Musings on Music

Calvin Moen
McFarland High School

Abstract

There has been a significant quantity of research conducted on the subject of musical preferences and their correlations with personality traits and cognitive styles. This paper aims to summarize the results of a multitude of studies and explain the significance of these findings in the real world, both in and outside of psychology. This paper will also explore the shortcomings of this field of research, including the insufficient knowledge on the physiological components of music-derived pleasure, and the lack of understanding of how evolution facilitates the pleasurable sensations derived from music. Music is a tool that can be used for things other than enjoyment: emotional regulation, physiological arousal (which may improve performance at physically demanding tasks), a way to relate to others, and organizing cognition (Blood and Zatorre, 2001) all are possible functions of music. Understanding what makes music enjoyable can help music educators teach students, and help psychologists treat their patients.

General Preference in Music

In a 2011 study by Ladinig and Schellenberg, participants listened to music of fast or slow tempos and major or minor modes. Music excerpts varied in genre, but all were unfamiliar to the participants. After listening to a piece, participants would rate the complexity, how much they liked the piece, intensity of emotions felt, and how happy or sad it made them feel. Consistent with the author's hypothesis, participants tended to have a higher liking rating for "happy" music (major mode, fast tempo). However, some did rate the "sad" music (minor mode, slow tempo) with greater liking. This may be due to sad music being rated more intensely; it was found that higher intensity correlated with greater enjoyment (Ladinig & Schellenberg, 2011). Of course, this can also be explained with personality and sociocultural factors, the former of which will be discussed later.

Overall, the study showed that higher perceived complexity, higher tempo, major mode, and higher emotional intensity means higher liking.

Not every song that an individual likes is something that they feel compelled to dance to. So what makes a piece of music "groovy?"According to 2019 research by Tomas E. Matthews and others on the sensation of groove, groove is defined as a desire to move to music. In terms of rhythm, medium complexity predicts the most liking. Low and medium complexity in terms of harmonic qualities predicts the most liking. Rhythmic complexity was the main component creating the sensation of groove (Matthews, Witek, Heggli, Penhune & Vuust, 2019).

Generally, people like fast tempo, major keys, low or medium harmonic complexity, and medium rhythmic complexity. Enjoyment of music comes from prediction, but a good piece of music must have a balance between predictability and violations of expectations (Sampoor 2013). However, while the majority of popular songs are at fast tempos ("Sucker" by Jonas Brothers (138 beats per minute), "Break Up With Your Girlfriend, I'm Bored" by Ariana Grande (170 beats per minute)), a good chunk are not ("ME!" by Taylor Swift (91 beats per minute), "7 rings" by Ariana Grande (70 beats per minute)). Additionally, popular music tends to be predictable without much variation and lacks rhythmic complexity. Hip-hop and rap, genres that have gained lots of popularity in the past decades and have even made its way into popular music, is primarily rhythmic-based--which fits the results of these various studies, as harmony functions as a modulator rather than a determiner in music-liking and groove. There is, however, a tendency for these pieces to lack melody and harmony; both qualities have been demonstrated to influence emotional intensity, a predictor of musical enjoyment. The few emotional elements that are present tend to be "dark," rather than the "happy" feeling the majority tend to seek. This can in part be explained through socio cultural factors, as well as personality and cognitive style, which will be discussed later.

What makes music pleasurable?

The previous studies showed what we like, but why do we like it? In a 2001 study by Anne J. Blood and Robert J. Zatorre, researchers set out to determine the brain regions activated during intensely pleasurable music listening. Intense pleasure was operationally defined by "chills" or "shivers-down-the-spine." These

sensations were reported by the participants.

Musicians at McGill University were used as subjects in this study due to them being more likely to have a strong emotional response to music (Blood & Zatorre, 2001). The subjects were asked to choose a piece of (classical) music that they knew induced chills, as the sensation is highly replicable (Blood & Zatorre, 2001) . None of the pieces selected for this study contained lyrics. The pieces selected by one subject were used as a control for one other subject. PET scans were used to determine brain activities. Heart rate, electromyogram, respiration depth, electrodermal response, and skin temperature were also measured. Participants rated the enjoyment and intensity they felt while listening.

