

A Study to Answer Why I Can Predict the Tunes of Songs I've Never  
Listened To

# What Trends Reside in Musical Composition

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## Abstract

A 6-week study of the top 25 rated songs of each week was conducted to find patterns in the building and composition of Contemporary Pop. Music. This was a multistep statistical analysis. Spreadsheets were built and reorganized to build nearly 100 different charts to observe frequencies and patterns between time signature, key signature, and motif composition. Conclusive results were collected, and 2 universal patterns were drawn. This work has the capacity to add a scientific lens into the field of music composition.

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## Relevant Terms

**Soundscape:** “The component sounds of an environment; the component sounds of a piece of music” (soundscape).

**Musical Motif:** “A short musical idea...These small pieces of melody will appear again and again in a piece of music, sometimes exactly the same and sometimes changed” (Motive).

**Interval:** “The difference in pitch between two tones, as between two tones sounded simultaneously (harmonic interval) or between two tones sounded successively (melodic interval)” (interval).

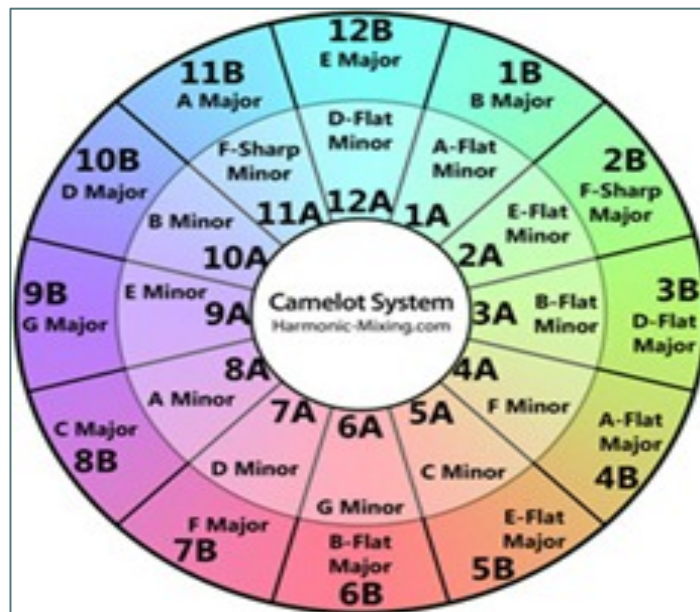
**Chromatic Circle:** Used to visualize the relationship between notes, particularly the relationship between notes and their intervals (Walton).

**Camelot Value:** A wheel used for the harmonic mixing of songs; labels specific key signatures that would mesh well together should someone use the song for a remix or mashup. Essential for DJ's to use

## Introduction

For a few years now, I have had the ability to sing the tunes of songs I have never listened to. This has puzzled me: “If I’ve never heard the song, why am I able to sing its tune?” So, I did some basic research to find what we know on the topic and if there is already an answer to my question.

I know how to say one song is similar to another song based upon **Camelot Value** and tempo. Companies like TuneBat use this information to help suggest songs that would mesh well in harmonic mixing. Amazon’s Echo line likely uses this and song genre to develop playlists when suggesting similar songs. Amazon will suggest similar songs when asked or when one of their



premium songs is suggested. Papers like the paper from (admin) have compared the accuracy of different harmonic mixing software's to prove that Mixed in Key, a harmonic mixing software, has the most accurate key detecting software as of today.

I know that music has an immeasurable impact on the human mind, particularly on a human's emotional state. The music psychology field has been flooded by these kinds of papers. A research paper written by (Kyle Wiebe) has drawn dozens of articles that all suggest the

various benefits of music on the human mind. Already into his second paragraph, Wiebe cites that music restores energy. Wiebe drew dozens of other articles that suggest other benefits as a result of music. Music's benefits have become so arguable popular that the field of musical psychotherapy was developed to acknowledge music's benefits in the field of therapy. A book was published by about the experiments of a Korean group of scientists that tested music's effect on the intervention

of adolescent Korean girls (Kim). They concluded music's ability to foster connectiveness between other people. All of these articles were found with a simple search that I thought of in 5 minutes.

I know that there are plenty of longitudinal studies that observe changes in music composition by observing songs ranging for the early 19<sup>th</sup> and 20<sup>th</sup> centuries. The Royal Society published an in-depth article called, "Musical trends and predictability of success in contemporary songs in and out of the top charts" (Iteriano). In their paper, various longitudinal trends in music were uncovered in successful music including a shift to more female sung songs, slower and more minor songs, great distinctions between successful and other songs, and more. They were able to predict a song's success to a certain extent.

I know that the music industry has been rapidly growing. This knowledge has become so universally known that the European Commission published a paper that calculated the economic impact of shifting from a CD to streaming service to answer whether streaming music stimulates or depresses the music industry (Aguiar). They used streaming data from the company Spotify. After accounting for piracy displacement and other possible factors, including permanent downloads, the European Commission concluded that Spotify helps stimulate the music industry better as it improves marketability and reduces the costs to market.

Lastly, I know that entertainment services like Tik Tok has transformed the music and fashion industries to be more open than ever to music and fashion discovery. An article posted by NBC News describes how songs like "Obsessed" by Mariah Carey are resurfacing again 10 years later because Tik Tok has popularized the songs. She includes statistics and personal quotes to show the virality and infectiveness of Tik Tok on the Music Industry (Rosenblatt). Celebrities like Rhianna have even built mansions to foster rising Tik Tok creators and artists.

But despite all of my research, I have remained unable to answer the question of, "why can I sing the tunes of songs I have never listened to?" So, I thought to myself, "my brain loves patterns; there must be some universal pattern that resides in all contemporary music that my brain has been decoding for years now." So, I hypothesized that music is the building of patterns using sound; these patterns give people the ability to decode and predict the tunes of songs despite never listening to the song before. Should I find any universal pattern among music, my studies will have the capacity to apply a scientific lens to the process of music composition. For centuries now, the science of music has been studied and well known; as a result, the progression of musical studies has remained slow; most work has remained unoriginal. However, if I can find a universal musical trend and can popularize my research, the science of musical composition would be utterly transformed.

# Materials

All materials, excluding the laptop, were electronic applications

- Laptop
- Music Streaming Service (recommended)
- Tuner
- Metronome
- Excel or Google Sheets (Excel Recommended)

# Methods 1

1. An Excel sheet been made and had been filled with information from Billboard: Hot 100. The information that had been recorded was the song's rank, the song's peak rank on the chart, the song's chart length on the Hot 100, and the songs rank change from what it had been the prior week. Any song that didn't stay on the top 25 charts was not included in the analysis
2. The Excel sheet was then become filled with information that had each song's tempo and key signature; this information was gathered from the site TuneBat
3. Each top song had become streamed and re-streamed on Apple Music in order for Max to have had all other information shown in Figure 1 recorded
4. Most of Max's time was spent on the 3 highlighted elements which had made up pieces to each song's **motif**. He has had each motif element recorded as so:
  - a. The motif was found while Max had been in the process of recording all other elements
  - b. The motif's notes were recorded first. The motif was broken up in 2-3 note increments. Max then played the song's motif and paused it increment

|              |                          |  |
|--------------|--------------------------|--|
| Title        | Blinding Lights          |  |
| Artist       | The Weekend              |  |
| Rank         | 1                        |  |
| Rank Chang.  | 1                        |  |
| Peak         | 1                        |  |
| Chart lengt  | 16                       |  |
| My interp.   | Reminiscing love         |  |
| Web interp   | Missing love & romance   |  |
| Tik Tok?     | No                       |  |
| Famous?      | Semi-Mega                |  |
|              |                          |  |
| Tone         | Major                    |  |
| Key Sig.     | Db                       |  |
| Pitch center | Tener->alto              |  |
| Play Style   | Groovy dark              |  |
| Tempo        | 171bpm                   |  |
| Time Sig.    | 4 4                      |  |
| Key words    | Wordless                 |  |
| Key Rhythm   | 2-1.5-.5-.5-1-.5-1       |  |
| Key Interval | Gb-Gb-Eb-Gb-Ab-Db-Eb     |  |
| Balance      | sop or bass              |  |
| Tagline      | Mysterious bass synth    |  |
| SubMelody    | Bass synth               |  |
|              | Soprano key synth        |  |
|              | Triads synth repeat      |  |
| Instruments  | Bass synth               |  |
|              | Tappy percussion(light)  |  |
|              | high alto voice          |  |
|              |                          |  |
|              |                          |  |
|              |                          |  |
|              |                          |  |
|              |                          |  |
|              |                          |  |
|              |                          |  |
|              |                          |  |
| Notes        | 4 variations of synth    |  |
|              | Lots of ins, but soloist |  |
|              |                          |  |

