PsychoMusic

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Abstract:

PsychoMusic is about analyzing and visualizing how music affects human emotions and behavior. There are some times where you get excited and happy when you hear a song or feel nostalgic or remember some things and get sad. These sudden changes in human emotions are associated with the attributes of music. The frequency, loudness, tones, pace, genre and instruments used in a song contribute in generating certain emotions in the listener. In this paper, various trends in music and human emotions are to be unraveled and observed by producing various visualizations.

Introduction:

Music is described as multidimensional and researchers have categorized it by its arousal properties (relaxing/calming vs. stimulating), emotional quality (happy, sad, peaceful), and structural features (as, e.g., tempo, tonality, pitch range, timbre, rhythmic structure). Efforts have been taken to recognize and describe it concretely.
Humans perceive musical sound as a complex phenomenon, which is known to induce an emotional response. There has been plenty of completed research and ongoing ones about how different music frequencies affect human emotions and the different chemicals or neurotoxins induced by listening to particular music. There are also many experiments depicting how various frequencies are correlated with different human emotions. These are some of the questions that researchers are trying to understand, and there is substantial belief that answering these questions could potentially explain the origin of a few diseases such as Alzheimer's disease and Schizophrenia.
Hence, a preliminary step towards investigating cues for human emotion on a fundamental level is by aiming to establish relationships between tonal frequencies of sound and emotions.

As mentioned earlier, there has been plenty of research and existing visualizations regarding this subject of matter. One research aimed to investigate frequency dependent cues for human emotions. Experimentation was conducted on random people from different age groups, with their moods recorded prior to this observation. Listed below is a plot from that paper:

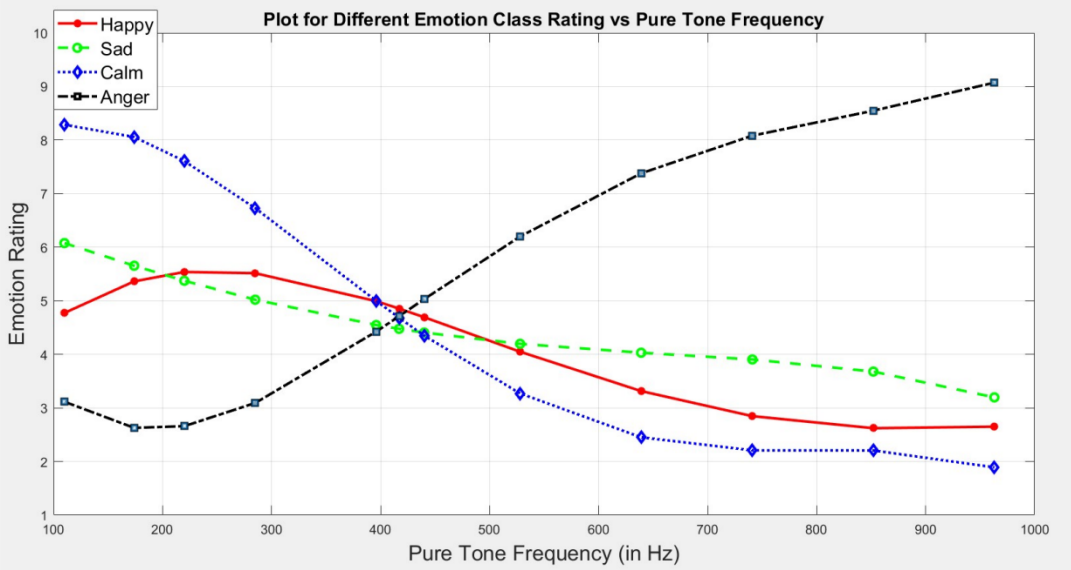


Figure 1. Plot for different emotion class rating vs Pure tone frequency. Here, the line graph for all four primary emotions—Happy, Sad, Anger, and Calm are plotted w.r.t pure tone frequency (in Hz).

