Can Your Song Make it to Next Year's Billboard Hot 100 Charts?

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Abstract: Whatever key a song is written in is less indicative of its success on the Billboard Hot 100 chart. However, there seems to be an increase in popularity of songs being written in minor keys. Overall, other traits like danceability and energy and better predictors.

Background

The music industry is ever evolving and ever growing. Last year alone, the industry grew by 10 percent in revenues (Vibe), amounting to an estimate of 278 million music streaming subscribers worldwide (Statista). With an industry with a size this large, it is important to study how the music landscape has changed over time not just to try to hedge the next big hit, but also to guide musicians on how they can create songs that appeal to the general population.

Hypothesis

A song key is a great predictor of how popular a song will be on the charts. Certain keys like the key of C and G are just inherently easier to play on instruments like the piano and guitar. Fun songs that are easier to accompany with a guitar or piano will be played more often, increasing the likelihood that more people will hear — and like — the song in the first place.

Method

Data
The Billboard Hot 100 list is a very accurate indicator of what the most popular songs were of any given year. An R package called 'billboard' contains information on the Hot 100 list from 1960 to 2016. This package contains many data on each song, including its ranking, the year it was in the chart, song artist, song lyrics, and more. A separate R package, 'chorrrds,' lets users input songs to get its song key.

Variable Creation
To quantify how music preferences changed overtime, we need to determine the different characteristics that songs can get rated on. The 'billboard' package includes track data like a song's song key or if it was written in major or minor. Other track characteristics include, acousticness, danceability, duration, energy, explicitness, instrumentalness, liveness, loudness, speechiness, tempo, and valence. These variables will allow us to analyze characteristics outside of the song key.

Analytic Methods
To analyze the trends, for each of the characteristics listed above, I averaged the ratings of all 100 songs within each year's list. Then, using a line graph, I illustrated these changes over time, with year on the x axis and the song ratings on the y axis.. A trend line with a 95% confidence interval band is also included in the graph to show the goodness of the fit — a narrow band indicates a more trustworthy trend line than a broader band.

When analyzing the song key, I modified the keys to include both its key (e.g., C) and its mode or scale (e.g., major). Similar to the process above, grouped to analysis to be within the same year and the same Hot 100 list. However, unlike the above, song key information is non-numeric, so it can't be averaged. Instead, I counted the number of songs that were written within each year and calculated what proportion of the list that count is. Calculating the

proportion as opposed to just using the count is crucial in data accuracy because, unfortunately, not all songs in the ‘billboard’ data was in the ‘chorrrds’ database.

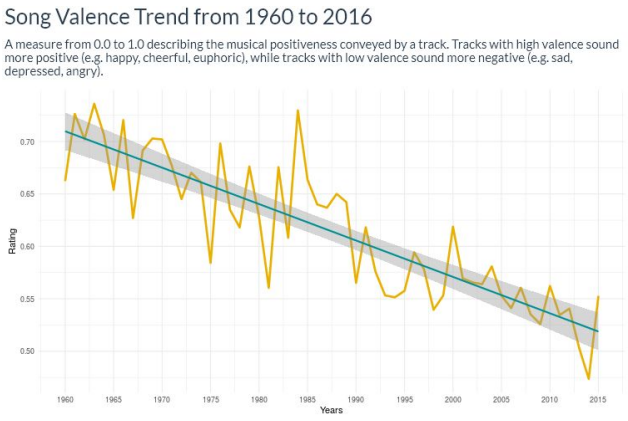
I illustrated these findings in two ways. The first one is to do an overall count of the total number of songs written in each key without looking at changes overtime and display it as a bar chart.. This is just to show whether certain keys are more popular than others. However, to show the changes in preferences over time, I created separate bar charts for each key with the year on the x axis and proportion on the y axis.

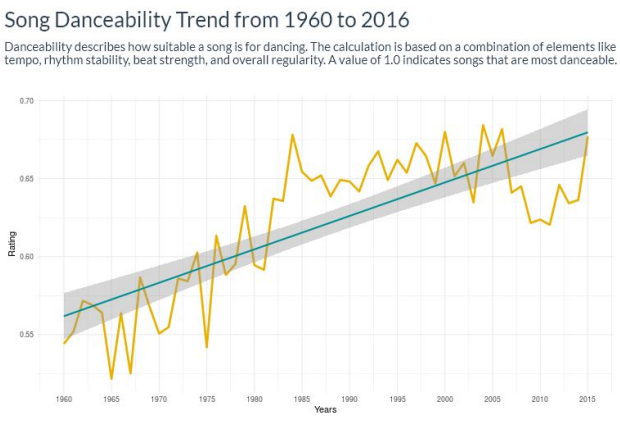
In addition to calculating the proportion of song keys within each year, I also looked into just the mode — are there any changes in the popularity of songs written in major or minor key? Similarly to the process above, instead of doing a simple count, I also calculated the proportion of major and minor songs within each year. To create a more effective illustration, instead of showing the results in separate graphs, I created a stacked bar chart color coded by mode type, year on the x axis, and proportion/percentage on the y axis.

