. Whether those higher in HSP had high or low EI, they had less variance in their response than those lower in HSP.

Figure 3

Relationship Between HSP, EI, and Positive Emotions in response to Song 4



Note. For participants scoring higher in EI, more variance in response is seen between those scoring higher and lower on the HSPS than for those lower in EI.

The same pattern, though differing in extremity, can be seen in both figures. The positive emotions for those with a lower EI and lower HSP score were stronger than those with a lower EI and higher HSP score. The positive emotions for those who had higher EI with a low HSP score were lowest for both songs, while those who had a higher HSP score and higher EI felt stronger positive emotions. When EI was lower, responses varied more drastically between those with low versus high scores on the HSPS. The means for each ANOVA are presented in Table 8. Here, a pattern becomes clear where for each Positive Affect score, participants with low EI scored higher if they were high in HSP and lower if they were low in HSP. Positive affect scores

for those with high EI were lower if they were a lower HSP, and higher if they scored high on the HSPS. This was true for positive affect responses after each song, though it was not always significant. A pattern can also be seen for negative affect scores, where participants with low EI scored lower if they were high HSP and higher if they were low in HSP. Negative affect scores for those with high EI were higher if they were a lower HSP, and lower if they scored high on the HSPS. This was true for songs one to four. However, for song five, those who were higher in EI and HSP scored higher than the other three categories. Those who were high in EI and low in HSP also consistently had the lowest average positive affect scores after each song. Interestingly, the standard deviation was consistently the highest for the positive affect scores of those who were high in EI and HSP, being above 10 each time.

Table 8

PANAS scores with Interactions between High and Low MSCEIT and High and Low HSP

Song	Emotional Intelligence	Highly Sensitive Person Score	Mean	Standard Deviation	N
Song 1 PA	Low	Low	28.800	6.01427	15
		High	26.636	5.48220	11
	High	Low	22.545	9.90317	11
		High	26.133	10.52118	15
Song 1 NA	Low	Low	13.133	3.44065	15
		High	16.000	7.93725	11
	High	Low	14.727	4.71362	11
		High	13.333	5.94819	15
Song 2 PA[a]	Low	Low	27.533	6.92683	15
		High	23.727	5.17863	11
	High	Low	17.818	5.98027	11
		High	24.333	10.27248	15
Song 2 NA	Low	Low	14.667	4.83539	15
		High	17.091	6.99220	11
	High	Low	17.545	7.58108	11
		High	15.533	5.15290	15
Song 3 PA	Low	Low	23.667	6.73654	15
		High	23.455	6.50175	11
	High	Low	21.818	8.78428	11
		High	25.200	10.31781	15
Song 3 NA	Low	Low	14.429	6.39368	14
		High	16.636	7.08904	11
	High	Low	13.545	4.86546	11
		High	13.200	5.37454	15

Song	Emotional Intelligence	Highly Sensitive Person Score	Mean	Standard Deviation	N
Song 4 PA[a]	Low	Low	22.867	5.97455	15
		High	20.182	6.33748	11
	High	Low	17.545	6.78769	11
		High	25.333	10.84084	15
Song 4 NA	Low	Low	14.429	6.17332	14
		High	15.727	4.77684	11
	High	Low	15.909	7.38180	11
		High	14.143	4.72077	14
Song 5 PA	Low	Low	24.733	7.53531	15
		High	23.273	7.55104	11
	High	Low	18.727	6.05130	11
		High	25.000	10.73712	15
Song 5 NA	Low	Low	14.267	6.07650	15
		High	15.455	6.71362	11
	High	Low	15.545	7.40761	11
		High	16.357	6.46419	14

Note. PA refers to the Positive Affect score, and NA refers to the Negative Affect score on the PANAS. Song 1 and 3 were intended to produce a higher PA, songs 2 and 4 were intended to produce a higher NA, and song 5 was intended to produce both a higher PA and NA.

[a]PA responses after song 2 and song 4 were significant.

Discussion

The purpose of this study was to gain a better understanding of one's ability to manage their emotions and cognitive abilities when a variety of music was played, and to explore how emotional intelligence and the HSP trait might impact those cognitive abilities. This was done by

analyzing how EI related to positive and negative emotions, how the HSP construct was related to those emotions, and how positive and negative emotions may have impacted memory task performance.

The hypothesis that those with higher emotional intelligence would experience lower positive and negative emotions was supported by three outcomes throughout this study. Those with a higher emotional intelligence felt lower positive and negative emotions before any music was presented. Those with a higher emotional intelligence also felt lower positive emotions after song two, which was intended to feel negative. The second hypothesis that the highly sensitive person would experience higher positive and negative emotions was not supported by findings within this study. The third hypothesis that those experiencing higher positive and negative emotions would perform worse on memory tasks while listening to highly emotional music was supported in only one outcome. Those who experienced higher positive emotions after song one generally remembered a lower number of words correctly than those who experienced lower positive emotions.

