TEAM OPUS

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Topic: Relation between user personality and musical preference

Paper of Choice: Qiu, L., Chen, J., Ramsay, J., Lu, J., Personality Predicts Words in Favorite Songs, Journal of Research in Personality (2018), doi: https://doi.org/10.1016/j.jrp.2018.11.004

The selected study studies the associations between participant personality traits and the linguistic styles of their favorite songs. The study was able to observe a stronger association for participants who held a preference towards lyrics over melody for songs in general.

Introduction

A person's musical taste is reflective of "the overall patterning of their preferences for music over "longer" periods of time", according to the American Psychological Association. Personality traits reflect an individual's characteristic pattern of thoughts, feelings, and behaviours.

We aim to replicate the above study in the Indian setting amongst an average college population. The project employs standard questionnaires for obtaining information about the individuals' music taste, preference for various musical features, and personality traits. Lyrics Inquiry and Word Count (LIWC) is used to analyse the lyrical aspect of the user-input songs and correlate them with the data obtained from the other tests.

The following sections outline the Research Method, Observations, Interpretations, and Individual Contribution. Some of the correlations that we obtained were consistent with the original paper while in other cases, entirely new correlations were discovered. The reason for the same will be discussed in one of the later sections.

Research Method

Data Collection

The required data was:

- Songs that the person likes, and those that the person dislikes
- Preference for Acoustic and Psychological features in music
- Preference between lyrics and melody in music
- Big Five Inventory (BFI) personality traits

For the above requirements, a form, which collected the relevant data, was released to the college demographic. Following were the contents of the form:

- 5 liked songs, 5 disliked songs
- 14 questions pertaining to preference for acoustic features
- 7 questions pertaining to preference for psychological features
- Preference between lyrics and melody
- 20-question version of the Big Five Inventory (BFI) for calculating the personality traits scores

The 14-, 7-, and 20-question sets–and preference between lyrics and melody–consisted entirely of questions to be answered on a 5-point Likert scale. Following is the exhaustive list of questions included:

Preference for Acoustic Features:

1. Loud
2. Heavy Bass
3. Brass
4. Woodwind
5. Dense
6. Fast
7. Percussive
8. Raspy voice
9. Piano
10. Distorted
11. Yelling voice
12. Instrumental
13. Synthesizer
14. Electric

Preference for Psychological Features:

1. Aggressive music
2. Complex music
3. Inspiring music
4. Intelligent music

5. Relaxing music
6. Romantic music
7. Sad music

Preference for Lyrics or Melody in Music: The individual was asked to rate their general reason for liking a song, between lyrics or melody, on a 5-point Likert scale where 1 leans towards preference for melody and 5 leans towards preference for lyrics.

The Big Five Inventory (BFI)

1. I am the life of the party
2. I feel little concern for others
3. I leave my belongings around
4. I am relaxed most of the time
5. I have a rich vocabulary
6. I keep in the background
7. I sympathize with others' feelings
8. I get chores done right away
9. I often worry about things
10. I have difficulty understanding abstract ideas
11. I talk to a lot of different people at parties
12. I am not interested in other people's problems
13. I often forget to put things back into their proper place
14. I seldom feel blue
15. I am full of new ideas
16. I am quiet around strangers
17. I take time out for others
18. I follow a schedule
19. I have frequent mood swings
20. I do not have a good imagination

These questions help gauge a person's levels of the personality traits: Openness, Agreeableness, Neuroticism, Extraversion, Conscientiousness.

Data Formatting

The liked and disliked songs were stored in separate tables, with a lookup table of all the songs in the dataset. Each entry in the lookup table had a song and the lyrical features extracted from LIWC associated with said song.

As LIWC is currently inaccessible to us due to its restricted availability behind a paywall, we had to rely on the demo version provided by the developers to obtain scores for the lyrics. However, manually entering the lyrics and copying the resulting scores was a cumbersome and time-consuming task. In order to streamline the process, we developed a scraper using Selenium that automates the extraction of scores. By inputting the song name and lyrics, this scraper generates a comprehensive data frame that records the song names and their corresponding LIWC scores obtained from the demo website. The code for this scraper is provided in the scrape.ipynb file, which is included in the code files attached with this report.

