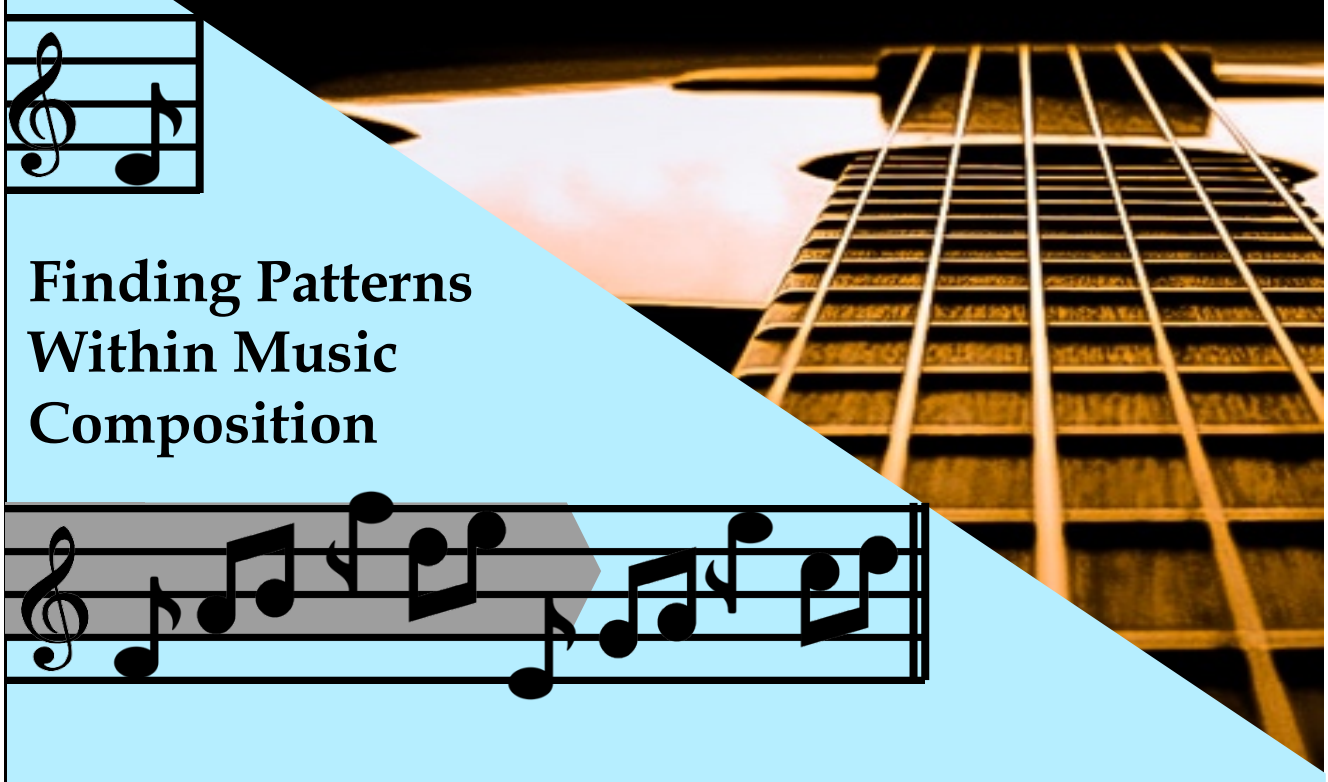
What Defines Musical Genres?



Finding Patterns Within Music Composition

Max Aronheim 2021

Applying Stock Analysis Techniques to Music

Abstract

A statistical analysis on music. Songs are selected and various sections of a song are sampled and analyzed. A qualitative section was made. The sample is split into 3 charts: note value vs # of notes, interval vs # of notes, rhythms vs # of notes. Songs were grouped together accordingly to similar qualitative data and then cross referenced for any distinct visual chart patterns. Patterns were identified, recorded, and related to common associations toward specific musical genres for final conclusions.