Fig. 1: An example of Method 1's final process: called a **block**

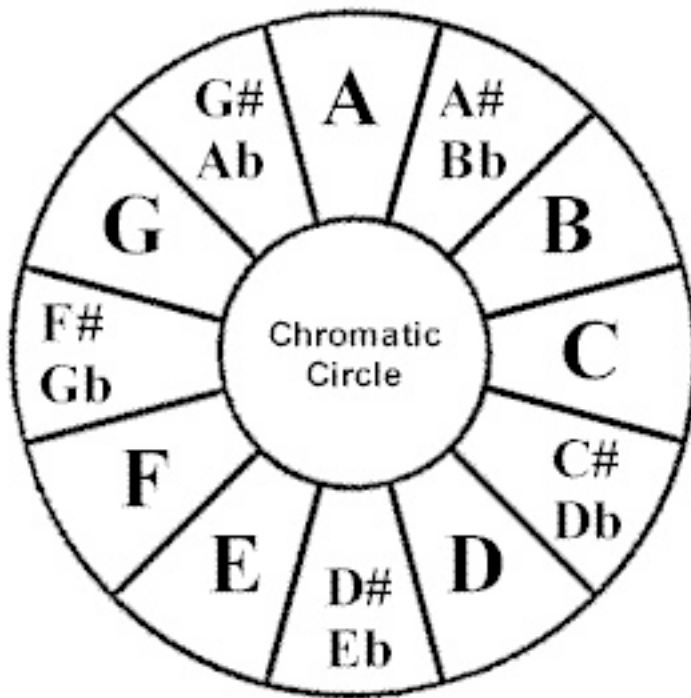


Image 1: Chromatic circle: visual for notes

by increment. Each increment was then sung to his tuner. The tuner's notes would then be recorded onto the spreadsheet. The notes were then double-checked with CTuner's chromatic circle. When one of the circle's tiles are tapped, the tuner plays the note's sound. It's generally used for instrument tuning and adjustments; however, it was repurposed to double check the note accuracy in this experiment. When the chromatic circle had repeated the increment properly, the process had become repeated until the motif had become completely recorded

- c. The motif words were recorded sequentially
- d. The motif's rhythm was completed last. The tempo recorded from TuneBat was imputed into CTuner's metronome and the rhythms had been counted, recorded, double-checked, and triple checked.

The process had been repeated for 6 weeks. By the end of the process, 140 **blocks** had been developed as shown in figure 2

Fig. 2: A collection 140 **blocks** like in Fig. 1 after 6 weeks of recording the top 25 songs from Billboard Hot 100



Once the 140 blocks had been finished, the table was reassessed in order to determine what information was most valuable, what could be built upon, and what information was structured enough to use. After the process had been finished, it had been quite clear that most of the information had not been structured enough to use and build upon. Since this was a statistics type study, the information needed to be quantitative or categorical. It had become quite evident that most of the recorded information wasn't structured enough and was eliminated. What had been left was recorded information on the tempo, the key signature, and the motif information.

Once valid information had been reassessed, the information was reorganized into its elements rather than each song's information; this had made the excel sheet much more coherent and cleaner to read. The reorganized chart is seen in figure 3.