The additional hypothesis that positive and negative emotions before music and after each song would be impacted by the interaction between emotional intelligence and sensitivity was supported by two outcomes. After songs two and four, emotional intelligence and the highly sensitive person construct interacted to produce significantly different emotional responses between participants.

Connections to Previous Research

Pearce and Halpern (2015) found that younger people (aged 18-35) tend to show a wider range of emotional reactivity than older people (aged 60-80), though both age groups can like music equally. While it was reasonable to expect participants would show a wider range of

emotional reactivity because a majority of participants in the present study were young adults, it is difficult to know whether older people would have had more or less emotional reactivity than younger people in the current study.

In this study, for one of the songs intended to produce a higher negative affect, EI was related to positive affect such that higher EI was related to lower positive affect. It was also expected that EI and sensitivity might interact in their impact on emotions, where people high in EI and high in sensitivity would feel more positive or negative emotions. This interaction was observed twice for positive emotions after hearing a song intended to sound more negative. This pattern of results is inconsistent with the previous literature of Kallinen and Ravaja (2006). They found that while fearful music was perceived as negative, it was felt as positive. The scale they used may have impacted what they viewed was positive emotion, but for the present study this was not the case.

For the present study, those with a lower EI consistently maintained higher positive emotions than those with higher EI, even before music played. The opposite pattern was found by Schutte, et al. (2002). Their research suggested that higher EI consistently related to a higher positive mood than those with lower EI. The memory task and music portions of the present study may have interacted with emotional intelligence so that participants with higher emotional intelligence worked to maintain lower positive emotions to ensure they could complete the memory task while listening to music. It should also be noted that participants completed this study during a pandemic. Perhaps this influenced people higher in EI, who may usually have more positive moods, to feel less positive at this time.

During the course of this research, it was clear that positive emotions on average were higher than negative emotions whether or not a sad or fearful song was being played. This is

consistent with what Zentner et al. (2008) found because music associated with negative emotion was not encountered in daily life as often as music associated with positive emotions. Their study also revealed how emotion in music is perceived more easily than it is felt. This was likely because of the proximity of the listener to the reality of that emotion. It can be easier for the listener to see their life in a positive light, so they may generally feel positive aspects of music more strongly than negative aspects. Considering this can help us understand why positive affect responses were consistently higher than negative affect responses, since positive music likely related more to a wide range of listeners than negative music.

This study focussed on the emotion a participant felt and did not ask them to report whether they perceived emotion in a particular piece. Hunter et al. (2010) found that music evokes emotion in a two-stage process. The first stage is recognition of that emotion, and the second stage is feeling that emotion. While this may have given participants enough time to recognize emotion, they may not have had enough time to feel this emotion contagiously evoked within themselves. It would be interesting to see if felt emotion became stronger with the amount of time spent listening to a particular piece of music.

Consistent with this, Bigand et al. (2005) found that just one second of musical exposure was enough for one to perceive emotion, but it was not long enough to evoke a strong emotional response. For the present study, participants listened to each song for approximately two minutes. Research is unclear on whether two minutes is enough time to evoke emotional responding, but in the present study this seemed to be enough time at least to evoke significant emotional responding for PA responses to negative music.

Rinn et al. (2018) stated that the HSPS may have three constructs: ease of excitation, low sensory threshold, and aesthetic sensitivity. High sensitivity is an innate trait for the highly

sensitive person (HSP), as the HSPS measures sensory processing sensitivity (SPS). McManus (2012) also states that the highly sensitive person is likely to be aware of details in stimuli and can become overwhelmed easily by too many stimuli. While the HSP may have been more easily overwhelmed during this study, HSP scores did not seem to indicate whether a participant would feel positive or negative emotions more or less extremely. Their higher sensitivity may have therefore contributed to their greater appreciation or dislike for a particular piece, but it is impossible to know, for each individual, whether their sensitivity might have made them appreciate or dislike any particular piece.

Although it was expected that exposure to emotionally arousing music might interfere with memory test performance differently for songs that elicited positive or negative affect, this was not the case for the most part. Musliu (2017) suggested that music hinders the ability to memorize, and that those who memorize things in silence can generally remember things more easily than if they listened to music. If music hindered memory performance for all of the songs in the present study, this could have contributed to why only one significant relationship between affect and memory was found. However, for the present study participants were asked to type the words they remembered as the songs played, but they were memorizing these words in silence before music was played. If participants were memorizing while listening to music, this may have impacted their memory performance differently.

Discussing Research Results

Higher EI was related to lower positive and negative affect before any music was presented. This was also true for positive emotional responses after song 2, which was intended to produce a higher negative emotional response. This means that for this song, participants with a higher EI felt fewer positive emotions after this song played than those with lower EI. While

their negative affect responses were not significant, it is interesting that their positive affect responses were significantly lower during a song intended to be more negative. While this may not have significantly influenced negative emotions, it significantly influenced the decrease in positive emotions. No other songs produced significant differences in PANAS scores based on EI differences.