Results and Discussion

Overall Trends
Over time, songs tended to be less acoustic, filled with instrumentals, have the feeling of a live recording, or have low valence scores. On the other hand, more and more songs in the yearly Billboard Hot 100 charts tended to increase in danceability, energy, explicitness, loudness, speechiness, and were longer in duration. Overall, the average tempo per year has remained about the same.

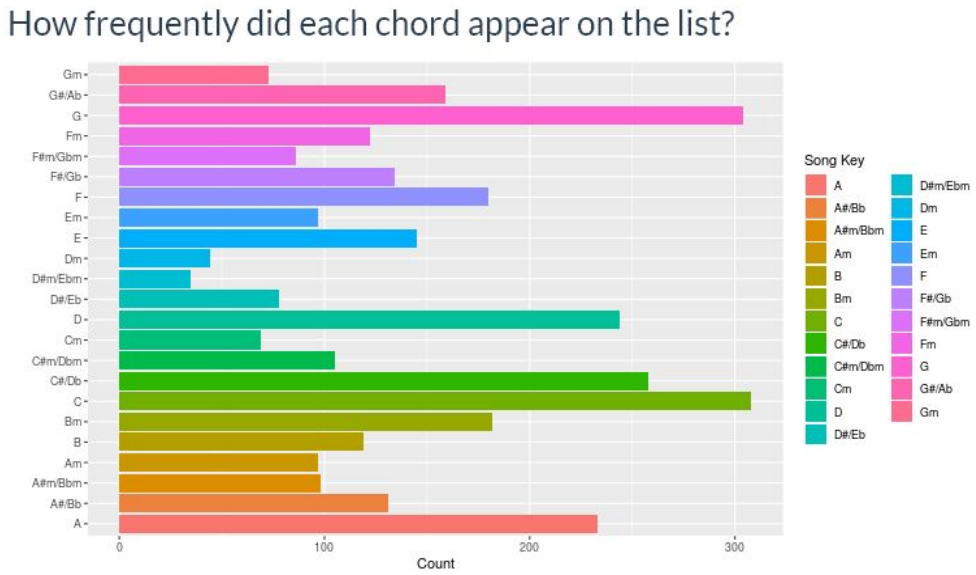
Danceability and Energy — which reasonably go hand in hand — increased over time. In addition, the average loudness of the songs within each year also increased, which also aligns with those characteristics. Interestingly, the average valence ratings within each year decreased. This means that, although songs are increasingly becoming much more danceable, they are also being perceived as having musical negativeness (e.g., sadness and anger).



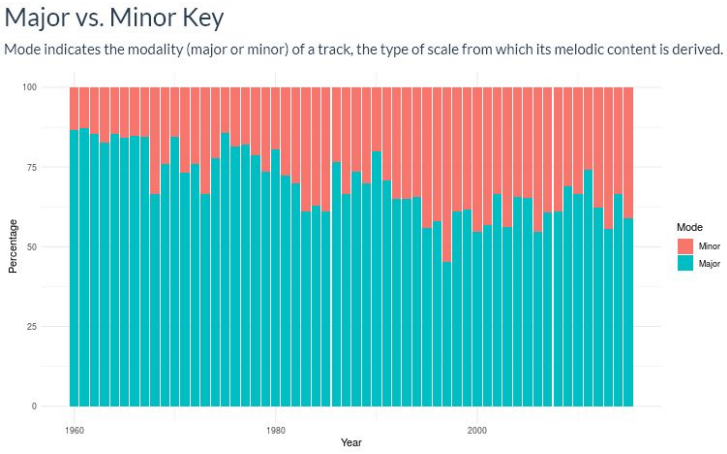


For graphs of other characteristics, see https://mariahdim.shinyapps.io/top_100_track_data/

Song Key



The song keys C and G are the most popular song keys over all as I predicted, and this may be due to the ease of playing those song keys in the guitar and piano. However, upon closer inspection, it seemed like those keys are not as popular in recent years. In the couple of years preceding 2016, the song key of C major made up at most 2% of the list when on average, it makes up more than 5% of the list with at most 12%.



Interestingly, the mode that a song key is written in seems like there might be some preference changes overtime. In 1969, less than 15% of the songs on the chart were written in the minor key. In 2015, this number has increased to almost 40%. Minor keys are associated with songs that tend to sound melancholy (Musical University). This chart indicates that, overtime, more and more songs in the Hot 100 list are being written in minor keys. This trend is more significant than within each specific song key.

Conclusions

As a whole, it seemed like individual song keys have no major trends that are pointing to any music preference changes, but whether it was in major or minor scale is a much better indication of its possible popularity. The increase in popularity maybe indicative that more prefer to listen to sad music. Interestingly, danceability, energy, less acousticness, and loudness are also associated with increase in song popularity. Maybe the solution is to create danceable, melancholy songs.

Citations

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