| song name           | tempo stuff | scale counte                             | Motif notes                                 | Motif's intervals                      | Rhythm readings                  | Motif wording reminders                             |
|---------------------|-------------|--|---|--|----------------------------------|---|
| The box             | 117         | 1C                                       | D-B-C                                       | 0.5                                    | 2(1)                             | ee-ee   |
| Circles             | 142         | 3B                                       | F#-E-E-D-D-C#-D-B-A                         | .5-0-1-0-.5-0-.5-2-1                   | 2(.5)-1-.3(.5)-2(1)-3(.5)        | season change                                       |
| life is good        | 120         | 1Bb                                      | G-F-C-F-D                                   | 1-3-3-2                                | 8-8-7-1-8                        | working on the weekend like usual                   |
| rooxane             | 98          | 3Ab                                      | D-Bb-D-B-A-B-SE-D-B-3B-A                    | 3.5-3.5-1-1-2-2-5-1.5-1-0-0-1          | 1-3-1-.5-.5-1-2r-.5(10)          | rooxanne-rooxanne                                   |
| don't start now     | 124         | 1A                                       | F-F#-E-Eb-Eb                                | —                                      | 2r-1-1-2r-1-1-2r-1-1             | uow uow   |
|                     |             |  |   |  |                                  |   |
|                     |             |  |   |  |                                  |   |
| adore you           | 117         | 3Db                                      | D-B-A-D-E-G-Gb-3Bb-Bb-Ab-G                  | 4.5-1-3.5-1-1.5-.5-4.5-6-1             | 2(.5)-1-2(.5)-2(1)-4(.5)-1-.5    | if you don't want to see me                         |
| everything I wanted | 91          | 1E                                       | 2(Bb-2Eb-D-Eb-Db)                           | 2.5-0-1-1-1                            | 4(.5)-1-5-2.5r                   | just let me adore you                               |
| Ballin              | 110         | 1G                                       | Ab-Ab-F-E-Eb-E-Eb                           | 0-1.5-.5-.5-.5-0-.5                    | 6(.5)-1-1-2.5r                   | I got everything I wanted                           |
| BOP                 | 148         | 1F#                                      | 4(B)-A-2(G)-A-A-G-A-B                       | 3(0)-1-1-0-1-0-1-1-1                   | 7(.25)-1-.25-.5-.5-1             | chorus  |
| Dance Monkey        | 171         | 2Bb Minor                                | ...A-A-G-D-B                                | 0-1-3.5-1.5                            | 1-2(.25)-2(.5)                   | ... oning   |
| Memories            | 146         | 4B Minor                                 | 2(Bb-2Eb-Ab-Ab-F-Eb-Bb-Ab) (submelody)      | 3.5-0-.5-1-0-4-.5-2.5-.5-1             | 1-.5-.5-1-.5-.5-1-.5-.5-1        | Tik subm.   |
| 10,000 hours        | 120         | 3F# Minor                                | 2(G-E-F)-G-2r-2(F-C-D)-E                    | 2(0)-.5-3(0)-1-0-1.5-0-1.5             | 3(.5)-.25-.25-.25-.38-6          | dance for me  |
| Someone you Loved   | 90          | 1D Minor                                 | 8C#-8A-7B (piano solo with complex)         | 7(0)-2-7(0)-1-6(0)                     | 23(.5)                           | piano solo  |
| Intentions          | 170         | 1A Minor                                 | 2(Db-Bb-Ab-Bb-F-Eb-Db-Ab-Db-Eb-2F...)       | 2(1.5-.5-1-2r-2(2-1))-1                | 2(.5)-2(.25)-2r                  | Heres to the ones that we got                       |
| Blinding Lights     | 130         | 1E Minor                                 | x(2Db-F-Gb-F)                               | 0-4.5-2(1)-2.5-2(1)                    | 5(.5)-1-6(.5)-1...               | If it's 10,000 hours                                |
| After Hours         | 105         | G Minor                                  | 7(F#)-F-2E-3D-2E-D                          | x(0-2-.2(.5)-r)                        | 16(.5)                           | I was getting kinda used to being someone you loved |
| Heartless           | 97          | F Minor                                  | Ab-3(Ab-F)-Bb-C-Bb-2Ab-Bb-Ab-F-Eb           | 6(0)-.5-.5-0-1-2(0)-1-0-1              | 12(.5)-1                         | I guess I kinda like the way you numbed..           |
| Hot Girl Bummer     | 127         | 2A Minor                                 | Ab-3(Bb)-3(E)-Eb-Db-B                       | 0-6(1.5)-2.5-1-1-0-1-1-1-1.5-1         | 14(.5)-1-.5-xr                   | (tagline)   |
| The Bones           | 77          | 2A Minor                                 | A-4Db-2E-Gb-3Db-E                           | 2.5-2(0)-3-2(0)-.5-1-1                 | 1-.5-1-.5-1                      | these are my only intentions                        |
| Lose You To love me | 99          | 3Ab-B                                    | 2(C-Bb)-C-6r-2(3(C-Bb)-Bb-C-G)-Bb-C-F       | 2-3(0)-1.5-0-1-2.5-2(0)-1.5            | 7(.5)-1-2(.5)-1-.5-.5r           | stay in the kitchen cooking up, got your own bread  |
| My Oh My            | 103         | G-C-D-Eb-D-C-G                           | 0-1.5-1.5-3-3.5-1-0-2(3.5-1.5-1-1)-1        | 2-1.5-.5-.5-1-.5-2                     | 5(.5)-6r-2(4(.5)-2(1-.5)-1-r)    | tik tok meme  |
| Cuz I Lov You       | 162         | G-Ab-Bb-Ab-G-Eb-F-G-Eb                   | 5-1-1-.5-2-1-1-2                            | 3(.5)-1-5-1-1-.5-.5-1-r                | 3(.5)-1-5-1-1-.5-.5-1-r          | I'm runnin out of time                              |
| Woah                | 109         | Bb-Gb-Ab-Eb-                             | 2-1-2.5                                     | 5-.5-2-r                               | 5-.5-2-r                         | Cuz I'm Heartless                                   |
| Stupid Love         | 143         | 2(Db-Bb)-3Db-Bb-Eb-Bb                    | 4(1.5)-2(0)-1.5-2.5-2.5                     | 8(.5)-1-1-2r                           | Never need a * I'm what a * need |   |
| Say So              | 118         | B-Db-2Ab-Gb-2Bb                          | 1-2.5-0-1-2-0                               | 1.5-1.5-1-1.5-1.5-1-7-r                |                                  |   |
| Yummy               | 111         | 8(A-Gb)                                  | 16(1.5)                                     | 16(.5)                                 |                                  | this that hot girl anthem                           |
| That Way            | 130         | 2(2A-2B-C#)-F-C#-B-A-F-2A-B-Db-3A-B-Db-A | 0-3(1)2(1.5)2(1)2(2)0-2(1)2-2(2)2(1)2       | 2(.5-1.5)-.5-3-.5-3(1)-2(.5)-2(1)      |                                  | I'm through, I'm through                            |
| After Hours         | 105         | 2(G-#)-2(D-Gb)-2(A-D)-2(A-Db)            | 2(2)-                                       | 4(.16-.38)-r                           |                                  | (guitar tagline solo)                               |
|                     |             | Ab-Bb-Db-Eb-F-.5r-2Db-2Eb-Db             | 1-1.5-2(1)-.5r-2-2(0-1)                     | 2(.25)-.75-.25-.5-.5r-.25-2(.5)-2(.25) |                                  | When the bones are good                             |
|                     |             | 3Ab-B                                    | 3(0)-5.5                                    | .75r-.25-1-1-1                         |                                  | To love, love yeah                                  |
|                     |             | Gb-Ab-Gb-2B-3E-Db-.5r                    | 1-1-2.5-0                                   | r-3(.25)-1.25-1-2(.25)-1-.25-.5r       |                                  |   |
|                     |             | Ab-Ab-G-F-G                              | 0-.5-2(1)                                   | 1-1-.5-.5-.5                           |                                  | [...]My oh my                                       |
|                     |             | G-C-D-Eb-D-C-G                           | 2.5-1-.5-.5-1-2.5                           | 5(0.5)-1-.5                            |                                  | They say he likes a good time                       |
|                     |             | C-2F-Ab-B-A-(A-Ab-Gb-F)                  | 3.5-0-2(1.5)-1-(0-.5-1-5)                   | 2-3-r-1-1-3-4-3(4-1-1)-4               |                                  | I'm cryin cuz I love you (...)                      |
|                     |             | G-3r-3D-3C-2B-G                          | 2(0)-1-2(0)-.5-0-2                          | 1-3r-3(.16)-4(.5)                      |                                  | Woah, yeah; none of you                             |
|                     |             | Bb-Eb-F-Gb                               | 3.5-1-.5                                    | 4(2)                                   |                                  |   |
|                     |             | C-Bb-G-Bb-.5r-Bb-Db-C                    | 1-2(1.5)-.5r-0-1.5-.5                       | 4(.25)-.5r-3(.5)                       |                                  | Intro   |
|                     |             | 2Ab-Bb                                   | x(0-1)                                      | 2(.5)-1-2r                             |                                  | hey, yeah yeah                                      |
|                     |             | Ab-Bb-Db-2Ab-2Bb-D                       | 1-1.5-2.5-0-1-0-x                           | 8(.5)-1                                |                                  | All I ever wanted was love                          |
|                     |             | 3(B-A)-3A-C-2A-Fb-B-3(A-Gb)-3A-B-Gb      | 6(1)-2(2)2(1.5)0-1.5-2.5-1-6(1.5)2(0)-1-2.5 | 4(.5)-1-1-5(.5)-.75-.75                |                                  | Didn't even notice                                  |
|                     |             | A-2C-D-A-2G-F-A-2G-F-C-2G-F              | 1.5-0-1-2.5-1-0-1-2-1-0-1-3.5-2.5-0-1       | 4(.5)-6(1.5-.5)                        |                                  | yeah you got that yummy                             |
|                     |             | Bb-C-D-C-Bb-D-Eb-2(C-Bb)                 | 1-1-1-1-r-2-.5                              | 2(1.5)-1-2(1.5)-r                      |                                  | I want it that way                                  |
|                     |             | 6D-C-Bb                                  | 5(0)-1-1-r                                  | 6(.66)-2-1-r                           |                                  | (everything)  |
|                     |             | Eb-2F-Eb-F-Bb-2G-2F-2Eb                  | 0-2(2)-0-1.5-0-3.5r-0-2.5-1.5-2-1.5-1       | 5-[.5-1.5-.5-1.5-.5-1-3.5r]-[]         |                                  | Cuz my heart...                                     |
|                     |             | 2Eb-G-2Eb-2C-3.5r-C-F-D-Bb-G-F           | 1-0-2(1)-2.5-0-1-2(0)-1-0                   | 6(.5-.25)-2r                           |                                  |   |
|                     |             | Eb-2F-Eb-F-Bb-2G-3F-2Eb                  |   |  |                                  |   |

Fig. 3: A filtered and reorganized spreadsheet of fig. 2's information

The tempo information was translated into a histogram, as shown in chart 1. The Key Signature information was translated into a bar chart labeled as chart 2. The notes information of each song was then used to find the intervals between each note using the chromatic circle as shown in image 1. Moving from each key was worth .5 of a step. So, moving from A to Bb was considered a half-step interval; moving from A to B was considered 1 full step. Lastly, the interval and rhythm data were charted into line graphs like in chart 3 and 4. All data has been displayed in the Results section of the paper below.

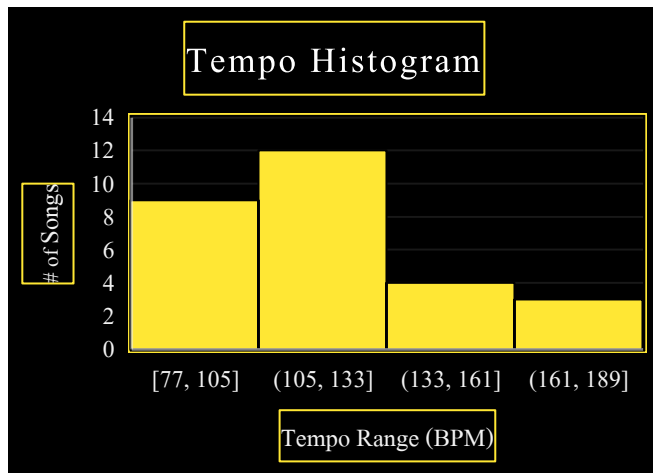


Chart 1: A tempo histogram displaying tempo frequency

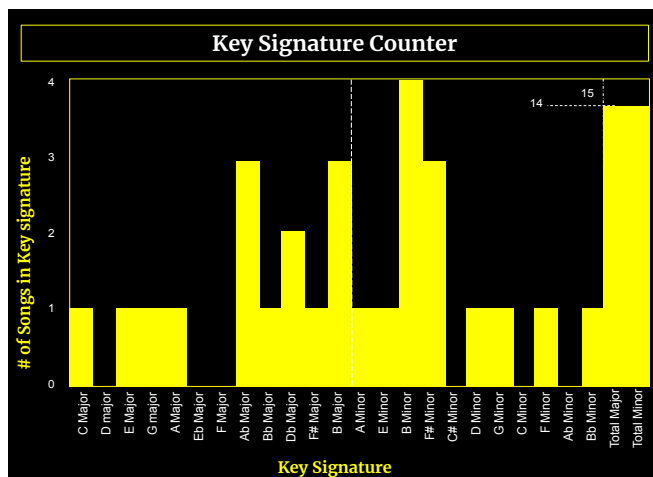


Chart 2: A Key Signature bar chart showing frequency of key signature among observed songs