Heart rate, electromyogram, and respiration depth all increased during the highest rated chills in comparison to control music. Electrodermal activity and skin temperature did not change significantly, however. Increased activity was found in various brain regions relating to reward and physical responses. Decreased activity was found in areas associated with negative emotions (Blood & Zatorre, 2001).

This research seems to suggest that not only does listening to intensely pleasurable music increase activity in areas of the brain related to reward, such as the hippocampus, and autonomic activities, such as the anterior cingulate cortex, but it also decreases activity in brain regions associated with undesirable emotions, such as the amygdala.

The author considers that our pleasure derived from music came with our increased cognitive capabilities and ability to interpret patterns in abstract stimuli (Blood & Zatorre, 2001). Music seemingly provides no direct survival-based benefit. The author suggests that this intense pleasure, similar to that of taking drugs or sex, may indicate a great importance to our mental and physical well-being in relation to music (Blood & Zatorre, 2001).

While the study proves nothing in terms of why these results are found, it does seem to indicate that music is significant to the human mind. This is further evidence that music education is vital, and is promising information for music therapy. The next step would of course be to delve into *why* music creates these physiological responses and brain activity in reward-based brain regions. Understanding why will help psychologists and ordinary people alike in utilizing music more efficiently.

Blood and Zatorre looked at the anatomical basis of musical pleasure. In a

2013 experiment by Valorie N. Sampoor, Sampoor looked both at brain regions activated as well as the behavioral and cognitive processes involved. fMRI scans indicated that the same reward circuits involved in biologically adaptive behaviors such as eating and sex are involved with listening to music. Simply put, dopamine-mediated responses create a sense of reward when one's prediction of what will happen next in a musical piece is met or surpassed (Sampoor, 2013). These expectations can be created by expectations of specific, familiar music, or based on schemas around the expected patterns of musical sound (Sampoor, 2013). The sense of reward was found to be resulting from the right nucleus accumbens, an important piece of the striatum, often known as the "reward center." Once again, this study emphasizes the significance of music-derived pleasure and reward, and finds activity in reward-based brain regions.Yet, as acknowledged by the author, the issue of what makes music enjoyable is much more complicated than relatively simple functions of the limbic system.

In comparison to Matthews' study on the interaction of rhythmic and harmonic complexity, these results make sense. Medium complexity allows a listener to somewhat anticipate what will happen in a given piece but still leaves room for unpredictability.

Music preferences and personality

Obviously, not every person enjoys the same music. As said before, a variety of factors influence preferences in music, including personality. A 2005 study by Małgorzata Kopacz aimed to show the relationships between personality and music. The 16 PF questionnaire was used to analyze the personalities of participants. Cattell's theory of personality was used, with 16 personality factors, including Warmth, Liveliness, Social Boldness, Openness to Change, and Vigilance. The research looked at different musical categories including tempo and tempo changes, number of melodic themes, and variety of instruments. Pieces of music fit on different sides or parts of the spectrum of each of these variables (Kopacz, 2005). For instance, a song may be fast in tempo, have no changes in tempo, shorter rhythm values, a low number of melodic themes, a high variety of instruments, a 4/4 time, with lots of crescendos and decrescendos, a major scale, and a piano as a leading instrument. It was found that those with high social boldness are most likely to prefer fast-paced music, large numbers of

melodic themes and music lacking a beat. Tempo and number of melodic themes positively correlated with liveliness and openness to change. In contrast, both previously mentioned elements correlate negatively with vigilance. Additionally, extraversion had a positive correlation with the number of melodic themes and tempo. Those who enjoy fast tempos are characterized by the highest mean for extraversion (Kopacz, 2005). This study provided insight on how personality traits interact with musical variables. It found what has been found time and time again, that extraversion predicts liking for fast tempo, which is associated with “happy” music.

The study used Cattell’s theory of personality factors to identify the personalities of participants. Although the Big Five Personality Traits is regarded as best in terms of most accurately labeling traits, the researchers chose Cattell’s theory simply for the fact that it is more specific, saying that narrower dimensions may be helpful for studying artistic preferences (Kopacz, 2005). The use of this personality inventory could have an impact on the validity of the results; there are a fair amount of personality inventories that are used to assess personality quite often, despite a lack of evidence to support its validity.

