



Moved to the core

COM-480 Data Visualization

Process Book

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Yiwei Liu
Ewan Golfier
Tianhao Dai

Motivation

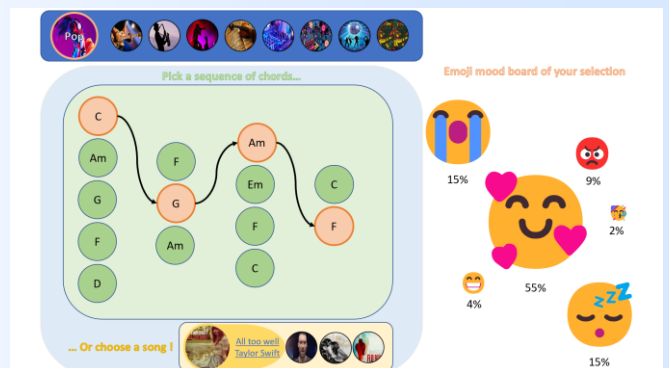
The objective of this website is to serve as an educational tool for exploring the relationships between music, culture and mood. Regardless of their musical background, we want any user to easily learn how mood is affected by music and how cultures differ in their approach to writing it.

People intuitively understand that music is closely linked to culture and the expression of emotions. However, it is difficult for most to pinpoint what makes us instantly recognize the mood or origin of a song, especially without knowing any music theory. Since this is a complex subject, our goal is to encourage people to explore these connections for themselves by interacting with our tools, rather than reading long explanations.

Inspiration

While exploring our song dataset, we noticed that it included chord and emotion information, which made us wonder if it was possible to predict a song's mood from its chord progression.

Initially, we envisioned the website as an exploration of this idea, assuming that different chord progressions would evoke different moods. Users would choose a genre of music, create their own chord progression and then discover the resulting emotions in the form of an emoji mood board.



However, after taking EPFL's Digital Musicology course and learning more about music theory, we realized there were two problems with this approach. First, a song's emotions are more dependent on BPM and gain than its chord progressions. Second, chord progressions are more related to the culture than to genre or mood.

While it would still be possible to create a website based on this concept, the conclusions the users would draw would be misguided, as we now know there are more effective predictors of a song's intended emotional expression than chord progressions.

Therefore, we decided to design our website as an educational piece about the effects of culture on chord choices and the relationship between BPM, gain and the mood of a song. We believe this design also provides a better user experience, as they can learn something new, rather than aimlessly pressing buttons without fully understanding what is happening.

Dataset

We chose to work with the Wasabi Song Corpus, a collection of around 2 million commercially released songs prior to the 2020s. The dataset contains expected metadata and analytical information such as song title, artist name, album and lyrics. Additionally, automatically extracted features are provided, such as emotion labels, genre distribution, language and chord progressions.

We filtered the dataset to only keep songs between 10 seconds and 10 minutes, which have an emotion label, a genre label and a high chord extraction confidence. We then group songs by culture using their genre label, and keep only the cultures with more than 30 songs. This process leaves us with approximately 21'000 songs and 14 culture groups.

Color scheme



Our primary color is a light shade of blue. Since the website is for educational purposes, we chose a color that represents trust and clarity. It is light enough to provide good contrast with black and darker shades of blue, yet it remains easily distinguishable from our secondary colors.

We chose white and shades of gray as our secondary colors to keep the design easy on the eyes so users can focus on the tools and information available to them. These neutral colors are used for backgrounds to keep the website free of distractions and to give it a professional look.

Website design

To make the website design as intuitive and user-friendly as possible, we chose to design it as a single, scrollable page. The page is divided into three main sections, where the second section is emphasized by being enclosed in a separate background, as that is where our interactions and most of our information are located.

The first section, at the top of the page, contains our title and a brief description of the website, as well as an invitation to scroll down and explore.

The second section has two parts that are accessible by pressing the corresponding menu button at the top of the section. The first part allows users to select a culture and view the most popular chords, as well as their most popular next chord. The second part lets users choose a mood and view histograms for BPM and gain, as well as key distribution graphs for songs in that mood.

The third section contains our contact information. It indicates to the user that they have reached the bottom of the website and that there is no more information to be found by scrolling further.

Culture selection

Our initial genre-based prototype featured bubbles of various sizes, reflecting the amount of songs. However, since the number of songs is not important for our analysis, we decided that this method of selection would be irrelevant and would bias users toward certain choices.



We briefly considered using a map given the geographical nature of cultures. However, our song dataset isn't complete enough to justify using it.

