Match in emotional content in lyrics and melody enhances pleasure

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Abstract

Introduction

* Research question
* Hypothesis
* Literature that motivates research
* Design table (see below)

Melodies of major and minor mode will be paired with lyrics with either a more positive or negative sentiment. Earlier experiments showed that music in major mode evokes a positive emotional response while music in minor mode evokes a negative response, based on self-report on a valence scale. A functional MRI will be used to measure the blood oxygen level-dependent signal.

The hypothesis is that the blood oxygen level-dependent signal in the liking network is enhanced when the valence of the lyrics is matched with melodies of corresponding valence.

This will be research by participants listening to music while getting a fMRI scan, further the participants will self-report on their emotional response. The functional MRI is used to measure the BOLD signal in the liking network so the signal can be compared when listening to matched and mismatched valence. The self-report is used to control if the songs we expect to be experienced with higher or lower valence is experienced like that.

fMRI looking at the liking network (Putkinen et al., 2021), based on this paper I will look at whether or not the participants like the music or not (WERE SPECIFICALLY DO WE EXPECT TO SEE ACTIVITY)

Key and tempo = the sound of the melody (happy/sad)

Sentiment analysis, [Python | Sentiment Analysis using VADER - GeeksforGeeks](https://www.geeksforgeeks.org/python-sentiment-analysis-using-vader/)

Preference in music

Predictive coding

Methods

All referenced code and data are available in the Code availability and Data availability section.

* Ethics
  + Consent form
* Pilot study (Cog com exam)

Participants

* + 33 participants, 66.67% female, age range 15-52, mean age 22.45 years (sd=5.97)

Material

* + Indie pop, mean tempo 100.5 BPM (sd=2.67), mean duration 1, 4 minutes (sd=6.22)
  + Key and type were the predictor variables, measured outcome variable were valence (self report)

Procedure

* + Presented with consent form, 8 sound clips, after each clip they reportet on the valence of the music piece on a scale from -5 (negative) to +5 (positive) hwo they should use the scale were thoroughly explained

Analysis

* + Valence ~ key +(1|ID)
  + Valence ~ key+type + (1|ID)
  + Valence ~ key\*type + (1|ID)
  + Model 2 and 3 were compared with ANOVA
  + Chart, line chart

    Description automatically generated

Results

* + Model 1, significant result
  + Model 2, significant result
  + Model 3, interactive effect not significant
  + ANOVA showed model 2 to be better in both AIC and BIC

Discussion

* + Music in major mode evoke a more positive emotional response then music in minor mode
  + Lyrics did not work as an intensifier on this effect, interactive effect, but a significant difference were found in the lyrical pieces compared to the instrumental pieces. Overall lyrical music evokes a more positive emotional response disregarded of the key of the piece which mean lyric have a additive effect on valence
    - Due to preference for sad music
    - Mirror neuron systems, representations of the singer their emotional state
    - Therefore, it makes sense to see if it is the sentiment of the lyric that control this effect or if the sentiment will not change this
    - Further a mismatch between sentiment of lyric and valence/key would be expected to give a less pleasant brain activation response then when the lyric and key match
* Design
  + Experimental procedure
  + Linked code and data (reference data and code availability)
  + Randomization
  + Within or between subjects
  + Blinding???

The Stimuli is picked based on various criterias. The songs will all be lyrical and in English. They will be selected from various genres to make the results more general (Hunter et al., 2008)and to minimize the effect of musical preference on the results (Kreutz et al., 2008)*.* Further the songs are picked based on key, tempo of the melody and sentiment of the lyrics and sorted into 4 conditions (table 1). The key and tempo of the melody is what determines whether the melody is perceived as sad or happy(Gagnon & Peretz, 2003). To determine the sentiment of the lyrics a sentiment analysis will be made on all lyrics (see sentiment\_analysis\_example.ipynb in GitHub). The sentiment analysis example was made using python (author, year) and vaderSentiment (author, year).

**Table 1**

Experiment conditions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Tempo | Melody key | Melody sound | Lyric sentiment | Match |
| Condition 1 | Fast | Major | Happy | Positive | Matched |
| Condition 2 | Fast | Major | Happy | Negative | Mismatched |
| Condition 3 | Slow | Minor | Sad | Positive | Mismatched |
| Condition 4 | slow | Minor | Sad | Negative | Matched |

*Note:* experiment conditions, based on tempo, key and sentiment

* Sampling plan
  + Evt. Power analysis (sample size), based on the lowest available/meaningful estimate of the effect size, priori power 0.95 or higher
  + Bayesian hypothesis testing encouraged
  + List data inclusion and exclusion
* Analysis plan
  + Include all pre-prosesing steps
  + All planned analysis
  + Is analysis strategy dependent on the results and how
* Design table
  + Mandatory
  + Number of rows depend on number of research questions
  + If analysis strategy is dependent on results this should be stated clearly (if-then)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **question** | **hypothesis** | **Sampling plan** | **Analysis plan** | **Interpretation given different outcomes** |
|  |  |  |  |  |

Data availability

All future data and materials will be made available upon acceptance of the stage 2 manuscript. Data for the pilot study and other referenced material and data is already available in the following GitHub repository in the ‘data\_and\_material’ folder (<https://github.com/mthomasen/cognitive_neuroscience_of_music_and_language>).

Code availability

All code will be shared publicly upon acceptance of the stage 2 manuscript. Already referenced code is already available in the following GitHub repository in the ‘code’ folder (<https://github.com/mthomasen/cognitive_neuroscience_of_music_and_language>).

Acknowledgement

The author received no specific funding for this work

Author contributions

Competing interests

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