This plot depicts how different frequencies are rated on average by people, and although we can depict some key findings from this line graph like the crossover points for all four primary emotions lies in the frequency range of 417–440 Hz. This clearly depicts that the frequency range 417–440 Hz is neutral. But there is no mention about taking into account the latent variables and confounding variables such as age, mood of the person prior to this experiment, genre of music etc. which were recorded by the researchers. And this makes us believe that the plot is misleading in some way - we do not know if this emotion rating represents average values of a proper population with equal importance to each category of Age and Genre of music.
Because there is no mention about how the data was sampled, whether they assumed equal distributions of different age groups or if they took into account the placebo effects by recording the mood prior to listening to the song, we can not conclude the information extracted from this plot.

The same researchers have tried to convince us by summarizing average emotion ratings for every emotion while listening to different frequencies, by using box-plots:

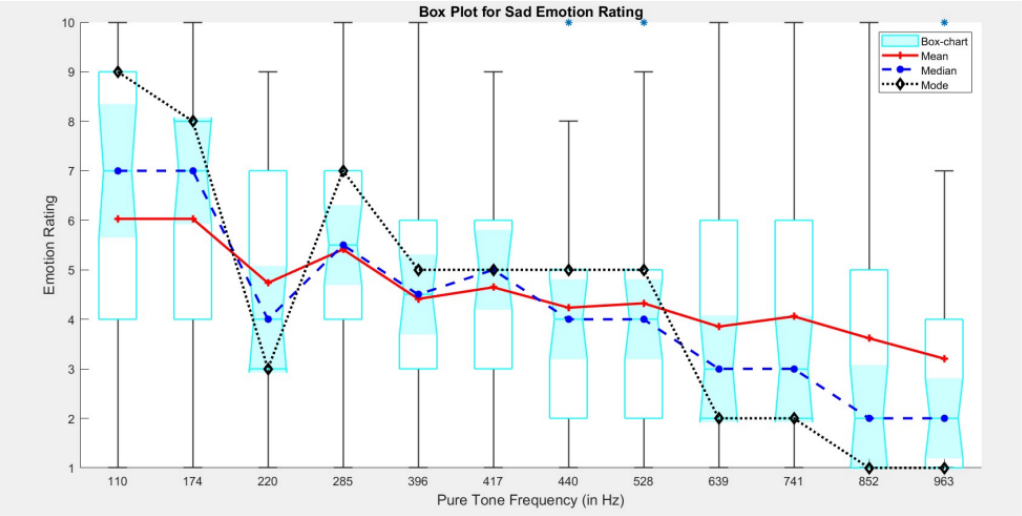


Figure 3. Plot for Sad emotion rating v/s Pure tone frequency. Here, the shaded area (cyan in color) of box chart represents distribution for annotated emotion corresponding to each pure tone frequency.