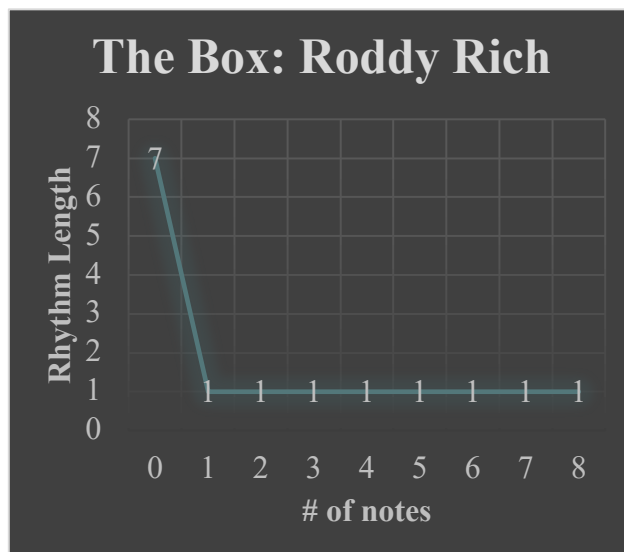


Chart 3: A rhythm chart example of # ranked song “The Box”

## Results 1

After charting the tempo frequencies, as shown in chart 1, it was clear that songs were generally slower or at moderate speeds as only a third of the songs had quick tempos exceeding 133 BPM (beats per minute).

When the key signatures of different song were charted, as shown if chart 2, it was observed that that the 4 most popular key signatures were A♭ Major, B Major, B minor, and F♯ minor; all of these keys had at least 3-4 songs that used the mentioned key signature. The amount of major songs matched the number of minor key songs.

The motif data was graphed as shown in Chart 3 and 4. The x axis described the number of notes or intervals present in the motif. The y-axis described the length of the rhythm or the magnitude of the interval. The motif words were used to help remember the motif.

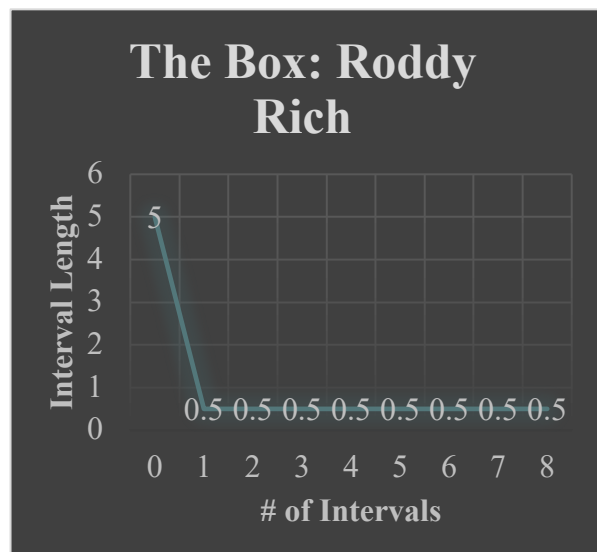


Chart 4: An interval chart showing the quantitative magnitude of “The Box’s” primary motif



## Methods 2

Originally, the charts had been blank and colorless. As the charts were observed more, various patterns were added to a separate page, as shown in image 3. These patterns on image 3 were then color coded and each pattern was drawn on the motif charts like in image 2.

Once all patterns were accounted for, the charts were remade on Excel like shown in figures 4.

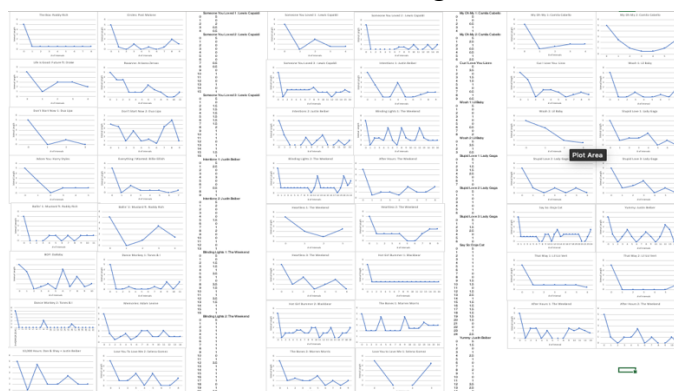


Figure 4: An image displaying all interval charts



Image 2: The rough draft form of charts 3 and 4

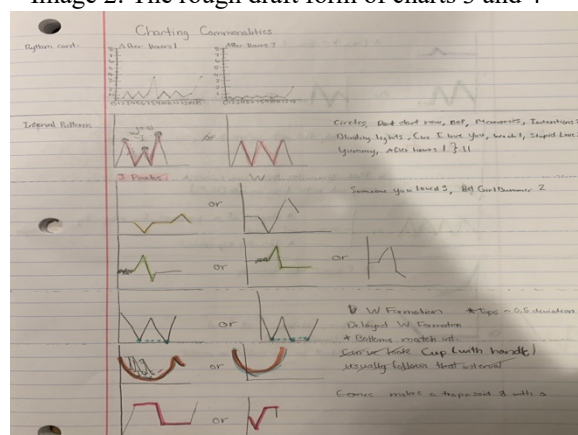


Image 3: A table of patterns found among my motif data

## Results 2

After everything, 6 interval patterns were found; 3 rhythm patterns were found; and 3 universal patterns were found alongside the tempo histogram and key signature bar chart, all of which is described below in figures 5 and 6.