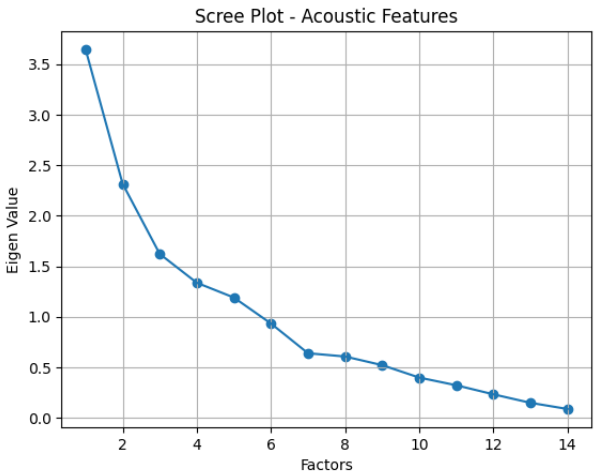
Factor Analysis

As a part of replicating the study[2] in question, we performed a factor analysis on the acoustic and psychological preference features obtained from our questionnaire data, which comprised responses on a 1-5 likert scale.

Factor analysis was conducted using PCA with 'varimax' rotation inline with the original study. Varimax rotation here is a technique used to simplify the interpretation of the principal components by producing more distinct and interpretable factors. It involves rotating the principal axes of the components so that each component has high loadings on a smaller number of variables and low loadings on the remaining variables. The intention here is to get multiple acoustic and psychological features to be mainly explained by a single factor which would represent those features best - allowing us to both group together certain preferences and use them to analyze further with reduced dimensions.

For each set of features, a scree plot was created and analyzed to determine the appropriate number of factors(Fig.1). Based on the scree plots, we selected the following number of factors:

- n=6 for acoustic features
- n=3 for psychological features



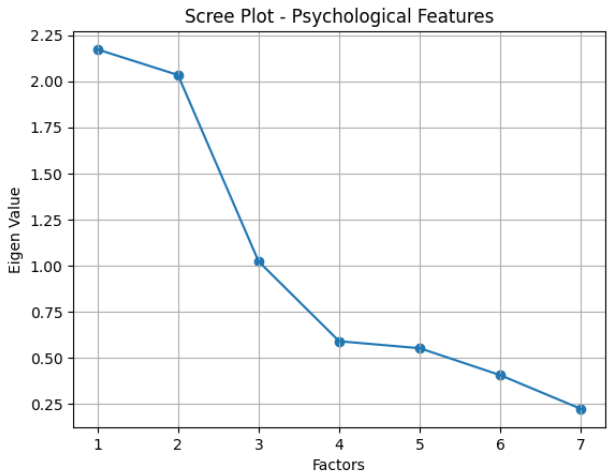


Fig 1: Scree plots analyzing the factors of Acoustic and Psychological features

After selecting these features, we tabulated the loading values of each factor across the feature they explain to give a better representation of the factor and which features are being grouped together. Only loading values > 0.5 have been taken in line with the original study.

	0	1	2	3	4	5
Loud	NaN	NaN	0.551009	NaN	NaN	NaN
Heavy Bass	0.683445	NaN	NaN	NaN	NaN	NaN
Brass	NaN	NaN	NaN	NaN	NaN	0.765333
Woodwind	NaN	NaN	NaN	NaN	NaN	0.511335
Dense	NaN	NaN	0.605537	NaN	NaN	NaN
Fast	NaN	NaN	NaN	NaN	0.854736	NaN
Percussive	NaN	NaN	NaN	NaN	NaN	NaN
Raspy voice	NaN	NaN	0.700482	NaN	NaN	NaN
Piano	NaN	NaN	NaN	0.562518	NaN	NaN
Distorted	0.763460	NaN	NaN	NaN	NaN	NaN
Yelling voice	0.803165	NaN	NaN	NaN	NaN	NaN
Instrumental	NaN	NaN	NaN	0.786082	NaN	NaN
Synthesizer	NaN	0.817965	NaN	NaN	NaN	NaN
Electric	NaN	0.771355	NaN	NaN	NaN	NaN

Fig 2: Loading values after factor analysis of Acoustic and Psychological features

