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Are there Differences in Music Preferences Following Major Events?

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Introduction

In the latter half of 2019, the world started to become aware of what would soon become a global pandemic. In just a few short months, almost every major country in the world was locking their borders and quarantining their citizens, with the goal to eradicate and protect their people from the disease. While in many countries it did work, and solutions or vaccines were created, there is no denying the affect that the quarantine had on some people mood and behavior. Major events can have profound effects on anyone, and that can be displayed through how they feel or act, what they do or even what type of music they listen to.

This study examines and discusses this potential influence of major events such as terrorism, war or changes in laws on people's emotions and consequently the type of music they chose to listen to.

A very good indicator to how a person feels lies within their choice in music. Music plays an important role in many people's lives. For example, it is an activity people can do to express themselves and reveal who they really are. Additionally it is so important because is a staple in many people lives. Music can allow people to party and have fun and enjoy life, it has also been proven to improve focus, reduce stress and improve mood (Harvard Health 2011). Very few activities or parts of people's lives can have this profound effect on someone's health and mood. That being said, with all the known benefits of music, research is still unclear on the role of major events have on the type of music people listen to. Whether it be something positive, like civil rights movements or positive anti-terror events or something negative like natural disasters or shootings, the role of music in these scenarios is still not well understood. After an event on

such a large scale, the question is that if there is an actual emotional reaction and can these emotional reactions be observed through the choices of music made by individuals following such events.

The main research question in this study is whether there is a difference in music preference following a major event. Extant research has not fully addressed the issue of whether major events, either good or bad, actually influence ways people can express themselves through music. Regardless of the event and the implications thereafter, any consistent change can show that music is an indicator of the extent to which people's moods can change following a major event. Finding answers to this question could have major implications to a number of audiences in the music industry and beyond. For musicians, while it may be insensitive to think about, an artist may want to capitalize or commemorate an event into a song. If the findings from this study demonstrate that more negative emotion-type songs are popular following a tragic or negative event, then a musician could seek to create a song that would match the "energy" that people have at the time, and increase their sales and popularity. Similarly, findings of this research could be important to record labels, A&R's managers and agencies for the same reason. The second research question seeks to determine whether there is a differences in music tastes when the event is positive versus when the event is negative. This is also worthwhile to know for those in the music industry as it will allow them to compose and release music that congruent with the emotional state of the populous following a major event. Along with that, it is important information to understand if anyone were to research the tendencies of the brain post-traumatic event. If the research shows that the brain wants to be happy after a sad event and shows this with more upbeat, happier music, then it could lead into deeper questions and more analysis about not only happiness, but the effect of music on humans.

The reminder of the study is organized as follows: The next section reviews the literature related to mood and music choice. Next a set of hypotheses are developed. Thereafter the methodology used as well as the findings of the study are presented. Finally, conclusions are drawn and directions for future research are outlined.

Literature Review

There are an estimated 97 million songs in the world (MarsBand, 2012), thus it is no surprise that the literature on music choice is broad. Additionally, music is universally known and enjoyed, leading many to invest time and resources into conducting research into various aspects of music.

The section of the brain that responds positively to music is the frontal lobe. However, one study titled "A neural predictor of cultural popularity" (Berns 2012) uses the reward-related sections of the brain, the orbitofrontal cortex among others, to predict the popularity in a song. At first glance, this is a completely different study than the research questions at hand, asking about forecasting a song's success in the future compared to seeing how people react to songs in the moment. However, every song can be judged on the same elements and can be graded on the same scale of emotion, regardless of the question being asked. This study takes a very close look at songs and examines how the brain reacts to the song, and then goes further to predict if the song will be become popular based on the brain's reaction to the song, rather than the subject's verbal opinion. The study found that humans react differently to unique variables in songs and these specific variables can lead to the popularity or the dislike of the songs.

What this means for the broad research question at hand is that music can be a very good indicator for brain activity and mood. This can be found because the study showed that the preference and thought process behind music takes place in a subconscious, reward-based section of the brain, so the connection between the two is that upon hearing the music, the brain will subconsciously listen to and analyze the music and make the decision to react a certain way, which can be a certain mood based on the elements.