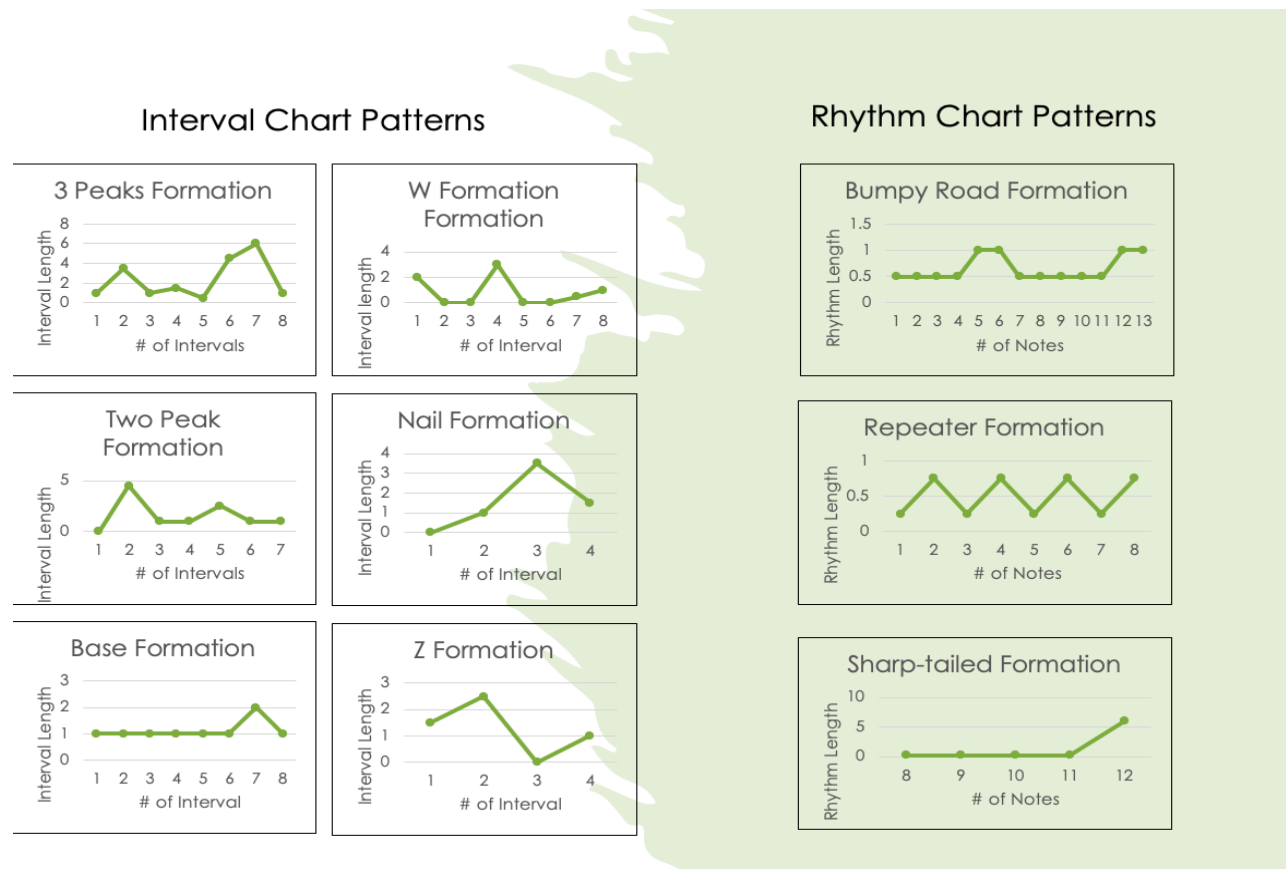
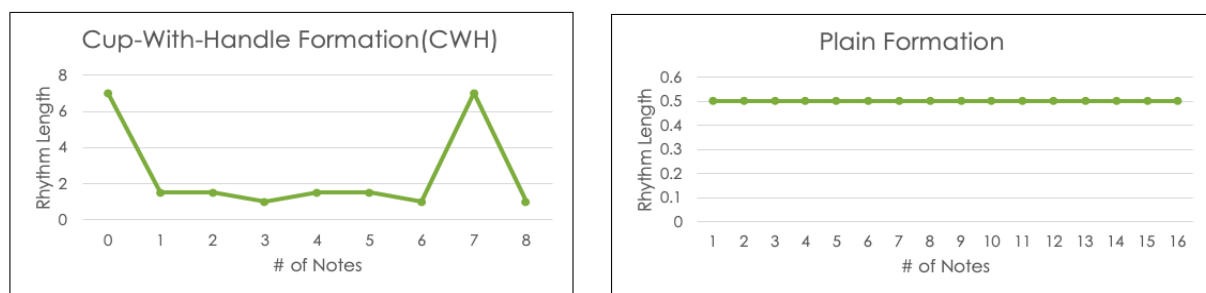


Figure 5: A summary of patterns found when charting motifs



☐ Follows semblance of shape above

☐ Consecutive flats are over 50% of graph

☐ Must have a 3 in a row flat point

Figure 6: The two universal patterns found in 94.5% of all analyzed motifs

The next sections will describe the qualities of each pattern type

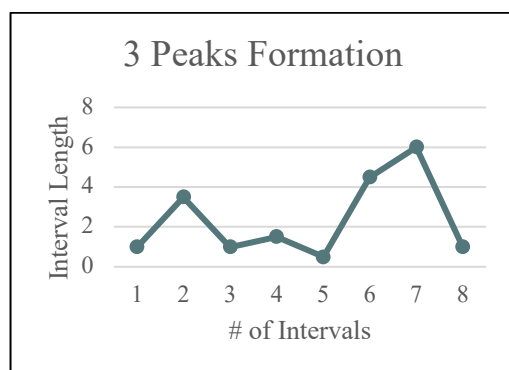


Chart 5: One of 6 minor interval patterns

- ☐ 3 mounds
- ☐ Middle mound usually shortest
- ☐ Last mound usually largest
- ☐ Mounds can all be equal

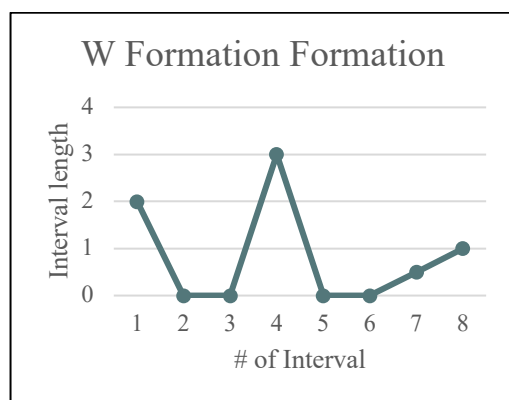


Chart 6: One of 6 minor interval patterns

- ☐ Looks like a W
- ☐ Bottoms of W should be horizontally planar
- ☐ Generally, connects to other patterns

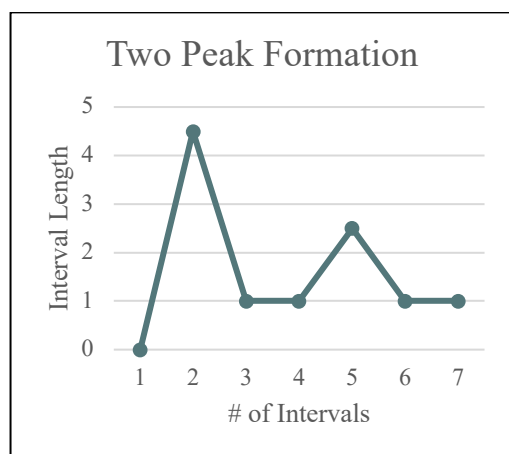


Chart 7: One of 6 minor interval patterns

- ☐ Two peaks
- ☐ One peak is shorter than the other
- ☐ 1 peak's bases should be horizontally planar

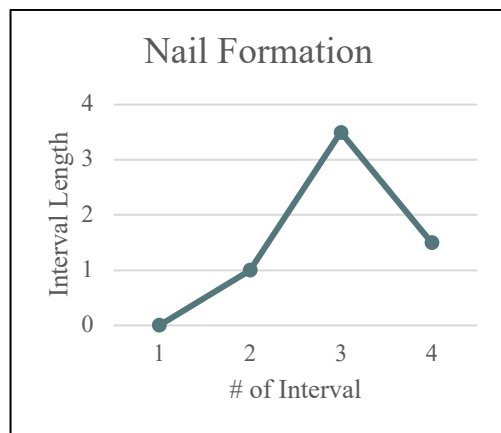


Chart 8: One of 6 minor interval patterns

- ☐ Short
- ☐ Flat slope at base
- ☐ High peak
- ☐ Looks like nail pointing up

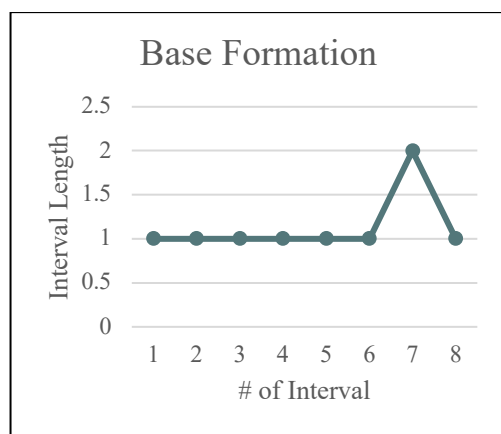


Chart 9: One of 6 minor interval patterns

- ☐ Nearly all planar
- ☐ Possible slope near end
- ☐ Longer motif

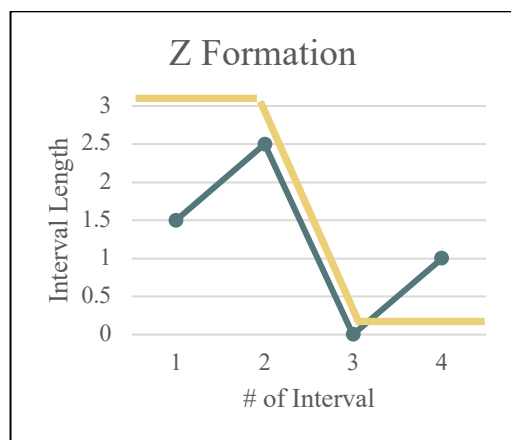


Chart 10: One of 6 minor interval patterns

- ☐ Makes a Z shape
- ☐ Can look like either line

The next 3 charts are common rhythm patterns among motifs

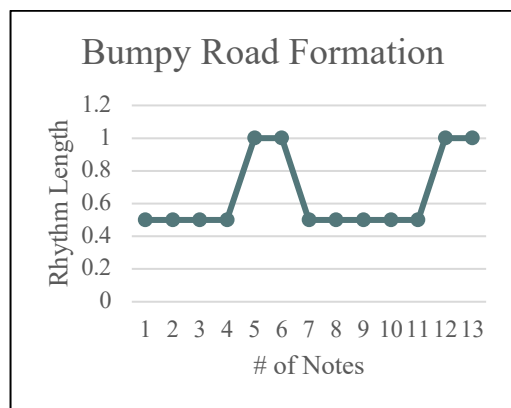


Chart 11: One of 3 minor rhythm patterns

- ☐ Generally flat
- ☐ Intermittent changes in rhythm, but mainly same rhythm though whole way