Ultimately, we created a simple, clean selector composed of two columns of seven buttons. Each culture is represented by a flag so you can easily see which culture you are selecting.

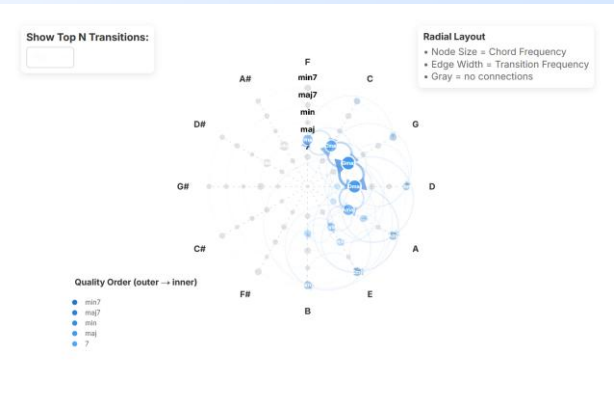
When a button is hovered over, it rises slightly and becomes shaded to provide the user with smooth feedback. Additionally, when a button is pressed, it is highlighted in blue to indicate the selection.

We believe this is the most user-friendly design possible for our culture groups as this selector is accessible and easy to understand.

Chord transitions

We represent chords on the circle of fifths, which is a common arrangement when working with chord progressions. Each chord is placed at an angle according to its key and ordered from in to out as follows: 7, major, minor, major 7th, and minor 7th.

This method allows all chords to be represented in a structured manner, enabling users to easily find chords while maintaining musical significance.



Each bubble represents a chord, and its size indicates how frequently it appears in songs from the selected culture. We also chose to indicate possible next chords with arrows, which are highlighted when a chord is hovered over. The width of the edge is proportional to the frequency with which this chord appears after the initial chord. To keep the graph readable and avoid clutter, users can choose to only show the top N chord transitions.

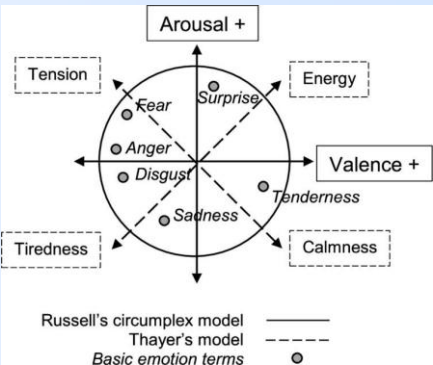
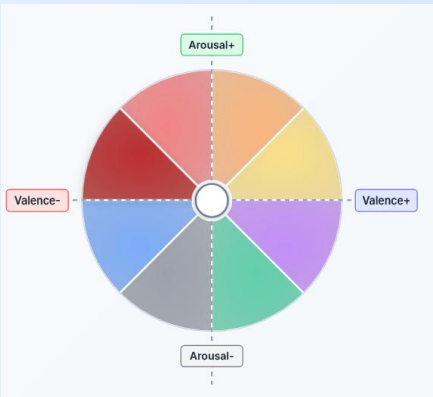
Mood selection

Since our song dataset contains emotion labels, we selected mood groups based on them. They were derived from a BERT-based model using lyrics information.

Users select a mood group by clicking on a slice of the valence-arousal chart. Each slice is a different color to distinguish the different mood groups. When a slice is selected, it becomes slightly darker to indicate selection. It also darkens when hovered over to show the user that it is clickable.