Intro

Have you ever listened to a song for the first time, and you just knew the tune before ever listening to it? What about songs can possibly make music predictable; after all, the possibilities for orchestrating music are considered numerically infinite? So, why is it so common for people to predict the tunes of all kinds of music, despite the infinitesimal possibilities in composing music? Furthermore, how is it possible that we can even have musical genres—genre labels that profile a song based on similarities? Based on our current understanding of music and the subconscious predictability in singing songs we've never heard of, there must surely be distinct

patterns in music to help profile songs. More specifically, what patterns are present among different genres to help profile songs?

Here's what we know. The concept of music predictability has been put into practice by a variety of people. A clear example is music improvisation where a group of band members play a song on the spot with almost no communication with each other. In a report from Jared B Burrows, he delves into the psychological aspect of cognitive distribution in application to music improvisation. He references various works from Carl Jung, Engestöm, and more.

We know there is a biological initiative towards pitch. Concepts introduced by Pythagoras changed the musical landscape by demonstrating the ratio relationship among notes. A report by a man named J.L Roche and 3 others entail a detailed report of these harmonic ratios. Furthermore, topics relating to the Solfeggio Frequencies demonstrate the human preference for specific frequencies and our present understanding of what qualifies a pitch to be in-tune. A report from Sonya Joseph demonstrates the application of these Solfeggio Frequencies and its hypothetical claim to be heal the human mind and body. Both of these reports illustrate the biological preferences for specific frequencies and the mathematical relationships between them.

Above everything, Steve Olson's cumulative article on the greatest developments in music theory history illustrates the universal relationship of mathematics in music and the human ability to rationalize and manipulate this obscure biological setting. Most prominently, Steve references Dmitri Tymoczko's work from *A Geometry of Music: Harmony and Counterpoint in the Extended Common Practice* in which Dmitri developed a musical fabric that can be shaped into a mobius strip by connecting the 1's with each other and the 2s with each other. This musical fabric is displayed in Image 1. According to Dmitri, the most famous artists in history—

Chopin, Bach, Mozart, etc.—have mastered this the harmonic relationships within this mobius strip. This scientific approach illustrates the predictability to an artist's success in music.

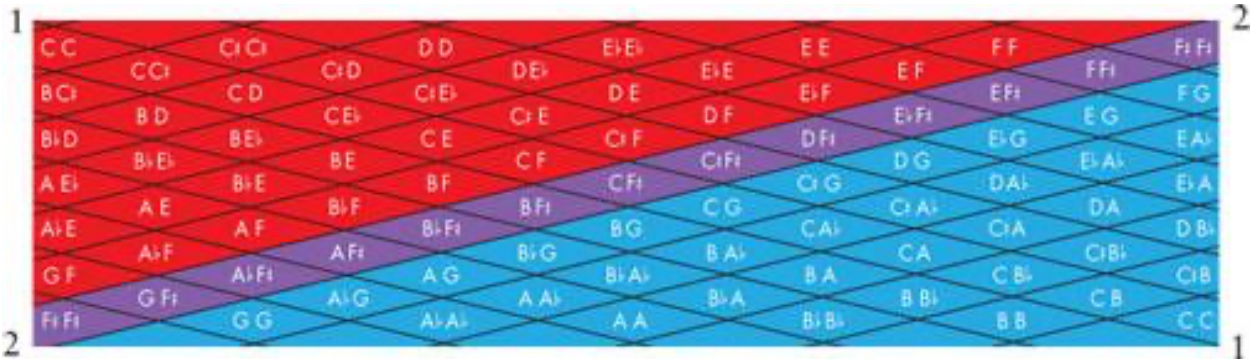


Image 1

However, there is a distinctive line that divides development of musical knowledge. In full, compositional knowledge within music has become rather stagnant. The majority of music theory taught in classes remains archaic. Pythagoras' discovery was made in the 10th century and many of the prominent theories taught in class were discovered between the 13-14th centuries. If you were to look search for most recent research papers on music, the majority of them are related to cultural divisions in music like John Blacking's cultural analysis on ethnomusicology, *Music, Culture, & Experience,* or the applications of music for psychotherapy like Kemper and Danhauer's synthesis report "Music on Therapy". And while these discoveries have value, the interested demographic that is impacted is rather small and the proven benefits are relatively minimal.