While the interaction between HSP scores and EI produced significant emotional results in two cases, HSP scores on their own were not significantly related to positive and negative emotions for this study. This was true both before music was presented, and after each song. This indicates that the highly sensitive person did not experience significantly different emotions from the non-highly sensitive person throughout this study.

In only one case, higher emotional responses were related to lower memory test performance as measured by the number of words correctly recalled. After Song 1 where higher positive affect was expected, memory test performance was negatively related to the positive affect. Therefore, for this particular song, more words were correctly recalled if positive emotions were lower, and less words were correctly recalled if positive emotions were higher. Since results for the relationship between PANAS and Memory were only significant after the first song, it is possible that this significance was due to participants adjusting to the nature of this portion of the study. However, it is interesting that a higher positive emotion was related to a lower recall of correct words, indicating that this positive emotion may have distracted or hindered the listener from correctly recalling the words given.

Another interesting finding was in the breakdown between EI and sensitivity, and how this related to positive and negative emotions. There were four conditions corresponding to those high and low in EI and/or HSP. People in each of these conditions had different emotional

responses. For each condition, there was a pattern behind positive emotions. Participants in each of the four categories consistently scored in the following pattern: Participants with low EI experienced higher positive emotions if they were more sensitive and lower positive emotions if they were less sensitive. However, those with a high EI experienced fewer positive emotions if they were less sensitive, and experienced higher positive emotions if they were more sensitive. Although this pattern was only significant for two songs which were meant to produce a higher negative affect, it is interesting that the means of each of the four categories consistently produced this pattern. The opposite pattern can be seen for negative emotions. Participants with a lower in EI had experienced fewer positive emotions if they were more sensitive, and experienced higher negative emotions if they were less sensitive. Negative emotions for those with a higher EI were higher if they were less sensitive, and negative emotions were lower if they were more sensitive. While this pattern was true for songs one to four, it was not true for song five. For song five, those who were higher in EI and sensitivity had the highest negative emotions of the four groups.

Those who were higher in EI and lower in sensitivity seemed to have the lowest positive emotional responding to each song. This could be due to the ability that a higher emotional intelligence gives people to regulate their emotions and maintain consistency. Nonetheless, those who were not high in HSP tended to have less variance in their responses, which could have also contributed to this consistency with those higher in EI.

Interestingly, there was consistently more variability in the degree of positive affect for those who were high in EI and high in sensitivity. These findings highlight that this group of people consistently varied most in their positive emotional responses to songs, no matter the emotion intended. When participants were high in EI, a higher HSP score seemed to have

contributed to more variance in responses, but this did not seem to indicate whether people would experience stronger or weaker positive emotions. These findings highlight that those who score higher on the HSP scale will be more sensitive to sensory stimuli. However, it is interesting that this sensitivity seems to be experienced very differently by individuals as they can experience increased positive emotions or decreased positive emotions as a result of their higher sensitivity.

Study Limitations

There was a lack of ability to control the environment which participants completed this study in, creating space for a few limitations surrounding this. Since this study was done from people's personal devices in their own homes, it is not possible to know the volume people listened to the music for this study at, nor is it possible to know if they skipped the music listening portion altogether. Participants also had the freedom to do this study at any time of day or night they chose, which may have impacted whether they were well rested and thinking clearly during this study. They also had the freedom to take as long or as little time as they needed where if this was happening in a controlled environment, the timing and atmosphere for this study would be far more regulated and consistent. Due to this study taking place online, it is also hard to know if participants were able to complete this study uninterrupted and free of distractions as their spaces were not monitored or controlled. Environmental distractions may have influenced results, especially for the HSP. This is because environmental stimuli can easily overwhelm the HSP more than it would for someone who scored lower on the HSP scale.

Another limitation to this study is its focus on classical music, as opposed to a variety of musical genres. It is difficult to know whether results would have been different, or whether

other genres of music would have yielded a greater significance, had this study used a variety of genres to convey emotions.

Participants familiarity with a particular piece may have also influenced their emotional responses. If participants had heard a particular piece previously, this may have elicited an emotional response which was attached to a memory or moment in time, rather than having an emotional response based on an initial reaction to the music.

Each of the songs used for this study were only listened to for approximately two minutes of time each. While there were significant results for some songs, this may not have been enough time to evoke an emotional response to music. It would be interesting to do another study where music is listened to for a longer period of time to see if these songs affect emotion more strongly after longer exposure.

It would have been interesting to explore the impact of sensitivity further by comparing high, medium, and low levels of sensitivity. It may have also been intriguing to explore the impact of EI by comparing high, medium, and low EI. However, the sample size of the present study was not large enough to divide participants into smaller groups. This limited the ability to further analyze the difference between those who had average scores versus those who had high or low scores on each of these tests.

Study Implications

Despite these limitations, these results suggest a few theoretical and practical implications. First, mood is generally more positive than negative, and classical music seems to have the ability to alter positive emotions more strongly than it alters negative emotions. Each of these songs was only approximately two minutes in length, but this was enough time to produce significant emotional responding for PA responses after negative songs. This indicates that

negative music may have the ability to significantly impact positive emotions, even when, or at least when someone only listens to negative music for a few minutes at a time.