A study by Martin Pichl in 2014 examined the effects of combining the conscious part of the human brain and how that reacts to music (Pichl 2014). One of the ways that can be done with today's technology is by sharing thoughts on social media, like Twitter. Specifically this study combined Spotify and Twitter data to generate a dataset with the goal to understand and forecast music recommendation. The authors examine the history of the certain Spotify users who posted the songs they were listening to on Twitter. They then evaluated the number of "listens" and how the music is recommended. Through their analysis the authors find the unique ways that people recommend their music choices and why they do it. While this does not entirely match the research questions mentioned before, it offers insight into them and some ideas as to the answer the questions assuming that people recommend the type of music that they like. The results reveal that more people recommend individual songs rather than the artists who created those songs. This discovery leads to possible questions like "how do certain artists affect mood after a major event?" However, with the information provided from this study, individual songs are much more prominent than listening to or recommending artists, or even a hybrid of the two. Overall, this study contributed to the research questions because not only did it find listening patterns of the average user, but it offered insight to listening patterns of Spotify listeners.

A study by Kelly Jakubowski created a variable called "earworms" which effectively means how well a song gets stuck in a listener's head (Jakubowski 2017). This study then analyzed how a song is listened to and sought to determine how easily it is for a song can get stuck in people's heads. In a sense, it is a variable just analyzing other variables; meaning that an earworms characteristics come from other components of the music including tempo, valence, etc.

While this study is relevant to the research question at hand, it opens the door for many other questions and studies regarding the science of music. Similarly to the study discussed prior involving the effect of music on the reward-based section of the brain, this research goes into the function of the brain when it comes to music. More specifically, the parts of the brain that retain and judge the music for what it is, and the variables involved. The goal of this research was to analyze popular music of today, and after finding the songs that would be looked further into, find out if there were variables or melodic indicators that point to what people find interesting enough to keep coming back to. This is very important when considering how people feel after a major event, because it could unlock information about what gets people to listen to music in the first place. Using this information, we can make arguments and find information regarding how variables within songs get listeners for the first time and then to keep coming back.

What was found from this study was similar to what the research question of this thesis was searching for in the fact that it intended to analyze variable importance in music. For example, in terms of importance to how people perceive and judge music, tempo was very close to the top for most important, which was also a variable tested during this thesis's research. After finding the songs and variables that are important to the study, the goal was to analyze the effect that all of the information had on people, and more importantly, how much of an earworm these

songs contain. The results in the end of this study indicated that the features in a song's melodic structure, as well as the recency of the music, can be used accurately to predict whether a song will contain characteristics of being an earworm (Jakubowski 2017). The importance of this shows that the variables in the music can have major effects on how they are interpreted and how much they are listened to. To further that, this study looks at how the variables change after an event that would affect someone's feelings.

Hypotheses

Many people use music as an escape or a way to express themselves. Much of the time, this can be seen through Billboard's top charts and the order of the rankings of the songs on the chart. For example, the song "Happy" by Pharrell Williams is in the tone of exactly what the song is named. The overall happiness and positivity of the song is ranked very high, which will be described in more detail later in the study. However, since the song was on the top charts for almost 80 weeks, and it is such a positive song, the escape theory is one that has a lot of evidence supporting it. Consequently the first hypothesis is that there will be a major difference in the top ranked music following a major event. With all that has been stated about songs affecting mood and how people portray themselves, it is not unreasonable to think that individuals taste in music would be altered by an event.

The next hypothesis is that the events that are considered negative will provoke more change in listening choice than the events that are considered positive. As stated in an earlier paragraph, music is used by many people to celebrate and party and be in a good mood. If a positive event occurs, it could lead to celebrations and the happier and positive songs being

played more and climbing the list. Conversely, negative events could lead to individuals to sink into melancholia which could subsequently motivate the choice of sadder music.

One notion that further lends credence to this hypothesis is the negative bias theory. This theory states that even of equal intensity, thoughts or events of a negative nature will have a greater effect on people than those of a positive nature (Moore 2021). This theory comes from studies and the findings that humans are more likely to react more to the bad events than the good. With this in mind, there is firm belief that the negative events will show a greater change than the positive events tested.