The majority of music development has been present in technology. Especially since the 2010's, the music technology industry has exploded. The development of streaming services like Spotify and Apply Music have paved a path to easily releasing music for the world to hear. As a result, companies like Komplete, Roland, Yamaha, and others have taken the forefront to a rapidly exploding industry built upon individual ergonomics; Imogen Heap's gloves take the forefront of musical technology by turning gestures into minute alterations in music dynamics, timbre,

instruments, tempo, and more; companies like Eventide have taken the forefront in the past decades to reshape the sound design industry with its advanced audio effects. Together, all of these companies have shifted the music technology industry away from music studios and more towards the individual home.

However, the explosion of new musical technology has shifted music artist's attention from composing unique music to producing unique sounds. As a result, many artists produce music that utilizes unique sound textures, but utterly lacks in unique composition; this differentiation is clearer than ever with the emergence of music artist Billie Eilish whose compositional uniqueness has earned the admiration of many listeners, artists, and companies—amidst the streamlined music culture of today.

Music Theory is infamous for being incredibly accurate, incredibly mathematical, and rather systematic in composition. There are essays on the value of music and massive surges in music technology. Most critically, many of the greatest works of music science, like D'mitri and Pythagoras, describe how math, harmony, and biology influence how we compose music. However, music theory continues to skirt around a critical aspect to music composition: the composer. Music theory continues to explain what influences how we compose but fails to significantly address the current compositional patterns that source popular music and music profiles. In an increasingly competitive industry, it is estimated that "only about 0.000002% of musicians become 'successful"'(Feathers). Therefore, it is a necessity to be unique in order for one's song to be "The One". In the following paper, you will be introduced to a process that helps to detect commonalities in music. Using these patterns, composers can make music that takes advantage of present music movements while developing enough distinction from other songs to make one's music memorable. This memorability will serve a key aspect into an artist's

success. It can be used to find the bad qualities in the worst of songs, and it can be used to find the great qualities among the best of songs. This year, this process was utilized to help clarify the compositional textures of musical genres. Ultimately, this research has the capacity to apply a scientific lens towards composing music with purpose. Because of this process' adaptability, it can be applied to any time, any place, any song to find a compositional pattern.

Methodology

Selecting Songs

There are 5 primary steps in this process: song selecting, qualitative data, quantitative data charts, data analysis, and final conclusions. Song selecting has been used to operationalize song selections. Qualitative data has primarily been utilized for grouping songs for cross-comparison analysis. Quantitative data has been the primary content that has been analyzed. Analysis had sought for primary patterns within the grouped music. Conclusions had compared these patterns to come characteristics people have used to describe different profiles of music, primarily genres

For selecting songs, YouTube playlists had been utilized. While having been signed out of any accounts, the phrase, "Top [genre type] songs today" had been typed into the search bar. The first playlist available that had been updated the day of or the day prior had been selected. The playlist that had been selected had then been divided by 5; the increment had been used to have decided which songs in the playlist would have been selected. The first song of each increment had been chosen for the analysis. For example, if a playlist had been with 40 songs total, the