It appeared that throughout the present study, EI and the sensitivity interacted to produce patterns of emotional responding. This could suggest that although EI may help someone manage their emotions and the emotions of those around them, sensitivity may influence the way their EI leads them to react to music. Together, sensitivity and EI may work well together to indicate whether someone will be more or less emotional in response to sensory stimuli in general.

When trying to memorize a list of words then listening to classical music, short-term memorization was not significantly impacted, whether music was positive or negative. This may indicate that listening to classical music does not significantly impact memory performance. It would be interesting to first test memory performance without involving music to assess how much participants were able to remember without adding music to this evaluation.

Directions for Future Research

In terms of future research, it would be useful to further examine the relationship between EI and the HSP construct. This interaction produced a significant interaction for some PANAS scores, and their most important contribution may be that they raise a variety of intriguing questions for future study. If it were possible, it would be very interesting to do a future study to explore how sensitivity and EI interact to predict or understand emotional responding to other types of sensory stimuli. Much work remains to be done before there is a full understanding of the relationship between music, emotion and memory. Perhaps other cognitive tasks such as reading comprehension or math would provide different insight to how emotion in music can impact a person's ability to complete a cognitive task.

This study only involved classical music, but it would be instructive to explore how different music genres might change the outcomes. Other genres of music might have led to very different results, especially for the memory and mood portions as lyrics can help create a mood as well as distract someone trying to remember specific words. Another avenue of inquiry could explore whether songs without lyrics from other genres prove to be easier or more difficult to concentrate for, or if they impact mood differently. Other music such as ambient music, electronic music, nature sounds, and instrumental pop music would have possibly yielded very different results for a study like this one as well.

Despite the limitations of this study, it has given us a better understanding of the relationship between the HSP and EI. Hopefully this research will encourage further investigation of this relationship. Future researchers may also want to move away from analyzing music when looking at the relationship between the HSP and EI. Perhaps studying things such as art, sounds, or stories in relationship with the HSP and EI would also bring interesting findings on this relationship.

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Appendix A

Informed Consent Form

Tyndale University
3377 Bayview Ave
M2M 3S4

Date:

Name of Participant:

Project Title: Experiencing Music

Researcher: Anastasia Madill, supervised by Dr. Nancy Ross; Associate Professor of Psychology

How to Contact Investigator:
Anastasia Madill:
Dr. Nancy Ross: nross@tyndale.ca or (416)226-6620 ext. 2708

Purpose of the Research: This research explores the relationships between emotions, sensitivity, music, and memory.

What You Will Be Asked to do in the Research: In this experiment, participants will be expected to complete a series of questionnaires and listen to multiple excerpts of music. The expected duration of this experiment is 1 hour to 2.5 hours.

Risks and Discomforts: Participants may experience eye strain due to long exposure to a computer screen (1-2.5 hours).

Voluntary Participation: Your participation in the study is completely voluntary and you may choose to stop participating at any time without penalty or loss of benefits. Your decision not to volunteer will not influence the final grades you receive in your courses, or the nature of your relationship with Tyndale University either now, or in the future. Participants will either have the opportunity to receive extra credit in a class which this has been approved, or be entered in a draw to receive one of three $25 gift cards to either Tim Horton's or Starbucks.

Withdrawal from the Study: You can stop participating in the study at any time, for any reason. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the researcher, your University, or any other group associated with this project. In the event you withdraw from the study, all associated data collected will be immediately destroyed wherever possible.

Confidentiality: Unless you choose otherwise, all information you supply during the research will be held in confidence and unless you specifically indicate your consent, your name will not

appear in any report or publication of the research. Your data will be collected through a series of online surveys. Your data will be safely stored in a locked facility or a password protected computer and only research staff will have access to this information. This data will be stored for two years following the completion of the study, and it will be archived at Tyndale University after the study. Confidentiality will be provided to the fullest extent possible by law.

Questions About the Research? If you have questions about the research in general or about your role in the study, please feel free to contact Anastasia Madill either by telephone at or by e-mail . This research has been reviewed and approved by the Tyndale REB Research Ethics Board, on behalf of Tyndale University, and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. This study will take place from September 8, 2020 to April 30, 2021. If you have any questions or concerns about this study either now or in the future, you can contact the REB (reb@tyndale.ca) or the supervisor of this study (Dr. Nancy Ross).

Legal Rights and Signatures:
I, _____ consent to participate in Experiencing Music study conducted by Anastasia Madill. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

Signature _____ **Date** _____
Participant

Signature _____ **Date** _____
Principal Investigator

***Optional*:** *Secondary use of data studies:* I, _____ consent *to allow their data to be used in secondary uses of data studies.*

Signature _____ **Date** _____
Participant

Appendix B

Sample MSCEIT Items

The MSCEIT has eight sub-tests and over one hundred individual items. These examples are meant to illustrate the type of items that this ability test of emotional intelligence consists of.