Methodology

Following the literature review and the hypothesis development, the next step in the study was to identify relevant major events that had had a major impact on the emotions of the populous. Given that different events occur over time and different events could impact different generations differently, it was necessary to identify a particular generation then focus on the major events that impacted that generations lives. A choice was made to focus on millennials due to the availability of data and the balance between positive and negative events that have occurred during millennials lifetimes. Millennials have lived through several traumatic experiences and continue to do so, but they are also a group that listens to a substantial amount of music. Knowing this, the next logical step was to identify a list the events that were to be tested. Pew research systematically tracks historic events that have the biggest influence on the country during different generation's lifetimes then ranks the top 10 most influential events (Pew 2021).

With the events taken, some had issues that had to be adjusted for. For example, one of the most memorable events of the millennial generation was the technology revolution. While it makes sense that this is a very memorable event for a lot of people, it is not one that is easy to test. There is no set date to this event, having no accurate time period to test. This is also true for the great recession; while it did impact America at around the same time, each individual person could have experienced it at a different time. Therefore, since finding an accurate time periods to test for such events would prove difficult they were not included in the final analysis.

After narrowing down the most feasible events to test, the next step was to identify music data around these events. Billboard served as the data source that provided rankings of songs surrounding version events. The billboard website offers a function that allows the viewer to see the top 100 songs from any given week. The top 50 songs 4 months before and 4 months after event were used. Examining data before the event allows for a pre-event baseline to be established. Following the event various variables associated with the music can be compared to the pre-event baseline. The variables for each song were drawn from a dataset found on Kaggle. Kaggle has a repository of music for every song from the top 50 of the worldwide charts dating back to 1920. Along with the title of the songs, the repository also provides information about the songs, such as the release date and other variables including song energy and sound level, danceability, valence, speechiness and liveliness..

The despite having a large amount of data, the dataset had to be cleaned and structured to permit the evaluation of the research questions. Thereafter a preliminary analysis of the data was conducted by taking the mean for the different variables of each month and comparing it to the other months to look for a trends or patterns. A more in-depth analysis using t-tests will be discussed in later sections.

Events Considered

Figure 1 lists the most impactful events in the lives of millennials as identified by a study

conducted by Pew Research. From the figure it is evident that the two most impactful events

were September 11 which 86% of the respondents indicated was an impactful event followed by

the election of Barak Obama. As stated before, the negativity bias theory suggests that people

pay more attention to negative cues/events than positive ones. Most of the events (8 out of 12)

that were remembered by millennials tend to be more negative thus providing some support for

the negativity bias theory.

For the purposes of this study the negative events considered are September 11, the

Iraq/Afghanistan wars, the Orlando Shooting, Hurricane Katrina, the Columbine shooting, the

Sandy Hook shooting, and the Boston Marathon bombing. The events that were classified as

positive include Obama election, Gar marriage, and Bin Laden capture and killing. To facilitate

analysis the positive events are then classified as either as Terrorism, war, shooting or natural

disaster. While the positive events are categories as either civil rights, election or antiterrorism.

Figure 1: The Most Memorable Events for Millennials

Millennials

1	Sept. 11	86%
2	Obama election	47
3	Iraq/Afghanistan wars	24
4	Gay marriage	19
5	The tech revolution	18
6	Orlando shooting	17
7	Hurricane Katrina	11
8	Columbine shooting	10
9	Bin Laden	10
10	Sandy Hook	7
11	Boston Marathon bombing	7
12	Great Recession	7

Variables Examined

After contracting the data and choosing the specific events, the next logical step is to decide on the variables that will be examined. The original dataset included about 10 different variables, ranging from computer generated variables like valence to basic ones like song duration. The important part of this step was to find the most suitable variables that can accurately gauge how people feel following a major event. These variables had to be accurate in terms of predicting behavior, both positive and negative. Ultimately six variables were selected for analysis namely song energy, sound level, danceability, valence, speechiness and liveliness.