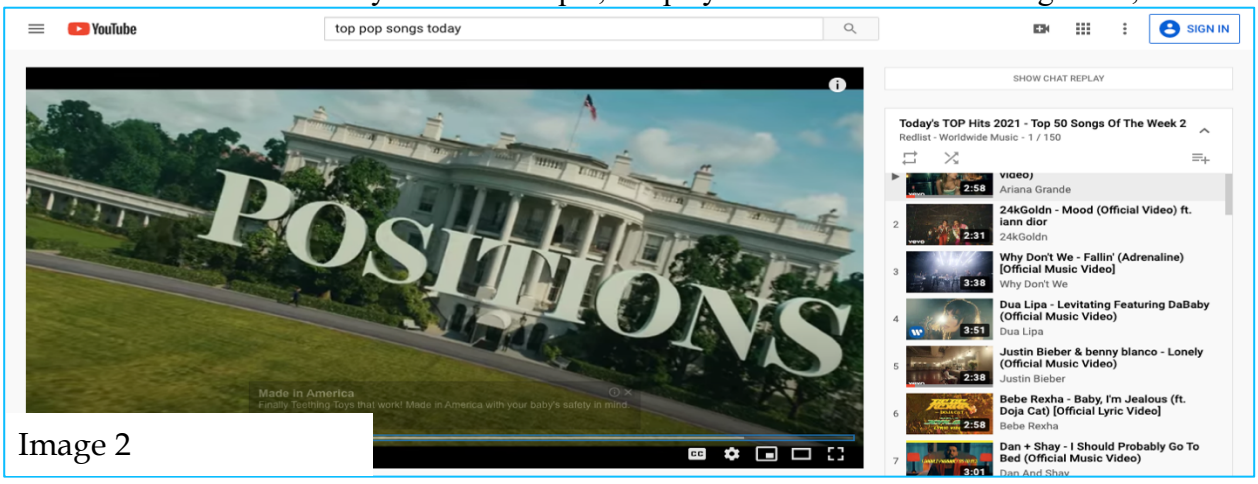


Image 2

song would have been divided by 5; therefore, the 1st song out of 8 songs in a set would have been selected. Selecting songs on YouTube have been displayed in Figure 1.

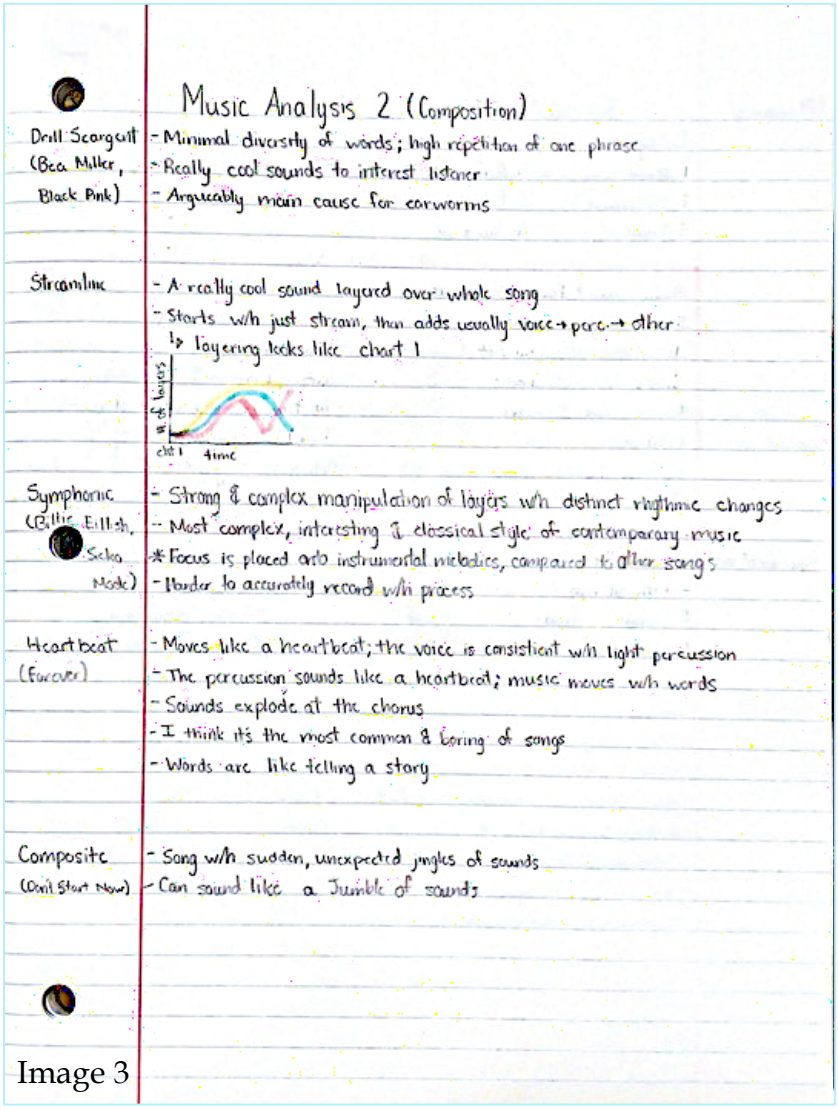


Image 3

Qualitative

Once the playlist had been selected and the increment steps had been calculated. The song had been recorded into an excel sheet. Each song has been separated along the x axis. The y axis has contained a checklist for qualitative data. Song name, song artist, genre, and time of selected song had been recorded concurrently when selecting songs: all the information had been provided via the selected YouTube Playlist. All of these components had been recorded without ever having listened to the song. On another day, the key signature and tempo of the song had been recorded through the website Tune bat.