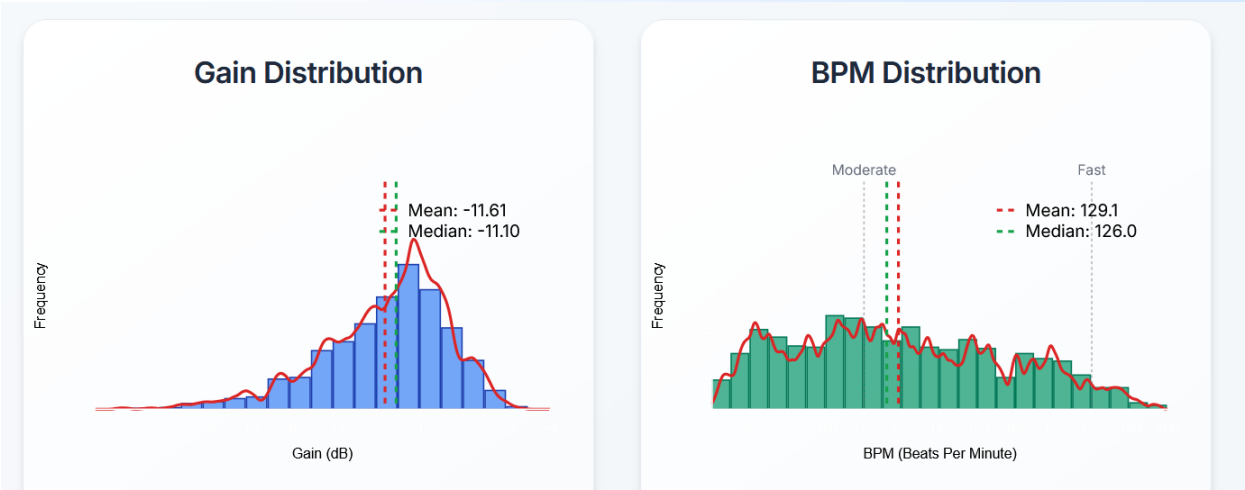
This chart is based on Russell’s circumplex model and Thayer’s model of emotions, which categorize emotions using two factors: arousal and valence.

Using the histograms, the idea is to then show that valence is related to gain and arousal to BPM. This will demonstrate, for example, that sad songs have low BPM and gain, the same way sadness is composed of low arousal and valence.



Gain and BPM histograms

We provide gain and BPM histograms for each selected mood. These histograms help users understand how these qualitative properties change when the intended emotion changes. For instance, you can observe the average BPM decrease when the mood shifts from energetic to depressed, or the average gain increase when the mood shifts from dreamy to angry.

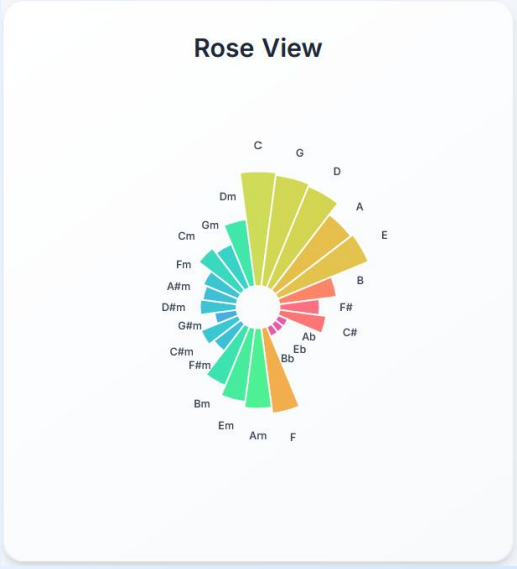


Key distribution

We also provide two ways of showing the key distribution for each mood, which allows users to immediately understand which keys are used most frequently for a particular mood. Each key is assigned a color that remains consistent across both graphs: warm colors for major scales and cool colors for minor scales. We chose to show both graphs because they serve different purposes.



In the hexagon view, the most frequent keys are represented by the largest hexagons. This emphasizes the most prevalent keys and helps users instantly identify the most frequently used chords by looking at the largest areas.



In the rose view, the frequency of keys is represented by proportional slices. While it is less obvious which scales are the most common, it is a lot better at emphasizing differences in key frequency.

Mood state

To help users better understand the graphs, we added text that varies depending on the mood state. They help direct the users to look for the information in the graphs, which improves engagement.

Current Mood State

Energetic / Joyful

Suggested Music Features:

- Up-beat rhythms
- Major keys
- Fast tempo 120-140 BPM
- Rich harmonies

After analyzing the data, we identified the most striking features from each mood category and came up with these short explanatory sentences.

Challenges

Once we realized that our assumptions about chords and mood were unfounded, we struggled to come up with a better idea for the website using our dataset. It took us some time to develop the current concept, which we believe provides a more engaging exploration of songs.

The most challenging task was choosing a good layout for the chord transition graph. Initially, we chose a random layout of bubbles to represent all the chords, but it was messy, and some nodes eclipsed others. We then looked for ways to categorize chords and decided to use the same structure as the circle of fifths because it already has musical significance. This organization of the data cleared up the graph and made it easier for users to find the chords.

Peer assessment

Our main responsibilities were divided as follows :

Yiwei Liu – 33%

Base skeleton for the website

Interactable elements

Ewan Golfier – 33%

Website design

Process book design and writing

Tianhao Dai – 33%

Data processing

Data analysis

However, we all contributed to every part of the website, and we met regularly to ensure that we were all on the same page throughout the semester.