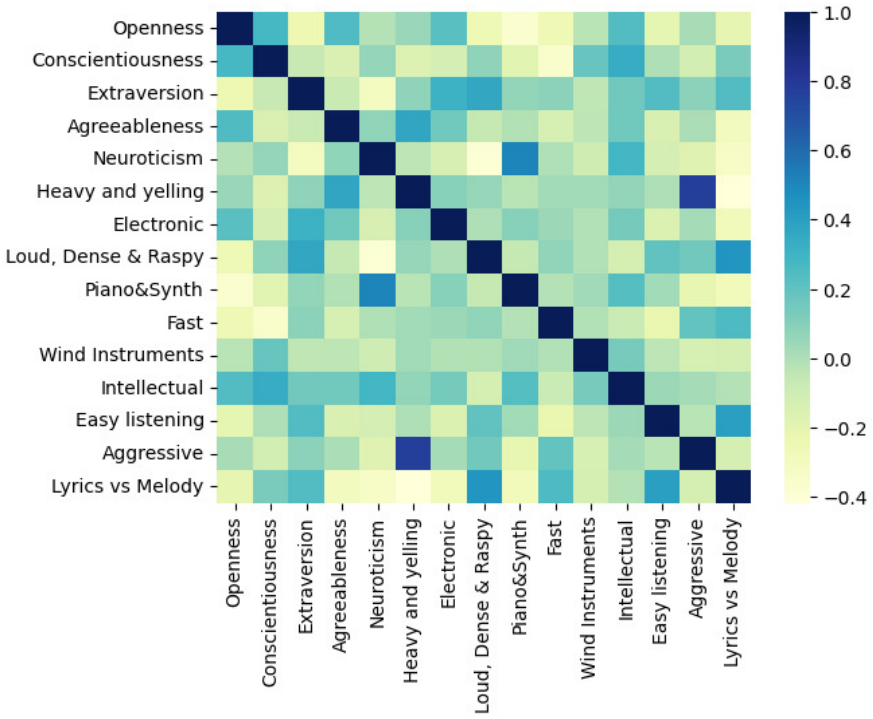
	0	1	2
Aggressive music	NaN	NaN	0.994846
Complex music	NaN	NaN	NaN
Inspiring music	0.733858	NaN	NaN
Intelligent music	0.891030	NaN	NaN
Relaxing music	NaN	0.513902	NaN
Romantic music	NaN	0.806924	NaN
Sad music	NaN	0.635021	NaN

Variance explained by these factors is 0.63 for acoustic features and 0.61 for the psychological features.

Based on these results, the factors shown above are named as per the loading values of the features they best describe. These factors are then used in all further analyses.

Correlations Between Various Features

Correlations were drawn between personality traits and the lyrical features of music. We chose Pearson correlation for this



We drew correlations for the BFI, the 6 feature-reduced acoustic features, 3 feature-reduced psychological features, and lyrics-vs-melody preference between each other and above are the results we obtained. The darker voxels indicate significant positive correlations, and the lighter voxels indicate significant negative correlations. Such significant correlations are mentioned below:

Positive Correlations	**Correlation Coefficient**
Heavy & Yelling vs *Agreeableness*	0.37*
Piano & Synth. vs *Neuroticism*	0.51**
Aggressive vs *Heavy & Yelling*	0.77**
Lyrics-Melody vs *Loud, Dense, Raspy*	0.44* (Lyrics)

Lyrics-Melody vs *Easy Listening*	0.4* (Lyrics)

Negative Correlations	**Correlation Coefficient**
Loud, Dense, Raspy vs *Neuroticism*	-0.39*
Piano & Synth. vs *Openness*	-0.36*
Lyrics-Melody vs *Heavy & Yelling*	-0.42* (Melody)

LIWC Features and Psychological Features

We chose to average the features of all the liked and disliked songs to get two vectors per user. These vectors were taken to be a general representation of the musical tastes.