The first variable that was considered was energy, defined as the forward motion of a song, or how well a song keeps a listener engaged and listening. This was an important variable for both positive and negative, as each can show the mood of a song and lead to assumptions. For example, a sadder, more melancholy song is likely to have lower energy, as it will most likely build slower and reach that pivotal moment slower. Conversely, a song with greater energy and more forward motion will most likely be happier and sound more positive. This is one variable that can be analyzed by following the trend from month to month, where if it goes up then the music is most likely becoming more cheerful and happy, but if the value is going down then the music is becoming more somber.

The next variable analyzed was loudness, which describes the volume of a song. At face value volume not appear to have an association with mood however research finds that a lot of the time, when in more negative moods, people tend to listen to quieter music, as it matches their mood (BBC 2018). Thus, when looking at the analysis of each month passing, if the variable showed music continually getting quieter, a fair assumption was that the music was getting more depressing and more negative.

Instead of a variable indicating sad music, others are strong indicators of more positive music. For example, the next variable that was studied was danceability, which is described as the suitableness for a person to dance to song. It goes without saying that if a person will find a song danceable and they actually want to dance to it, there is a large chance that the song is not meant to be unhappy. Therefore, when looking at the value for this, the higher it is over a sample of 50 songs then the happier people are. The converse also applies. Lower levels of danceability may signal that the songs are not meant to be danced to, thus suggesting a more somber mood. This is one of the more important variables because it affects a natural human instinct of happiness and a way that joy can be expressed in a physical form. If a certain piece of music affects a person's happiness enough to the point where they either begin dancing or it makes them stop, then it is worth studying as their mood has clearly changed.

Another variable that was examined was speechiness, which refers to how many words are present in a song compared to other noises found. This variable could provide useful insights about a song as well as the public's reaction to it. For example, the lack of words, could indicate loneliness, as there is no noise but instruments or white noise in music, which is not meant to be actively listened to, to the point of comprehensive listening. Similarly, the lack of words can be an indicator of acousticness, which indicates the level of acoustics in a song. The belief is that if a song is more acoustic and has few words, and places more emphasis on the few words that are present in the song it may have a deeper meaning and communicate more a serious and somber message in other words it is more likely to be a sadder song.

Similar to speechiness, liveness is another variable that measures the components of a song by the sounds. Liveness is described as the extent to which a song sounds as if it were performed live. This nature relates back to the meaning of the song, as the more live it sounds the

less artificial or fake it can sound. A variable like this is best when combined with speechiness, as they are looking for something similar that can be found through a combination of the two.

The final variable is valence which is defined as the overall positivity of a sing. From a definition standpoint, this is the most accurate and desired variable for the research questions at hand. However, just one variable can't be trusted, as a song a can sound positive but other variables can point to a different conclusion. In other words, a song can sound positive to a computer, but another variable or the actual meaning of the song can be a completely different feeling. This variable is, however, extremely important as it does analyze the overall sound of the song and place a value on it. When combined with another variable like danceability, the information is backed up and can be taken with more confidence.

Table 1 provides a summary and definitions of each of the variables considered.

Table 1: Variable Definitions

Variable	Definition
Energy	The forward motion of a song, or how well a song keeps the listener engaged and listening
Loudness	The measure of volume relative to a specific song
Danceability	The suitableness for a person to dance to a song; how easily a song is to dance to, based on musical elements like tempo, key, and others
Valence	The overall positivity within a song
Speechiness	The degree of words in a song compared to other sounds
Liveness	The extent of the song that sounds like it were performed in front of a live audience

 Source: Spotify Web API developer guide

Analysis

Factor analysis was used to group similar variables and reduce the number of dimensions. Ultimately this permitted a more straight forward approach for analysis The factor analysis

identified 3 groupings of variables :song energy & sound level(E&L), danceability and

valence(D&L), speechiness and liveliness(S&L). The factor analysis revealed.