Whereas the previous experiment looked at correlation between musical elements and personality traits, a 1993 study by Stephen J. Dollinger looked at the relationship between genres and personality. Researchers used NEO-PI, which according to the author is a valid measure of The Five Factor Theory of Personality, to measure personality (Dollinger, 1993). They utilized the music preference survey developed by Little and Zuckerman to measure music preference. It was found that openness correlated positively with preference towards classical, jazz, and soul/rhythm and blue composites. Extraversion is also correlated with liking jazz (ranging from soft jazz to bebop), and excitement-seeking is correlated to hard rock (which included heavy metal, acid rock, and punk rock), neuroticism and pop, and agreeableness and classical. Unsurprisingly, openness found the greatest number of positive correlations with a wide variety of genres, including new age, reggae, and folk-ethnic (Dollinger, 1993). Extraversion and excitement-seeking traits found a negative correlation with preference towards gospel music. The results of this study corroborate the findings of the aforementioned Kopacz

study. Jazz, especially of sub genres like bebop, have high tempos and lack beats. However, other sub genres of jazz are very slow and have simplistic beats. Openness to change was found to correlate with genres such as jazz and classical; both genres tend to have large numbers of melodic themes.

Two issues can be found with Dolligner's 1993 study in particular. Firstly, there is a lack of electronic music genres besides disco, despite its popularity in this age likely due to the age of the article. Genres such as dubstep, Trap, Drum n' Bass, and EDM were either not developed or weren't popularized at that time. The other issue is that the various composites (ie. Jazz, hard rock) encompass too large a variety within their makeup. For example, Slayer, a heavy metal band, and Jefferson Airplane, an acid rock band, while encompassing some similar elements such as having a relatively loud sound, are very different in their sounds. More specific genres can create more accurate representations of relationships between personality and music preferences.

Ladinig and Schellenberg's study also looked at individual music preferences (2011). Personality was measured through a BFI, based upon the Big Five Personality Traits. Agreeableness correlated with higher levels of feeling sadness (closer to pure than mixed) as well as higher levels of emotional intensity (both happy and sad). It would appear that those who are highly agreeable will be more empathetic and will relate more to the emotions of the music. Neuroticism correlated with a strong intensity of sad feelings leading to the conclusion that emotional instability is correlated with strong negative effects. When openness to experience and introversion increases, liking for "sad" music increases. Previous findings had shown that extroversion increases liking for happy music, so it's only logical that introversion would increase liking for sad music (Ladinig & Schellenberg, 2011). Openness to experience has been found to be associated with liking of a variety of music, especially music outside of the norm. This study seems to suggest that it's the same for emotion; those who score high on openness will be more open to enjoying sad music unlike what people typically enjoy (Ladinig & Schellenberg, 2011).

Compared to the previous study, classical music has a tendency to have higher emotional intensity for listeners. The empathetic quality of the agreeableness factor may allow a person to enhance the already emotionally intense piece, thereby

increasing liking of the music. Popular music typically is upbeat; rather than listening to music for maximum intensity and therefore enjoyment, persons with a high neurotic factor may use music as a calming device or mood enhance, a possible explanation for the correlation between neuroticism and pop.

Personality is not the only variable in determining musical preferences. Indeed, correlations between personality and music preferences are relatively low (Greenberg, Baron-Cohen, Stillwell, Kosinski & Rentfrow, 2015). This makes personality unreliable in predicting music preferences, and vice-versa. Psychologists, music educators, and employers must beware of using music as a predictor of personality. Better predictors are socio-cultural factors, such as preferences within a family or group of friends.

Music is a rapidly evolving art form. Every decade has a sound different from the rest. Yet the majority listen to and enjoy these sounds, indicating a strong sociocultural influence. This also means that music is not a good measurement of personality; while the latter may stay consistent, the former certainly will not.

Music preferences and cognitive style

Personality and cognitive style can be hard to differentiate: personality is a collection of persistent characteristics unique to a person. Cognitive styles are also unique and persistent. This study, however, showed that cognitive style does have an impact on musical preferences separate from personality. A 2015 study led by David M. Greenberg looked at how cognitive styles affect one's preference for certain music. Researchers looked at two dimensions of cognitive style in particular, empathy and systemizing, in accordance with the Empathizing-Systemizing Theory. Empathy is the ability to identify, predict, and respond to the mental states of others. Systemizing is the ability to identify, predict and respond to the behaviors of systems. Both cognitive styles have similarities to skills used when listening to music; processing the sound, interpreting it on a deeper level, and predicting what will happen next (Greenberg, Baron-Cohen, Stillwell, Kosinski & Rentfrow, 2015).