We then drew correlations between personality traits of the user and the averaged out LIWC scores for likes and dislikes. From that, we gathered the following correlations:

Correlations for Liked Songs	**Correlation Coefficient**
Agreeableness vs *Moralization*	0.47*

Correlations for Disliked Songs	**Correlation Coefficient**
Conscientiousness vs *I-words*	0.41*
Conscientiousness vs *Authenticity*	0.41*

Partial Correlations:

Covariates: Acoustic features

- Agreeableness, Moralization (liked)
  r = 0.477, p = 0.021
- Conscientiousness, I-word (disliked)
  r = 0.476, p = 0.026
- Conscientiousness, Authenticity (disliked)

r = 0.419, p = 0.066

Covariates: Psychological features

- Agreeableness, Moralization (liked)
  r = 0.522, p = 0.006
- Conscientiousness, I-words (disliked)
  r = 0.516, p = 0.02
- Conscientiousness, Authenticity (disliked)
  r = 0.445, p = 0.033

Liked and Disliked Songs

After generating LIWC scores for both liked and disliked songs, an evaluation was done to ascertain if there was a difference in the distribution of the LIWC scores among liked and disliked songs across the participants. A pairwise t-test was chosen for these purposes(as the samples across the same index were correlated), where we compared the means of the two distributions and see if there is a statistically significant difference across the two. The t-test was conducted across all the features individually, and finally across the mean of all scores and the scores are tabulated below.

Measure	**t-Statistic**	**p-value**[1]
I Words, (I, me, my)	2.28	0.031*
Positive tone	2.78	0.009**
Negative Tone	2.37	0.025*
Social Words	2.27	0.031*
Cognitive Processes	7.90	<0.001***
Allure	6.02	<0.001***

[1] Significance represented by stars. * = p < 0.05, ** = p < 0.01, *** = p < 0.001

Moralization	0.35	0.728
Analytical	1.03	0.312
Authentic	6.61	<0.001***
Mean	6.18	<0.001***

After conducting this test, and observing descriptive statistics of the scores on their own - another pairwise t-test was conducted, but this time directional with the alternative hypothesis that liked songs will score higher than disliked songs(based on mean scores in each category across likes and dislikes). The results are displayed in the table below -

Measure	**t-Statistic**	**p-value[2]**
I Words, (I, me, my)	2.28	0.015*
Positive tone	2.78	0.005**
Negative Tone	2.37	0.013*
Social Words	2.27	0.016*
Cognitive Processes	7.90	<0.001***
Allure	6.02	<0.001***
Moralization	0.35	0.362
Analytical	1.03	0.156
Authentic	6.61	<0.001***
Mean	6.18	<0.001***

[2] Significance represented by stars. * = p < 0.05, ** = p < 0.01, *** = p < 0.001

Interpretation

Factor Analysis

Based on the results demonstrated in Fig.2, we can see certain features are being grouped together under a single factor - demonstrating how closely those features are preferred among the population. The names of the factors we decide to assign to these factors (following the original study) are given below

Acoustic

1. Heavy and yelling - Heavy bass, Distorted, Yelling voice
2. Electronic - Synthesizer, Electronic
3. Loud, Dense & Raspy - Loud, Dense, Raspy
4. Piano & Synth - Piano, Synth
5. Fast - Fast
6. Wind Instruments - Brass, Woodwind

Psychological

1. Intellectual - Inspiring, Intelligent
2. Easy listening - Relaxing, Romantic, Sad
3. Aggressive - Aggressive

These groupings are mostly in line with the original study, with some deviation in grouping, which we attribute to both different demographics and the number of participants we had(n=30) versus the original study(n=124). This indicates across demographics, the same preferences tend to get grouped together - implying a general trend of association amidst people likings one type of sound preferring another along with it(Eg: Heavy bass enjoyers preferring Distorted and Yelling voice, atypical of Heavy Metal songs).

Correlations Between Various Features

There are two important caveats to consider: firstly, the target audience was Indian; secondly, the number of responses garnered was 31. All 31 individuals are college-attending students with ages ranging from 19 to 21. Therefore, it is more appropriate to generalize the results obtained to an Indian college demographic (even so, the fact that not more responses were collected is a limitation of this project).

We observe that *Neuroticism* strongly correlates to a preference for *Piano and Synthesizer* elements in music. Similarly, people who prefer *Aggressive music* (from a psychological perspective) tend to like music falling into the *Heavy & Yelling* category (from the acoustic perspective). We also find that individuals who prefer lyrics over melody gravitate towards music that falls into the *Loud, Dense, Raspy* and *Easy Listening* categories.

From the negative correlations, we observe that people who display strong *Neuroticism* as their personality trait do not prefer *Loud, Dense, Raspy* music. Similarly, people with strong values of *Openness* avoid *Piano & Synthesizer* music. Lastly, the negative correlation between *Lyrics-vs-Melody* and *Heavy & Yelling* indicates a preference for melody over lyrics.