Once factor score had been computed, the scores were then used in a paired sample t-test

(see formula below), and the mean differences were compared before and after the event. This

way, all of the new, combined variables are tested for each event and every month that was

required.

$$t = \frac{\sum(\bar{x}_{before\ event} - \bar{x}_{after\ event})}{SE_{diff}}$$

Findings

Table 1 show the results from the paired samples t-test. Note that the table was separated

into negative and positive events, to track the possible changes in a more organized manner. In

Table 1 the column after the list of events shows the variables considered. Next the paired

differences (before -after event) of each variable category are listed Thereafter the standard

deviation is provided. Finally, the t-statistic and the p value are listed. For the purposes of this

study p-values less than 0.1 are considered statistically significant.

Regarding the results, the events are compared as categories of events, rather than

specific events. For example, instead of the 9/11 terrorist attacks having their own section and

results, the event type is listed as "terrorism" and contains data from multiple events, in which

the grouping is also a way of testing if the event type itself is more of an indicator than a specific

event.

The results reveal some interesting patters, particularly between negative and positive

events. For the positive events there is very little changes any of the music variables following a

major event. The only observed change was a marginal increase in S&L following civil rights events. For all the negative events there are statistically significant differences in the scores of the variables scores before and after the event. Specifically, after a terrorist related event S&L decreases. In cases of war E&L increases significantly. When shooting events occur D&V increase and finally when natural disasters occur E&L decreases. Taken together the results reveal that whenever a negative event occurs there is some type of change in at least one of the variables considered also occurs. In other words, negative events trigger more changes. It is worth noting is that it is not always the same variables that change, and they do not always trend the same direction. Not only does this point to differences among events, but also certain how variables in music change with mood. Future studies could look into this further perhaps by first addressing questions such as "do people want to hear more words in music when they are sad, or would they prefer to hear less?" Questions like this go beyond the scope of the current study.

Table 2: Results from Pair Differences Tests

Event Type	Variable	Paired Differences (before-after event)	Std. Deviation	t	Sig. (2-tailed)
Terrorism	E&L	-0.06	1.46	-0.51	0.61
	D&V	0.11	1.62	0.78	0.43
	S&L	0.19	1.23	1.90	**0.06**
War	E&L	-0.44	1.27	-2.73	**0.01**
	D&V	0.01	1.85	0.05	0.96
	S&L	-0.03	1.65	-0.14	0.89
Shooting	E&L	-0.01	1.43	-0.11	0.92
	D&V	-0.25	1.21	-3.08	**0.00**
	S&L	0.06	1.29	0.73	0.47
Natural Disaster	E&L	0.52	1.4	3.01	**0.00**
	D&V	-0.02	1.37	-0.13	0.90
	S&L	-0.07	1.61	-0.36	0.72
Civil Rights	E&L	-0.15	1.28	-0.94	0.35
	D&V	0.05	1.36	0.29	0.77
	S&L	-0.31	1.52	-1.71	**0.09**
Election	E&L	0	1.02	-0.02	0.98
	D&V	0.13	1.28	0.89	0.38
	S&L	0.11	1.54	0.62	0.53
Anti-Terror	E&L	0.08	0.99	0.63	0.53
	D&V	0.02	0.95	0.15	0.88
	S&L	-0.26	1.59	-1.32	0.19

E&L-Energy & Loudness; D&L-Danceability & Valence; S&L-Speechiness & Liveness
Red-Negative Events. Blue-positive Events

Conclusion and Limitations

This study found that people's music taste changes after a major event. Specifically the results show that significant changes take place more frequently when an event is negative compared to when an event is positive. These findings provide support to the negativity bias theory, negative events will cause a larger reaction than a positive ones since all four of the negative events showed a change in variables, and only one of the positive events showed a change.

However, this study was not without its limitations. One of the limitations is the time period considered. While eight months(4 months before the event and 4 months after the event) is a long time, it may not be enough. For example, if an artist were to make a song dedicated to an event, that would likely take more time than just four months after the event for the song to be released and become popular. If the time period were set longer, and the songs like this were considered, it could possibly affect some of the results.

Similar to the event date as a limitation, the event selection itself could be a limitation. It could be possible that events with no exact date could have extremely different results. For instance, studying how music selection has changed in a pandemic lockdown was a major element that motivated the current study, nevertheless the study only considered events that were not spread over long periods of time. Future studies could consider measuring the time from the beginning of long-term events such as the quarantine to the end could yield some interesting findings.

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