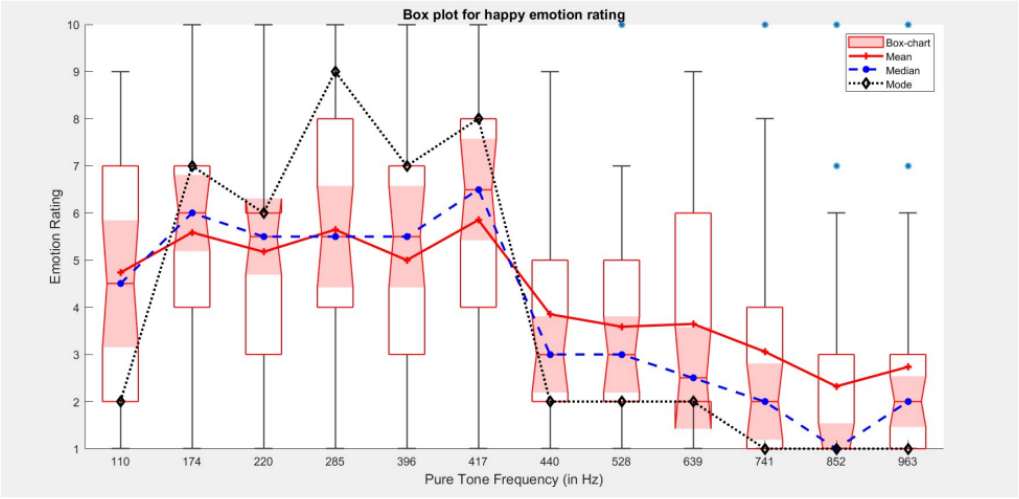
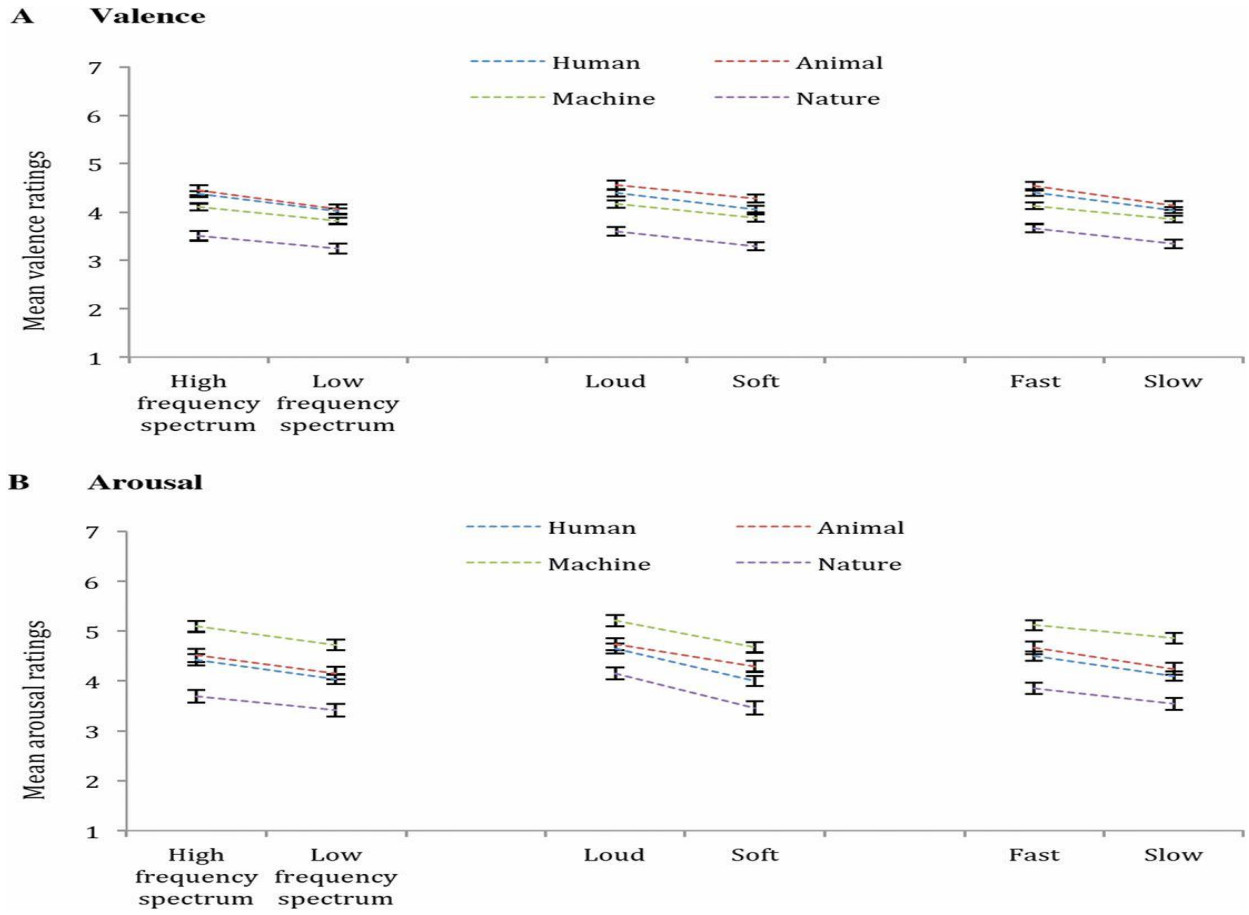


Figure 2. Plot for Happy emotion rating *v/s* Pure tone frequency. Here, the shaded area (red in color) of box chart represents distribution for annotated emotion corresponding to each pure tone frequency.