Identifying Emotions

	Indicate the emotions expressed by this face.				
Happiness	1	2	3	4	5
Fear	1	2	3	4	5
Sadness	1	2	3	4	5

Using Emotions

What mood (s) might be helpful to feel when meeting in-laws for the very first time?

	Not Useful				*Useful*
Tension	1	2	3	4	5
Surprise	1	2	3	4	5
Joy	1	2	3	4	5

Understanding Emotions

Tom felt anxious, and became a bit stressed when he thought about all the work he needed to do. When his supervisor brought him an additional project, he felt ____. (Select the best choice.)

a) Overwhelmed
b) Depressed
c) Ashamed
d) Self Conscious
e) Jittery

Appendix C

QUESTIONNAIRE (HSP Scale)

INSTRUCTIONS: This questionnaire is completely anonymous and confidential. Answer each question according to the way you personally feel, using the following scale:

1	2	3	4	5	6	7
Not at All			**Moderately**			**Extremely**

____ 1. Are you easily overwhelmed by strong sensory input?

____ 2. Do you seem to be aware of subtleties in your environment?

____ 3. Do other people's moods affect you?

____ 4. Do you tend to be more sensitive to pain?

____ 5. Do you find yourself needing to withdraw during busy days, into bed or into a darkened room or any place where you can have some privacy and relief from stimulation?

____ 6. Are you particularly sensitive to the effects of caffeine?

____ 7. Are you easily overwhelmed by things like bright lights, strong smells, coarse fabrics, or sirens close by?

____ 8. Do you have a rich, complex inner life?

____ 9. Are you made uncomfortable by loud noises?

___ 10. Are you deeply moved by the arts or music?

___ 11. Does your nervous system sometimes feel so frazzled that you just have to go off by yourself?

___ 12. Are you conscientious?

___ 13. Do you startle easily?

___ 14. Do you get rattled when you have a lot to do in a short amount of time?

___ 15. When people are uncomfortable in a physical environment do you tend to know what needs to be done to make it more comfortable (like changing the lighting or the seating)?

___ 16. Are you annoyed when people try to get you to do too many things at once?

___ 17. Do you try hard to avoid making mistakes or forgetting things?

___ 18. Do you make a point to avoid violent movies and TV shows?

___ 19. Do you become unpleasantly aroused when a lot is going on around you?

___ 20. Does being very hungry create a strong reaction in you, disrupting your concentration or mood?

___ 21. Do changes in your life shake you up?

___ 22. Do you notice and enjoy delicate or fine scents, tastes, sounds, works of art?

___ 23. Do you find it unpleasant to have a lot going on at once?

___ 24. Do you make it a high priority to arrange your life to avoid upsetting or overwhelming situations?

___ 25. Are you bothered by intense stimuli, like loud noises or chaotic scenes?

___ 26. When you must compete or be observed while performing a task, do you become so nervous or shaky that you do much worse than you would otherwise?

___ 27. When you were a child, did parents or teachers seem to see you as sensitive or shy?

Appendix D

STOMP

For the following items, please indicate your basic preference level for the genres listed using the scale provided.

1----------2----------3----------4----------5----------6----------7
Strongly dislike neither like nor dislike Strongly like

1. _____ Classical
2. _____ Blues
3. _____ Country
4. _____ Dance/Electronica
5. _____ Folk
6. _____ Rap/hip-hop
7. _____ Soul/funk
8. _____ Religious
9. _____ Alternative
10. _____ Jazz
11. _____ Rock
12. _____ Pop
13. _____ Heavy Metal
14. _____ Soundtracks/theme songs

Appendix E

PANAS questionnaire

toolshero

Time instructions

Score each of these feelings/emotions based on the way you feel right now.

Scale & Scorecard

1	2	3	4	5
Very slightly or not at all	A little	Moderately	Quite a bit	Extremely

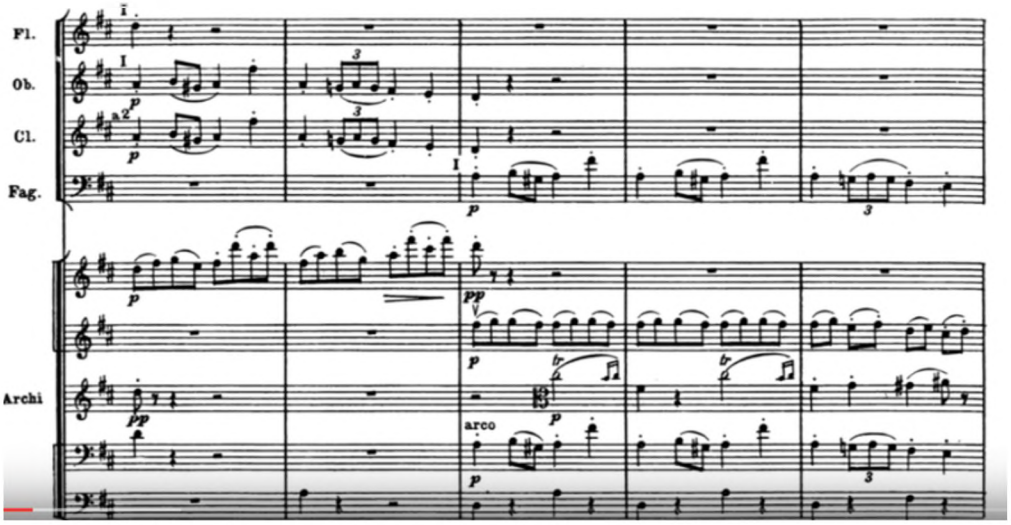
#	Score	Feelings/emotions
1		Interested
2		Distressed
3		Excited
4		Upset
5		Strong
6		Guilty
7		Scared
8		Hostile
9		Enthusiastic
10		Proud