Correlations Between LIWC and Other Features

For the correlations between lyrical features and personality traits for liked and disliked songs, we observe that in liked songs, *Agreeableness* correlates positively with *Moralization*, indicating that people with an agreeable personality have a mild tendency to prefer songs with some small level of moral-direction. This preference is also affected by the acoustic and psychological features of the song, as seen in the statistical significance they have. In disliked songs, we observe that *Conscientiousness* correlates positively with both *I-words* and *Authenticity*. This would imply that people with a conscientious personality would have a mild distaste for songs with a lot of self-referential wording and avoid authenticity in lyrics. Based on the partial correlations, we observe that most of our correlations for both liked and disliked songs are independent of acoustic or psychological features.

Regarding the entry of non-English songs (even though the form explicitly mentioned to enter English songs), we decided not to go ahead and translate the lyrics to English and put them through LIWC. This is because the experience of listening to a song also depends on the other features (acoustic and psychological). Changing the language to English by translation would be a very inaccurate imitation of the song in its original language since that itself contributes hugely to the acoustic and psychological preferences (apart from the content of the lyrics themselves). This is potentially an entirely new research discussion to be had, and would perhaps have been possible had we had the access to the paid version of LIWC.

Liked and Disliked Songs

From the results, we can see most of the columns show a t-statistic with significant p-value indicating that the results are indeed significant and there exists a difference across the two distributions. In other words, between a person's liked and disliked songs, there is a significant

difference in the content of the lyrics (based on the LIWC scores). The only columns which do not conform to this are the *moralization* and *analytical* scores - *Moralization* scores were generally low for all songs (mean = 0.33, std = 0.36) and generally represent how someone judges someone else's actions. Given the low values, it seems songs in general do not include a lot of these and thus it may not be a predominant factor in an individual's liking or disliking a song.

As for *Analytical*, it represents formal thinking and acts as a metric of logic. Again, given the low difference and non-significant p-value, we speculate that individuals' likes and dislikes aren't dependent on the presence of analytical words/features present in the lyrics but rather other themes, like positive and negative tone for example. As such, this feature does not show a significant difference across the liked and disliked songs.

The one tailed t-test agrees with the result of the two-tailed t-test, implying that all the differences we saw are in one direction with the liked songs having a higher score in all these categories.This seems to imply that (at least in our sampled demographic), songs liked by individuals are more likely to score higher across these categories, i.e. the songs they like have more I-words, positive tone, negative tone, etc than songs they would dislike. This might be better explained if we had access to all 42 dimensions of the LIWC score, showing more variations across the categories, but currently these categories all mostly fit our hypothesis barring two (*Moralization* and *Analytical*)

Individual Contribution

Chinmay Deshpande

- Using LIWC to extract song lyrics
- Obtaining correlations between personality and lyrical preference (averaged LIWC features of liked and dislike for each user)
- Calculating BFI scores from form data

Atharva Gogate

- Aligning the naming schemes used in the lookup table and the user-input list of songs ([song name] - [artist name])
- Using LIWC to extract lyrics of the songs

- Obtaining correlations between the BFI, the 6 feature-reduced acoustic features, the 3 feature-reduced psychological features, and the lyrics-vs-melody preference with each other

Amal Sunny

- Created a scrapper to automate generation and accumulation of LIWC demo scores from their website (Data Formatting)
- Conducted Factor Analysis to reduce dimensions of Acoustic and Psychological preference data generated from the form (Factor Analysis) for further analysis.
- Conducted paired t-test to check for difference between LIWC features for liked and disliked songs. (Liked and Disliked songs)

References

1. Topolewska-Siedzik, Ewa & Skimina, Ewa & Strus, Włodzimierz & Cieciuch, Jan & Rowiński, Tomasz. (2014). The short IPIP-BFM-20 questionnaire for measuring the big five. Roczniki Psychologiczne // Annals of Psychology. 17. 385-402.
2. Qiu, Lin, Chen, Jiayu, Ramsay, Jonathan, and Lu, Jiahui (2018) Personality predicts words in favorite songs. Journal of Research in Personality, 78 pp. 25-35.