Everything that has been recorded so far had been recorded for all songs on the same day for efficiency. The rest of the data had been collected individually for each song on separate

occasions before moving onto another song. Other pieces of the checklist had been recorded during the first listening session of the song. These pieces have included complexity, style, composition class, recordability, personal approval, and notes. Word topic has been recorded after the first listening session has occurred. Word topic has been decided by searching up the lyrics of the song. For better clarity, Figure 2 has been provided as an example for these components and how they had been recorded for an individual song.

Song Name	Lonely
Song Artist	Justin Bieber & Benny Blanco
Genre	pop
Time Stamp	22-Oct-20
Search	Top pop songs today
Tempo	80
Key Signature	B Minor
Complexity	simple
Style	Mellow-sad
Word Topic	emotion, heartbreak
Composition Class	Symphonic, streamline,
Recoradbility	Simple
Personal Approval	Yes
Notes	entire chorus

Figure 1

For scientific reliability, all qualitative data possibilities had been operationalized prior to the start of the project; the scope of these possibilities have all been recorded into Image 2, excluding the composition class. The operationalized possibilities for composition class have been listed in Image 3; under each composition class, the defining qualities of each class have been listed underneath.

For clarification on operationalizing, complexity has been decided if all 3 criteria have been met; if only one criterion had been met, it was considered simple: two criteria have been considered moderate and all three criteria has been considered complex. Recordability has been deliberated similarly; however, the more criteria that has been met, the less effective the process can analyze the song. Style and word topic have had a prechosen selection of topics, as shown in Image 2. Composition class refers to the overall structure of the song and the way it's composed; some songs overlay the same sound for the entire song(streamline). Others drill a specific message throughout the whole song. Composition class has been the best way to quickly and broadly analyze the entirety of the song, rather than just the melody.

Quantitative Methodology

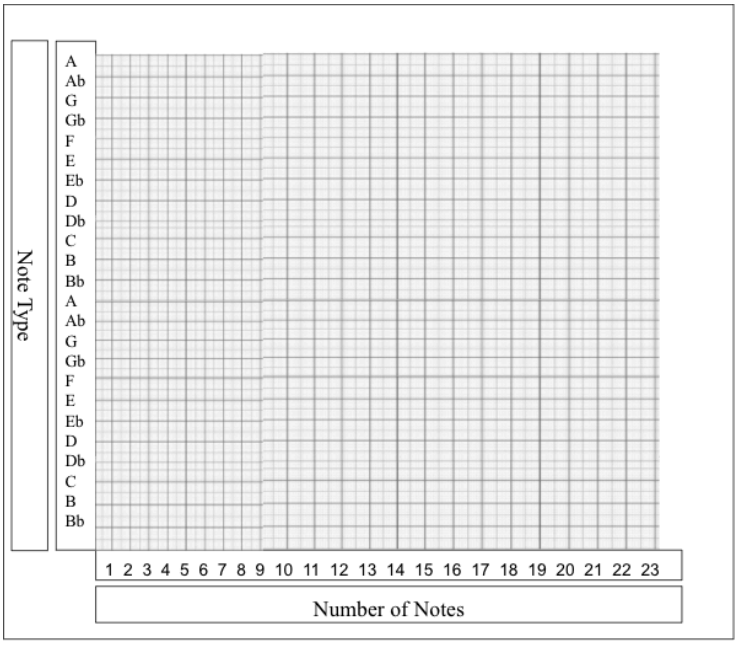


Figure 2

In classical music, music is written and read on a staff that displays the note value via line placement, rhythm through notation type, and an invisible interval that has measured the distance between the placement between two notes. For this project, the music staff has been split into these notes, rhythms, and intervals in order to operationalize and analyze this musical data. Once all qualitative data had been gathered, the songs had then been listened to for a secondary time. The focus for this listening section has been to record the identify musical motifs in the song. Once identified, a note motif graph had been filled out for the selected section. The note motif chart had been hand drawn. This chart has included the name of the song and the artist and the time from where the song had been sampled. An example of a note motif chart has been illustrated in Figure 3. If sheet music could not have been found to circumvent the arduous recording process, then a keyboard synthesizer had been used to accurately graph out the notes for the graph. Shaded areas in the charts have been representing a period of rest for the melody. The process had then been repeated until all relevant melodies had been recorded.