#	Score	Feelings/emotions
11		Irritable
12		Alert
13		Ashamed
14		Inspired
15		Nervous
16		Determined
17		Attentive
18		Jittery
19		Active
20		Afraid

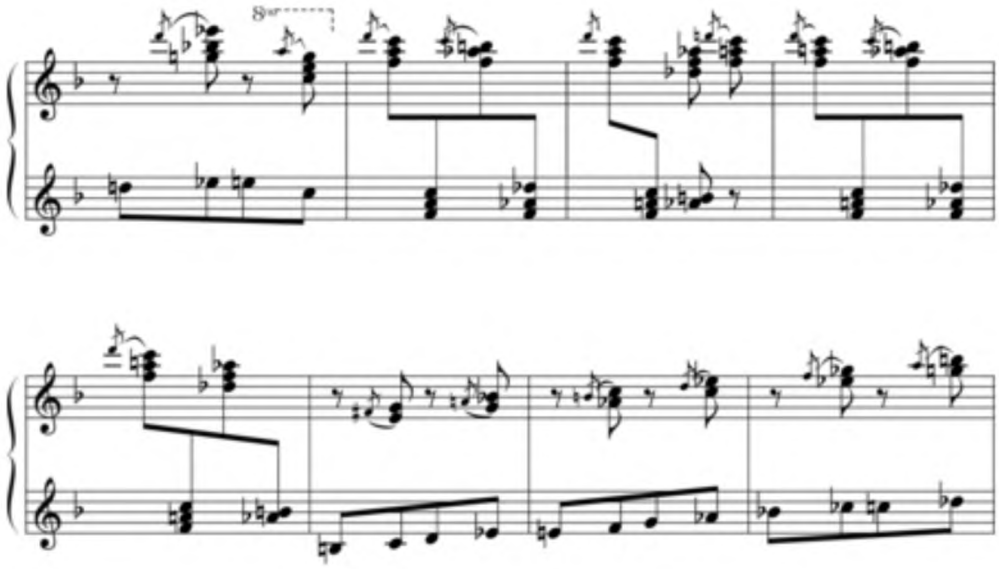
Appendix F

Musical Excerpts

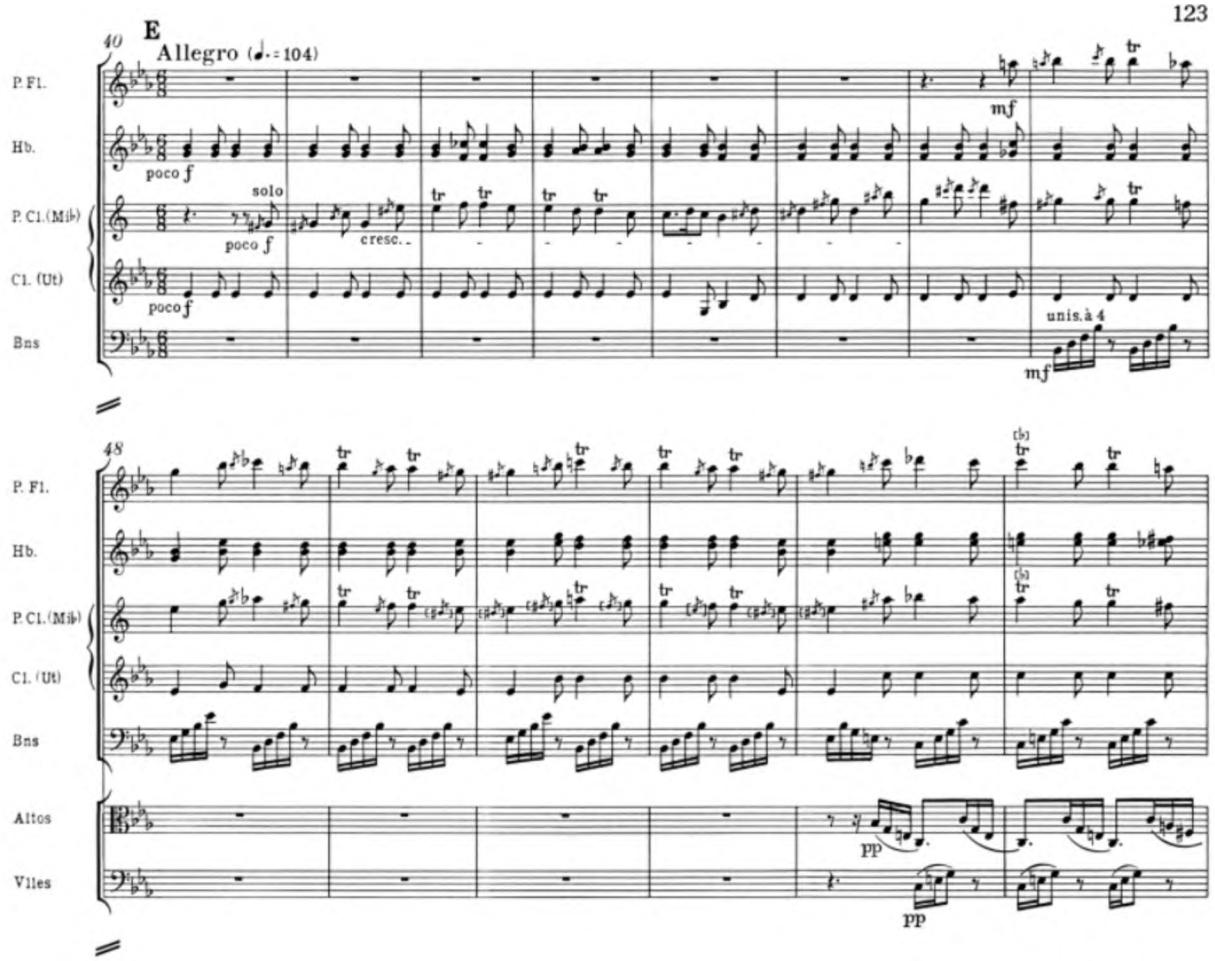