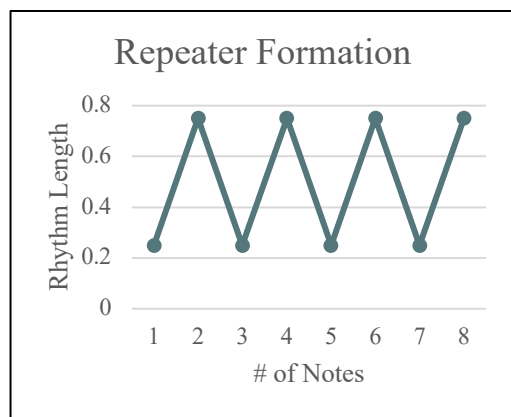


Chart 12: One of 3 minor rhythm patterns

- ☐ Small rhythm that's repeated for motif's duration
- ☐ The common earworm uses this motif pattern

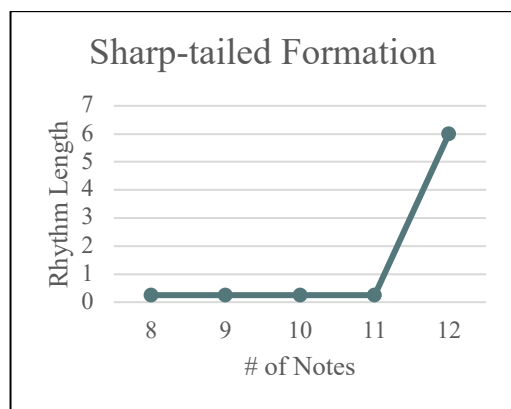


Chart 13: One of 3 minor rhythm patterns

- ☐ Short
- ☐ Relatively flat
- ☐ Suddenly shoot up at end
  - ☐ Only considered sharp if end is 2x bigger than base

The last 3 charts are universal patterns that are applicable to motif charts

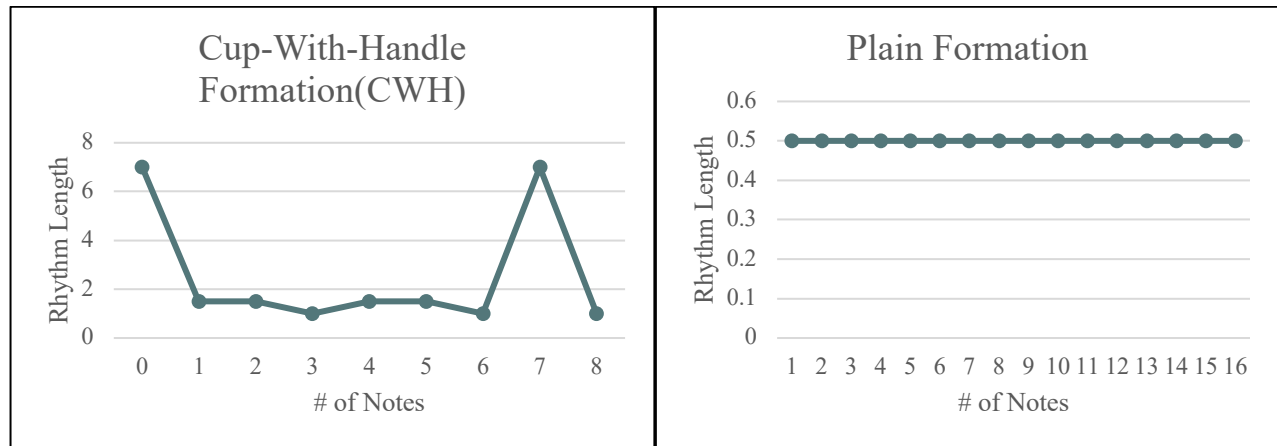


Chart 14: Most common universal pattern among motifs

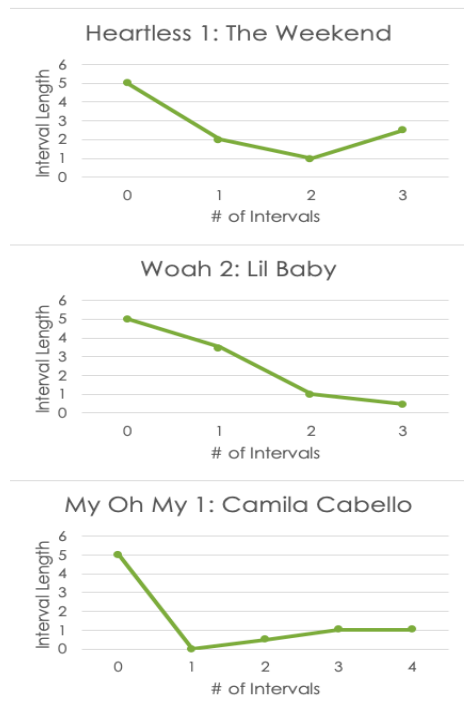
- ☐ Resembles the shape of a cup
- ☐ Found in 70% of all charts
- ☐ Most common pattern found in nearly all musical patterns

Chart 14: The 2<sup>nd</sup> most common universal pattern among motifs

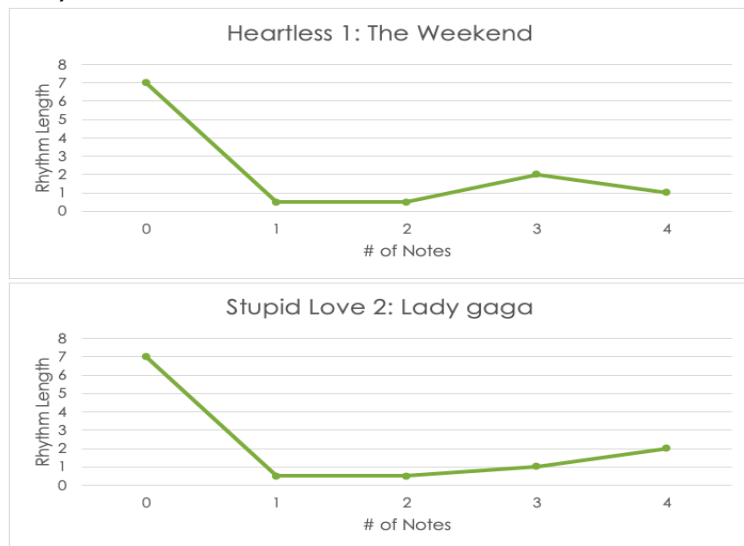
- ☐ Majority of graph is flat
- ☐ Must have a 3 in a row flat point
- ☐ Found in 20% of all charts
- ☐ Primarily present among rhythms

There were 5 leftover charts that did not portray one of the 2 universal patterns. All of the leftover charts are shown in figure 7. These charts developed a final pattern universal pattern. 4/5 of the motifs had 4 notes for the motif. This final pattern accounted for all remaining charts.

### Interval Chart Patterns



### Rhythm Chart Patterns



- ☐ All of the charts are very short
- ☐ No leftover outliers

Figure 7: Leftovers charts that didn't portray a universal pattern



# Conclusion

At the beginning of this project, I hypothesized that music is the building of patterns using sound and that these patterns give people the ability to decode and predict the tunes of songs despite never listening to the song before; I was right. I found 3 universal patterns that applied to all 90 of my charts; these three patterns are the Cup-With-Handle formation, the Plain formation, and the Leftovers formation. The Cup with Handle formation was found present in 70% of all of my charts. The Plain formation was found present in 24.5% of all my charts while the Leftovers formation applied to all leftover charts. The 2 primary patterns explain my ultimate question of why I have been able to sing the tunes of songs I've never heard before.