Empathy and systemizing was measured by questionnaires. As empathy and the Five Factor Theory personality trait of agreeableness has been said by some to be overlapping (Greenberg, Baron-Cohen, Stillwell, Kosinski & Rentfrow, 2015), the researchers had participants have their

personalities tested too. Rather than have participants indicate preference for different genres, the researchers created 5 musical stimuli found across all genres: Mellow, Unpretentious, sophisticated, Intense, and Contemporary (MUSIC).

The study showed that empathy positively correlated with preferences for mellow, unpretentious and contemporary dimensions. It correlated negatively with the intense dimension. The study found that associations between empathy and musical preferences are independent of the links between preferences and personality (Greenberg, Baron-Cohen, Stillwell, Kosinski & Rentfrow, 2015). Empathy does in fact predict musical preferences beyond personality.

In a second study by the same researchers, participants took a survey to determine brain-type. Every person has an empathy and systematic value; the difference between the two makes one's brain-type. There are 5 types of brain-type: Extreme systematic, systematic, balanced, empathetic, and extreme empathetic (Greenberg, Baron-Cohen, Stillwell, Kosinski & Rentfrow, 2015). The results for this study were largely the same as the first one. Those with an empathetic brain-type have preferences for mellow, unpretentious, sophisticated, and contemporary music. Systematic brain-types had preference for intense music. Empathetic brain-type had negative correlation with the intense dimension, and systematic-brain types had negative correlation with mellow and unpretentious dimensions. Balanced brain-type correlated positively with mellow and unpretentious dimensions, and negatively correlated with sophisticated and intense dimensions.

In addition to the mellow, unpretentious, sophisticated, intense, and contemporary dimensions, the second study looked at preferences for psychological aspects, with categories describing high and low arousal, positive and negative valence, and emotional and cerebral depth. It also looked at sonic aspects, such as tempo, percussive, bass guitar, etc. In terms of psychological aspects, type S participants preferred high arousal, and type E preferred music with low arousal. Type S preferred music with positive valence, while Type E preferred music with negative valence. Type E preferred music with cerebral depth. Type E did not prefer complexity; Type S did. Finally, Type E preferred music with emotional depth. In terms of sonic attributes, type S preferred music that was dense, distorted, loud, percussive, and fast in tempo. Type S preferred music that featured brass and electric guitar. It was

found for Type E that they did not like these attributes. Type E preferred music with strings.

These studies showed that cognitive style is a variable of musical preferences. Just like with personality, understanding the correlations between cognitive style and musical preferences helps psychologists and music educators help clients and students with maximum effectiveness.

As said by the author in the Introduction, there is a lack of research on music preferences and cognitive styles. This is troubling, as research has been mainly in relation to personality, which while having a consistent correlation with genres, has relatively low correlation (Greenberg, Baron-Cohen, Stillwell, Kosinski & Rentfrow, 2015). This suggests there are other elements at play in determining the liking for musical styles and elements.

Conclusion

When listening to pleasurable music, increased activity is found in brain regions associated with reward and motivation, as well as with brain regions relating to physiological and autonomic responses. Simultaneously, activity is inhibited in regions of the brain associated with negative emotions. It has been found that pleasure from music listening is derived from predicting what will happen in a song based on expectations and schemas of what is musical, while still having subtle violations of expectations to keep interest. Generally speaking, people prefer “happy” music over “sad” music. Additionally preference is highest for music with medium rhythmic and harmonic complexity, which also creates the highest sense of groove.

In terms of personality, extroversion has been found in multiple experiments to correlate with preference towards fast-paced, “happy” music. Openness to experience correlates with liking for a variety of genres, including jazz, classical, soul, and R&B. Neuroticism correlated with greater intensity of “sad” feelings. Agreeableness correlated with higher levels of feeling sadness as well as higher levels of emotional intensity.