Sergei Prokofiev Classical Symphony in D major Op.25, Leonard Bernstein
YouTube Clip: 0:00 – 1:31



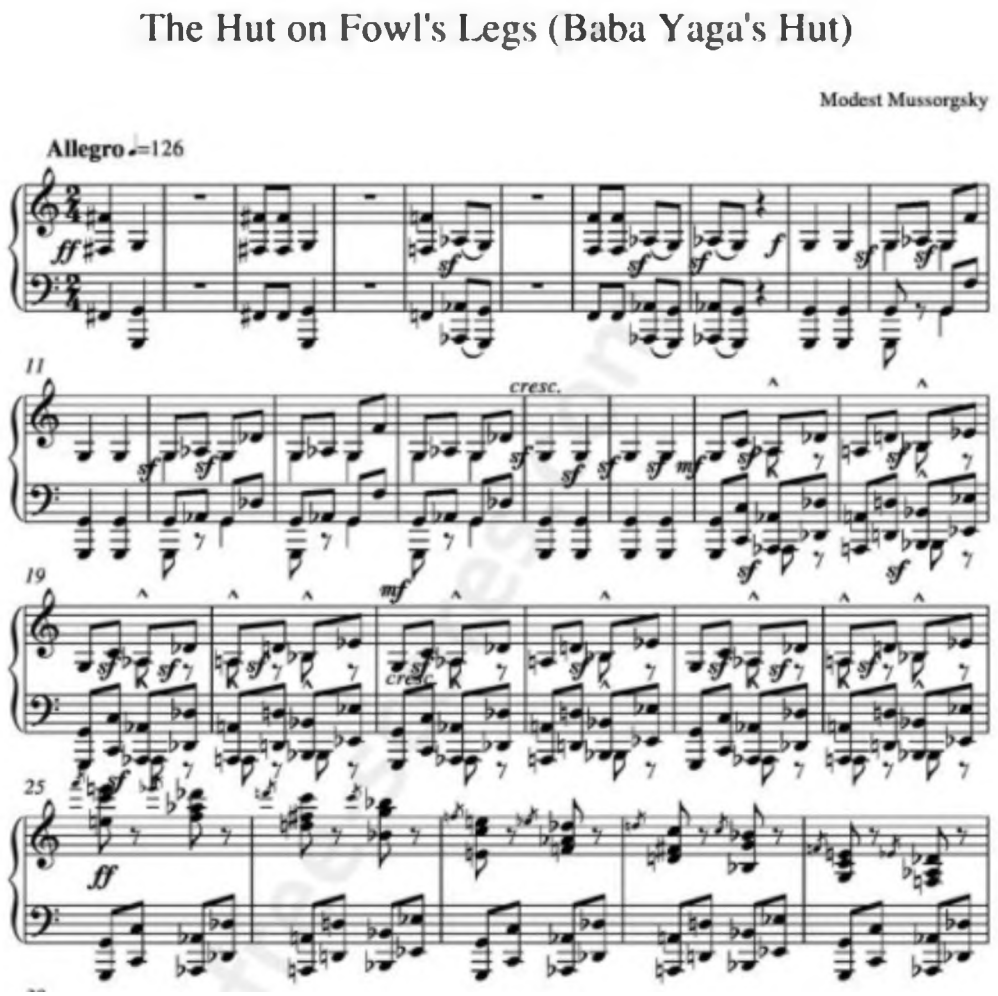
Mussorgsky: "Ballet of the chicks in their shells" from Pictures at an Exhibition:Oundjian
YouTube Clip: 0:00 – 1:14