Once the note motif had been completed, the chart was then translated from paper into an interval chart that analyzed the distance between the notes on excel. The distance for a half step was equal to 1. For example, if a song had gone from a Bb note to a B note, then the value would have been 1. Each square in the note chart had represented 1 interval step. Any gaps in the chart

represent a rest in the melody. Periods of rest have identified clearly by labeling the length of the resting period to the side of the chart numbers, as shown in Figure 4.

Lonely 1- Justin Beiber & Benny Blanco 0:35		
1	2	
2	3	
3	5	
4	1	
5		r
6	5	
7	4	
8	4	
9	3	
10		r
11	3	
12	1	
13	5	
14	4	
15	4	
16	5	
17	5	
18	0	
19		r
20	2	

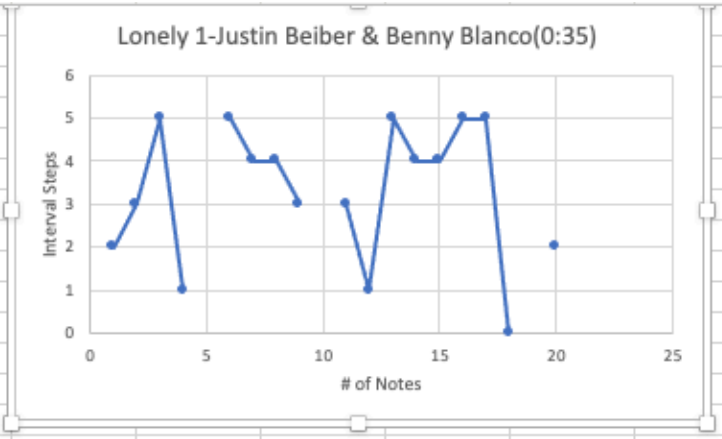


Figure 3

Once the note and interval charts have been completed, a rhythm chart has been developed. The rhythm chart has analyzed the number of rhythmic patterns to the length of the rhythm. When sheet music has been accessible, the rhythms have been converted into the chart format. When sheet music had not been accessible, the rhythmic melody had recorded onto excel. Afterward, it would have been triple checked to ensure accuracy.

Quantitative data has been designed for minimal inaccuracies. Qualitative data has been thoroughly operationalized for minimal subjectivity. While incorporating external parties of people has been considered to generalize the results, it has been determined that it would further muddle the data. Having a collection of people's preferences would require sifting through 10 different subjectivities that would have been influencing the results. Furthermore, having a group of people incorporated into the study would have come at a great cost of time. Consequently, external human subjects have not been incorporated and countermeasures have been made to rule

out most of the personal bias. This includes operationalized questions on personal preference of the song, the recordability of the song, and composition classes. Secondly, these subjective questions have been considered of lesser value into the study, unless there have been clear results in frequency during the analysis process.

Analyzing

The analysis section had been performed via grouping. Once all data has been collected, each song has been grouped based on the classified genre. Once groupings have been decided, each song had been cross-referenced to each other for any other similarities, particularly in chart patterns. Strong similarities within a group would have suggested a defining feature for the respective genre. By having concluded a variety of similarities, a loose standard can be developed regarding a specific genre, composition class, style, or melodic composition. Ultimately, this form of technical analysis had been expected to qualify tangible standards for profiling songs into music genres.

Summarized Process

1. Select Songs systematically
2. Record song name, artist, time, genre, tempo, key signature
3. Fill out remaining qualitative data while listening to song once
4. Determine Music Motif times
5. Fill out Note chart with song name, artist, time from song
6. Convert data into Interval Chart on excel
7. Complete rhythm chart on excel
8. Repeat on new song