There were two primary possibilities for experimental error. Those two possibilities would happen in my process to record the notes and rhythms of each motif. There were multiple times an entire motif was redone because it was recorded incorrectly. These inaccuracies completely make sense because the motifs were determined by human experiment in which I swung to a tuner and counted based off a metronome. It is very simple to sing the wrong note and to count a wrong rhythm. A strong estimate would guess that the possible error is 5% on the low side and 10% on the high side. While these errors do occur, these inaccuracies are unlikely to impact the overall structure of each chart. The percent error is accounting for any deviation. However, most errors will be close enough from the actual value that it doesn't affect the image of the chart.

This work is very valuable in that music has never been studied this way yet. By finding the direct patterns in music composition, the stage has been set for future works to be replicated. By growing this form of musical analysis, scientists will be able to identify common patterns and use those patterns to study deeper into what about music heal the human body. There are all kinds of works showing that music and only the sounds of music will grow and heal the brain. These patterns can be used to find what about music is so different from everyday noises and what makes music so popular from the other sounds around the environment.

This study has a variety of outlets for growth potential. On the field of science, the study should be expanded to the direct composition of different soundscapes. As of now, this study focuses on a very specific section to music. There must be patterns in the layering and building of different sounds. The study can be narrowed down further to identify what about music varies so differently from everyday environmental sounds. Lastly, this work can be applied to engineer a song that incorporates this new tidbit of knowledge.

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# Enlarged Visuals

| song name           | tempo stuff | scale counte | Motif notes                             | Motif's intervals                          | Rhythm readings                       | Motif wording reminders                             |
|---------------------|-------------|--------------|---|--|---------------------------------------|---|
| The box             | 117         | 1C           | Db-C                                    | 0.5  | 2(1)                                  | ee-eer  |
| Circles             | 142         | 3B           | F#-E-E-D-D-CH-CH-D-B-A                  | .5-0-1-0-.5-0-.5-2-1                       | 2(.5)-1-.3(.5)-2(1)-3(.5)             | season change                                       |
| life is good        | 120         | 1Bb          | G-F-C-F-D                               | 1-3-3-2                                    | 8-8-7-1-8                             | working on the weekend like usual                   |
| roxxane             | 98          | 3Ab          | Db-Gb-Db-B-A-B-5E-Db-3B-A               | 3.5-3.5-1-1-1-2.5-1.5-1-0-0-1              | 1-3-1-.5-.5-1-2r-.5(10)               | roxxanne-roxxanne                                   |
| don't start now     | 124         | 1A           | F-F-r-r-Eb-Eb                           | ---  | 2r-1-1-2r-1-1-2r-1-1                  | uow uow   |
|                     |             |              |   |  |                                       |   |
|                     |             |              | D-B-A-D-E-G-Gb-3Bb-Bb-Ab-G              | 4.5-1-3.5-1-1.5-.5-4.5-6-1                 | 2(.5)-1-2(.5)-2(1)-4(.5)-1-5          | if you don't want to see me                         |
| adore you           | 117         | 3Db          | 2(Bb-2Eb-Db-Eb-Db)                      | 2.5-0-1-1-1                                | 4(.5)-1-.5-2.5r                       | just let me adore you                               |
| everything I wanted | 91          | 1E           | Ab-Ab-F-E-Eb-E-Eb                       | 0-1.5-.5-.5-.5-0-.5                        | 6(.5)-1-1-2.5r                        | I got everything I wanted                           |
| Ballin              | 110         | 1G           | 4(B)-A-2(G)-A-A-G-A-B                   | 3(0)-1-1-0-1-0-1-1-1                       | 7(.25)-1-.25-.5-.5-1                  | chorus  |
|                     |             |              | ...A-A-G-D-B                            | 0-1-3.5-1.5                                | 1-2(.25)-2(.5)                        | ... onning  |
| BOP                 | 148         | 1F#          | Eb-B-Bb-Ab-Ab-E-Eb-Bb-Ab (submelody)    | 3.5-0-.5-1-0-4-.5-2.5-.5-1                 | 1-.5-.5-1-.5-.5-1-.5-.5-1             | Tik subm.   |
| Dance Monkey        | 171         | 2Bb Minor    | A(3x)-Ab(4x)-F#(2)-A(2)-F#              | 2(0)-.5-3(0)-1-0-1.5-0-1.5                 | 3x(.5-.25-.25)-.25-.38-6              | dance for me  |
|                     |             |              | 8CH-8A-7B (piano solo with complex)     | 7(0)-2-7(0)-1-6(0)                         | 23(.5)                                | piano solo  |
| Memories            | 146         | 4B Minor     | 2(G-E-F)-G-2r-2(E-C-D)-E                | 2(1.5-.5-1)-2r-2(2-2(1))-1                 | 2(.5-2(.25)-2r                        | Heres to the ones that we got                       |
| 10,000 hours        | 120         | 3F#Minor     | 2Db-Bb-Ab-Bb-F-Eb-Db-Ab-Db-Eb-2F...     | 0-4.5-2(1)-2.5-2(1)                        | 5(.5)-1-6(.5)-1...                    | If it's 10,000 hours                                |
| Someone you Loved   | 90          | 1D Minor     | x(2Db-F-Gb-F)                           | x(0-2-.2(.5)-r)                            | 16(.5)                                | I was getting kinda used to being someone you loved |
|                     |             |              | 7(F#)-F-2E-3D-2E-D                      | 6(0)-.5-.5-0-1-2(0)-1-0-1                  | 12(.5)-1                              | I guess I kinda like the way you numbed..           |
|                     |             |              | Ab-3(Ab-F)-Bb-C-Bb-2Ab-Bb-Ab-F-Eb       | 0-6(1.5)-2.5-1-1-1-0-1-1-1.5-1             | 14(.5)-1-.5-xr                        | (tagline)   |
| Intentions          | 170         | 1A Minor     | Eb-3(Bb)-3(E)-Eb-Db-B                   | 2.5-2(0)-3-2(0)-.5-1-1                     | 1-.5-1-.5-1                           | these are my only intentions                        |
|                     |             |              | A-4Db-2E-Gb-3Db-E                       | 2-3(0)-1.5-0-1-2.5-2(0)-1.5                | 7(.5)-1-2(.5)-1-.5-.5r                | stay in the kitchen cooking up, got your own bread  |
| Blinking Lights     | 130         | 1E Minor     | 2(2Gb-Eb-Gb-Ab-Db-Eb)-Eb-2(Bb-G-F-Eb)-F | 0-1.5-1.5-1-3.5-1-0-2(3.5-1.5-1-1)-1       | 2-1.5-.5-.5-1-.5-2                    | tik tok meme  |
|                     |             |              | 2(C-Bb)-C-6r-2(3(C-Bb)-Bb-C-G)-Bb-C-F   | 4(1)-6r-2(5(1)-0-1-3.5)-1.5-2.5            | 5(.5)-6r-2(4(.5)-2(1.5)-1-r)          | I'm runnin out of time                              |
| After Hours         | 105         | G Minor      | G-Ab-Bb-Ab-G-Eb-F-G-Eb                  | .5-1-1-.5-2-1-1-2                          | 3(.5)-1-.5-1-1.5-.5-1-r               |   |
| Heartless           | 97          | F Minor      | Bb-Gb-Ab-Eb-                            | 2-1-2.5                                    | .5-.5-2-r                             | Cuz I'm Heartless                                   |
|                     |             |              | 2(Db-Bb)-3Db-Bb-Eb-Bb                   | 4(1.5)-2(0)-1.5-2.5-2.5                    | 8(.5)-1-1-2r                          | Never need a * I'm what a * need                    |
|                     |             |              | B-Db-2Ab-Gb-2Bb                         | 1-2.5-0-1-2-0                              | 1.5-1.5-1-1.5-1.5-1-7-r               |   |
| Hot Girl Bummer     | 127         |              | 8(A-Gb)                                 | 16(1.5)                                    | 16(.5)                                | this that hot girl anthem                           |
|                     |             |              | 2(2A-2(Bb)E Eb-B-A-F-2A-B-Db-3A-B-Db-A) | 0-3(1)2(1.5)2(1)2(2)0-2(1)2-2(0)2(1)2      | 2(.5-1.5)-.5-3-5-3(1)-2(.5)-2(1)      | I'm through, I'm through                            |
| The Bones           | 77          |              | 2(G-B)2(D-Gb)2(A-D)2(A-Db)              | 2(2)-                                      | 4(.16-.38)-r                          | (guitar tagline solo)                               |
|                     |             |              | Ab-Bb-Db-Eb-F-.5r-2Db-2Eb-Db            | 1-1.5-2(1)-.5r-2-2(0-1)                    | 2(.25)-.75-.25-.5-.5r-25-2(.5)-2(.25) | When the bones are good                             |
| Lose You To love me | 99          |              | 3Ab-B                                   | 3(0)-5.5                                   | .75r-.25-1-1-1                        | To love, love yeah                                  |
|                     |             |              | Gb-Ab-Gb-2B-3E-Db-.5r                   | 1-1-2.5-0                                  | r-3(.25)-1.25-1-2(.25)-1-.25-.5r      |   |
| My Oh My            | 103         |              | Ab-Ab-G-F-G                             | 0-.5-2(1)                                  | 1-1-.5-.5-.5                          | (...)-My oh my                                      |
|                     |             |              | G-C-D-Eb-D-C-G                          | 2.5-1-.5-.5-1-2.5                          | 5(0.5)-1-.5                           | They say he likes a good time                       |
| Cuz I Lov You       | 162         |              | C-2F-Ab-B-A-(A-Ab-Gb-F)                 | 3.5-0-2(1.5)-1-(0-.5-1-.5)                 | 2-3-r-1-1-3-4-3(4-1-1)-4              | I'm cryin cuz I love you (...)                      |
| Woah                | 109         |              | G-3r-3D-3C-2B-G                         | 2(0)-1-2(0)-.5-0-2                         | 1-3r-3(.16)-4(.5)                     | Woah, yeah; none of you                             |
|                     |             |              | Bb-Eb-F-Gb                              | 3.5-1-.5                                   | 4(2)                                  |   |
| Stupid Love         | 143         |              | C-Bb-G-Bb-.5r-Bb-Db-C                   | 1-2(1.5)-.5r-0-1.5-.5                      | 4(.25)-.5r-3(.5)                      | Intro   |
|                     |             |              | 2Ab-Bb                                  | x(0-1)                                     | 2(.5)-1-2r                            | hey, yeah yeah                                      |
|                     |             |              | Ab-Bb-Db-2Ab-2Bb-D                      | 1-1.5-2.5-0-1-0-x                          | 8(.5)-1                               | All I ever wanted was love                          |
| Say So              | 118         |              | 3(B-A)-3A-C-2A-Fb-B-3(A-Gb)-3A-B-Gb     | 6(1)2(0)2(1.5)0-1.5-2.5-1-6(1.5)2(0)-1-2.5 | 4(.5)-1-1-5(.5)-.75-.75               | Didn't even notice                                  |
| Yummy               | 111         |              | A-2C-D-A-2G-F-A-2G-F-C-2G-F             | 1.5-0-1-2.5-1-0-1-2-1-0-1-3.5-2.5-0-1      | 4(.5)-6(1.5-.5)                       | yeah you got that yummy                             |
| That Way            | 130         |              | Bb-C-D-C-Bb-D-Eb-2(C-Bb)                | 1-1-1-1-r-2-.5-                            | 2(1.5)-1-2(1.5)-r                     | I want it that way                                  |
|                     |             |              | 6D-C-Bb                                 | 5(0)-1-1-r                                 | 6(.66)-2-1-r                          | (everything)  |
| After Hours         | 105         |              | Eb-2F-Eb-F-Bb-2G-2F-2Eb                 |  |                                       |   |
|                     |             |              | 2Eb-G-2Eb-2C-3.5r-C-F-D-Bb-G-F          | 0-2(2)-0-1.5-0-3.5r-0-2.5-1.5-2-1.5-1      | .5-1.5-1.5-1.5-1.5-1-3.5r-1-1         | Cuz my heart...                                     |
|                     |             |              | Eb-2F-Eb-F-Bb-2G-3F-2Eb                 | 1-0-2(1)-2.5-0-1-2(0)-1-0                  | 6(.5-.25)-2r                          |   |