In terms of cognitive style, systematic types had preferences for intense music. Empathetic types had preferences for mellow, unpretentious, sophisticated, and contemporary music. Type S participants preferred high arousal.Type Ss preferred music with positive valence. Type Es preferred the opposites of both. Type E preferred music with cerebral depth. Type Ss preferred complexity. Type E preferred music with emotional depth. Type S

preferred music that was dense, distorted, loud, percussive, and fast in tempo. Type S preferred music that featured brass and electric guitar. Type E preferred music with strings.

One must wonder; who benefits from this knowledge? Would the time, effort and resources put into these studies be better spent elsewhere? The brain functions similarly when listening to music as other pleasurable adaptive behaviors such as eating, and yet there is no clear benefit to listening to music as far as survivability. It has been hypothesized that music is a tool to enhance the brain's learning to predict, a necessary thing for survival (Matthews, Witek, Heggli, Penhune & Vuust, 2019).

According to a paper by Marcela Mrásová (2010), music therapy has been a promising approach to psychotherapy. Children are especially responsive to music therapy. Music's impact on cognitive and physiological functions can be used to treat mental illnesses (Mrásová, 2010). In a 2015 study by Shu-Hui Yeh and others, music and aerobic exercise was found to not only decrease depression in depressed women, but also promote neurotrophic factors, which supports the growth and survival of neurons (Yeh, Lin, Chuang, Liu, Tsai, Tsuei, Lee, Hsiao & Yang, 2015).

According to a 2017 paper by Stephanie E. Pitts, "musical activities can lead to a sense of accomplishment, enhanced determination and persistence and of children being better able to cope with anger and express their emotions effectively" (p. 160). Other benefits include increased discipline, time management, relaxation, coping with difficulties, communication, and teamwork skills. The benefits of musical education and involvement with music are tremendous and extend beyond the previously listed benefits, which makes keeping people interested more important than one may initially think. Knowing how people's personalities and cognitive styles affect their musical preferences allows teachers to maximize involvement and benefits of music education.

All of this points to music being very important to our mental well-being. Therefore, it is no doubt beneficial to understand the individual differences in musical preferences.

References

Blood, A. J., & Zatorre, R. J. (2001, September 25). Intensely pleasurable responses to music correlate with activity in brain regions implicated in reward and emotion. Retrieved from https://www.pnas.org/content/98/20/11818.long

Dollinger SJ (1993). Research Note: Personality and music preference: Extraversion and excitement seeking or openness to experience? *Psychology of Music*, *21*(1), 73–77. https://doi.org/10.1177/030573569302100105

Greenberg D<. Baron-Cohen S, Stillwell DJ, Kosinski M, Rentfrow PJ (2015) Musical preferences are linked to cognitive styles. *PLoS ONE 10*(7): https://doi.org/10.371/journal.pone.0131151

Kopacz M (2005). Personality and Music Preferences: The influence of personality traits on preferences regarding musical elements. *Journal of Music Therapy, 42*(3), 216-239.

Ladinig, O., & Schellenberg, E. G. (2012). Liking unfamiliar music: Effects of felt emotion and individual differences. *Psychology of Aesthetics, Creativity, and the Arts, 6*(2), 146-154.

Matthews T E, Witek MAG, Heggli OA, Penhune VB, Vuust P (2019). The sensation of groove is affected by the interaction of rhythmic and harmonic complexity. *PLoS ONE*, *14*(01), 1–17. https://doi.org/10.1371/journal.pone.0204539

Mrázová, M., & Celec, P. (2010). A systematic review of randomized controlled trials using music therapy for children. *Journal of Alternative and Complementary Medicine (New York, N.Y.)*, *16*(10), 1089–1095. https://doi.org/10.1089/acm.2009.0430

Pitts, S.E. (2017) What is music education for? Understanding and fostering routes into lifelong musical engagement. *Music Education Research, 19* (2). pp. 160-168. ISSN 1461-3808

Salimpoor, V.N., Bosch, I.V.D., Kovacevic, N., McIntosh, A.N., Dagher, A., & Zatorre, R.J. (2013, April 12). Interactions between the nucleus accumbens and auditory cortices predict music reward value. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/23580531

Shu-Hui Yeh, Li-Wei Lin, Yu Kuan Chuang, et al. Effects of music aerobic exercise on depression and brain-derived neurotrophic factor levels in community dwelling women. BioMed Research International, vol. 2015, Article ID 135893, 10 pages, 2015. https://doi.org/10.1155/2015/135893.