Similar to the previous critique, we can mention that the authors have not considered how this ratings by people vary for other characteristics like age of the rater, mood before he rated the song, if he likes or dislikes the song etc. These are some things that we plan to improve and visually present for rich information gathering.
A better way would be to use histograms or bar charts to differentiate average emotion ratings over different age groups over varying frequencies. We also plan to have an interactive plot (Altair based) to allow people to interact and change different attributes

of x and y axis, to compare multiple subplots at the same time. This would make the visual more transparent and detect direct patterns.
One more important point to notice in these box-plots are that there are shaded regions - we are not sure what those shaded regions represent or if they are supposed to depict some significant attribute. But having those shaded regions surely does not improve our understanding of the data and it only makes it more complicated.

Similarly, another research tracks human emotional responses to changes in the acoustic environment. And one of their plots is this:



The two features Arousal and Valence are compared against high-low frequency, load-soft sounds and the slow or fast beat-pace, even though it's intuitive to use these features, their poor choice of visualization plot has completely diminished our interest about this topic. With all the unnecessary overlaps and occlusions, it's very hard to get any information from this plot. Using continuous lines is better and helps people perceive the information much easily. Moreover, our choice of dataset is different from what these researchers have used, and we believe our dataset has the potential to

uncover many different relationships and trends about human emotions and various acoustic attributes.

Objectives:

The project as a whole aims at creating a visualization that encompasses the differences in frequencies in correlation with the genre of the music. In particular, since a particular genre can often be associated with a certain type of emotion, the frequency difference can then be attributed to a change in emotion. It must provide a clear and defining picture as to how a particular tone or beat and subsequent variations in the same can result in mild to drastic alterations regarding how they affect a person emotionally. Moreover, separate graphs are also expected to be plotted that denote the association between the age of the listener and how the particular genre is perceived by them. A pattern is expected to be formed based on a specific range of frequencies and how they correlate to similar age groups. Furthermore, a factor of liking is also incorporated so as to display the correspondence between how a certain age group experiences unique genres in unique ways. The initial plan is to create an interactive visual plot that has toggle options enabled to switch between different age groups, genres and liking factors. An additional avenue planned to be explored is involving the mood of the listener before indulging in the experiment.

Datasets and methods:

- 9 emotional categories in the dataset, they are binary values.(Amazement, Solemnity, Tenderness, Nostalgia, Calmness, Power, Joyful activation, Tension, Sadness)
- There are 4 types of Genre(pop,classical,..)
- It also contains the age,gender, mother tongue and mood of the person listening to the song.
- There are columns for dislike and like of the song which are binary.
- The columns in the dataset are
    - Id of the music file
    - Genre of the music file
    - 9 annotations by the participant (whether emotion was strongly felt for this song or not). 1 means emotion was felt.
    - Participant's mood prior to playing the game.
    - Liking (1 if participant decided to report he liked the song).
    - Disliking (1 if participant decided to report he disliked the song).

    - Age, gender and mother tongue of the participant (self-reported).
- Mention different datatypes.
- There is another dataset which consists of 400 songs audio files, which can be used to get other attributes of the song like intensity, frequency, etc.
- Use histograms for mood(1-sad, 5– good)
- Used radar char for each mood to find the attributes of the songs.
- Scatter plot, beeswarm, color mesh(correlations), line graphs, bar graphs,
- The aim of the project is to produce visualizations between human emotions and songs, this data set contains information about the human emotions and song. It has observations of songs annotated by 48 people, and by 16 people in the other.
- This experiment is reasonably sufficient to produce visualizations.
- We also have audio files from which we get the other attributes of the songs.