Figure 3

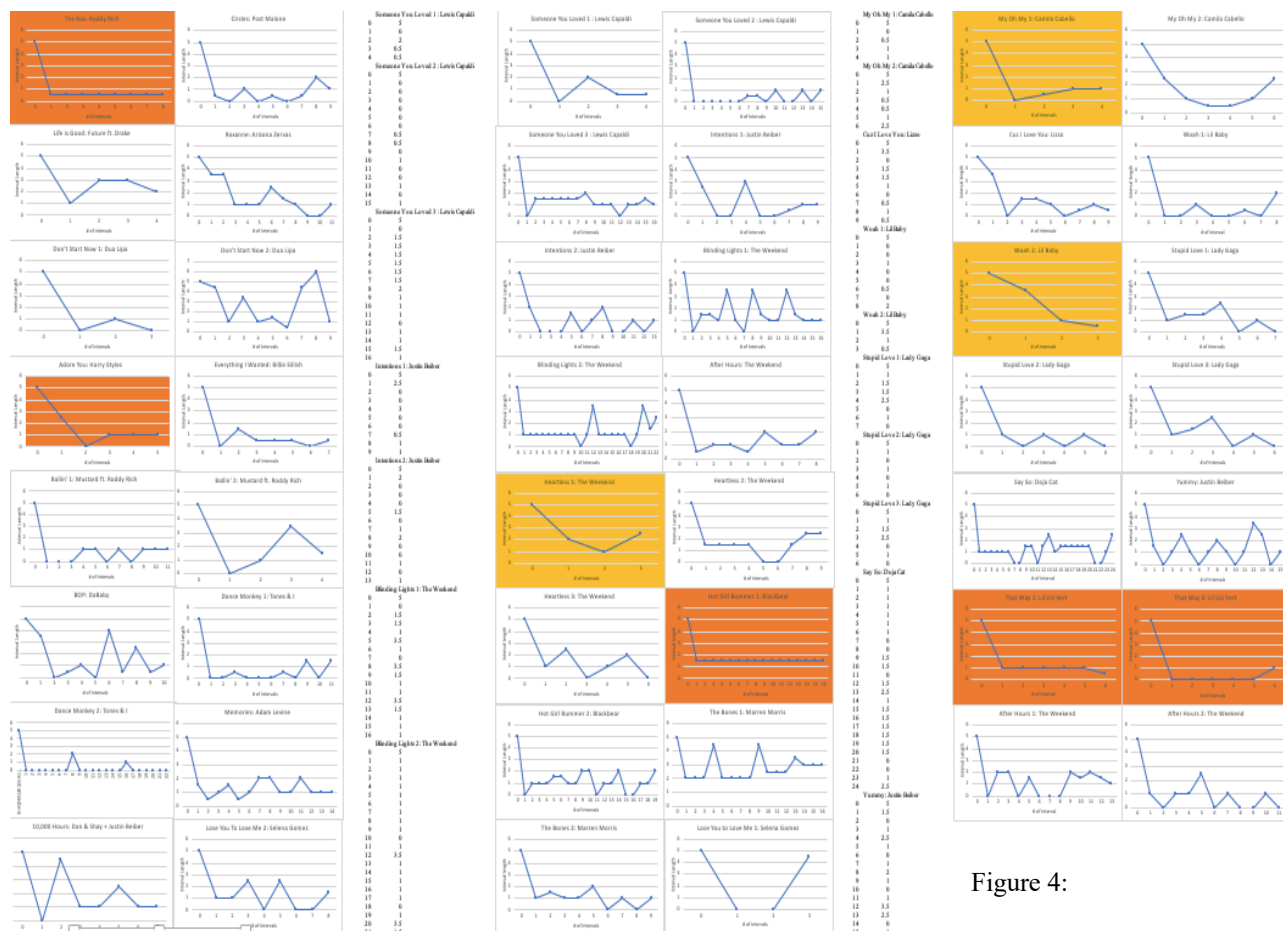
[illegible]



Figure x: Not shown in paper, but is the second half to the motif charts. All of the rhythm charts