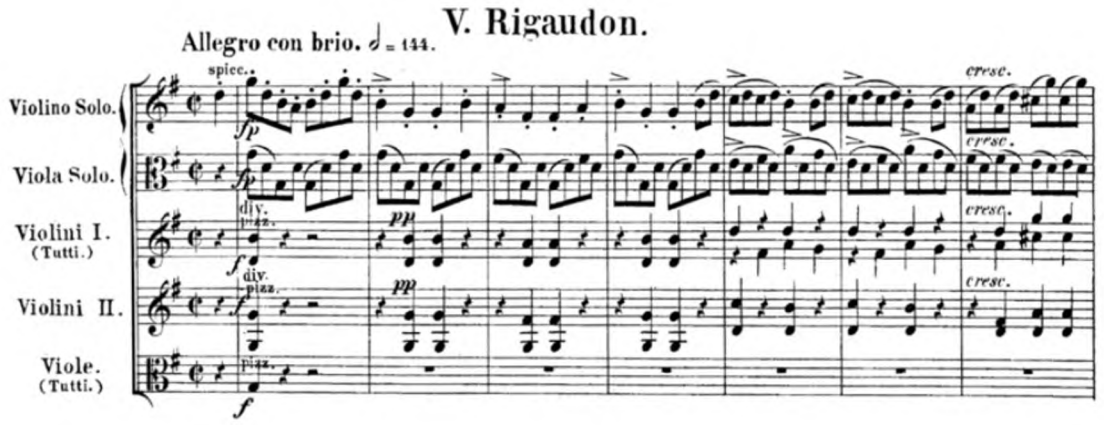
Berlioz - Symphonie Fantastique - Dream Of A Witches Sabbath
YouTube clip: 5:15 - 6:45



Mussorgsky - Pictures at an Exhibition - XIV. The Hut on Fowl's Legs (Baba-Yagá) YouTube Video: 0:00 - 1:30



Edvard Grieg: Holberg Suite, Op. 40, Rigaudon



Appendix G

Example of Words on Random Word List

cling
steal
smell
dusty
noisy
earth
sentence
dress
attack
wealth
add
charming
wet
dwell
welcome
shock
hit
stage
tan
caption
drag
tooth
dump
toad
cheap
boats
type
roof
broad
burn
root
push
twist
apple
messy
orange
destroy
level
cute
throne
wary
shoe
spiders

hate
wealthy
daily
clover
verse
goose
thunder
twist
urge
grip
slip
pancake
average
cloud
end
arm
drum
moon
idea
cry
defeated
average
magenta
eager
history
enormous
qualify
cold
bear
contest
spiritual
sun
river
rain
smooth
deafening
inscribe
huge
suit
volcano
yell
choke
separate

determine
useless
point
mislead
shock
awake
smelly
cheer
fact
observation
grain
direction
screw
bells
reason
grass
supply
hope
smoke
lovely
coo
feather
tank
trousers
contradict
flimsy
beef
increase
shock
fire
crayon
withdraw
hobbies
smoggy
ladybug
soggy
bed
gifted
unsuitable
boring
political
spring
achieve

Appendix H

Demographics

Please indicate the answer that applies to you most.

1. What is your gender?
- ☐ Male
- ☐ Female
- ☐ Prefer not to identify
- ☐ Other

2. What is your age?
- ☐ Below 18
- ☐ 18-23
- ☐ 24-29
- ☐ 30-34
- ☐ 35+

3. Ethnicity
    a. Caucasian
    b. African American
    c. Asian or Asian American
    d. Latino or Hispanic
    e. Other
4. How would you describe your musical ability/experience?
    a. Beginner: I do not have a lot of experience with music
    b. Intermediate: I have a basic understanding of music
    c. Advanced: I have a good understanding of music and have experienced academic training at an advanced level
    d. Expert: I have an excellent and proficient understanding of music and music theory
5. Education
    a. Some High School
    b. High School
    c. Bachelor's Degree

   d. Master's Degree
   e. Ph.D. or higher
   f. Prefer not to say

6. Marital Status
   a. Married
   b. Single
   c. Widow/ Widower
   d. Divorced
   e. Prefer not to say

7. How many children do you have?
   a. None
   b. 1
   c. 2 – 4
   d. More than 4
   e. Prefer not to say

8. Is English your first language?
   a. Yes
   b. No

9. Have you heard any of these songs before?
   a. Yes
   b. No

   If you answered yes, please state which one(s) here (first, second, third, fourth, fifth):

   _____

   _____