Music and emotion dataset (Primary Musical Cues)

Dataverse http://dx.doi.org/10.7910/DVN/IFOBRN

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Stimulus materials, design matrix, and mean ratings for music and emotion study using optimal design in factorial manipulation of musical features (Eerola, Friberg & Bresin, 2013).

- Design rationale
- Stimulus materials wave files
- Mean emotion ratings
- Design matrix of the 200 stimuli combining the seven factors

Source

The study with four audio examples is available at:

- Eerola, T., Friberg, A., & Bresin, R. (2013). Emotional Expression in Music: Contribution, Linearity, and Additivity of Primary Musical Cues. *Frontiers in Psychology, 4(487)*. http://www.frontiersin.org/emotion_science/10.3389/fpsyg.2013.00487/

The design was based on findings provided in:

- Bresin, R. & Friberg, A. (2011). Emotion rendering in music: range and characteristic values of seven musical variables. *Cortex, 47(9)*, 1068-1081.

The melodic materials come from:

- Vieillard, S., Peretz, I., Gosselin, N., Khalfa, S., Gagnon, L., and Bouchard, B. (2008). Happy, sad, scary and peaceful musical excerpts for research on emotions. *Cognition and Emotion, 22,* 720–752.

The full melodic materials are available from http://www.brams.umontreal.ca/plab/publications/article/96#downloads

Sound files

The sound files are provided in a zipped archive (509 Mb, titled `stimuli`) that contains uncompressed wave files named as `001.wav` to `200.wav` corresponding to the design matrix (see notes below). Additionally, there is an extra sound file titled `sound-level-cal-C4-eng-horn-0dB.wav` for calibrating the sound presentation (this is 0 dB, whereas the dynamics in stimuli will vary around it).

Emotion ratings

Mean emotion ratings from the two laboratories (KTH at Stockholm and UJy at Jyväskylä) are available in `mean_emotion_ratings.csv`, which is a comma-separated ascii file, organised according to the stimulus order (1-200).

Background for the design matrix

This study (Eerola, Friberg & Bresin, 2013) set out to manipulate 6-7 features of music in factorial fashion to determine how much they contribute to emotions perceived in music. In this case, we also wanted to have more than two levels in most variables (e.g. play the same music in six different registers) in order to explore whether the factors contribute to emotions in a linear fashion. A full factorial would have been impossible since it would have require over 14000 combinations to be tested. Fractional Factorial Designs (FFD) and Response Surface Methodologies (RSM), collectively called optimal designs are fortunately available, although widespread usage of these within behavioural sciences is still rare despite serious attempts of advocating them (see McClelland, 1997; Collins, Dziak, & Li, 2009). The main advantage of using optimal designs over full factorials design is that they allow to focus the research resources on particular questions, minimize redundancy (e.g., by eliminating high-order factor interactions), and to maximize the statistical power.

Here the aim was to only focus on main effects and first-order interactions and to explore whether the levels of these factors operate in linear or cubic fashion, both of which allow to fully capitalize on the benefits offered by the optimal design paradigms. It is worth pointing out that the main effects of the factors are little affected by the optimal design. We constructed the design matrix in a way that kept the number of cases for factor levels approximately equal regarding the main effects and first-order interactions in order to present balanced array of factor combinations to the listeners and be compatible with the traditional statistical analysis methods. A summary of the cases for each factor levels is displayed below. Similarly, the cells of the first order factor interactions are near to the equal distribution. An optimal design may offer advances in scientific knowledge by sacrificing such aspects of the design that are of little interest in this stage of research. In the field of emotions and the contributing features, few complete factorial studies with 2-3 factors have already been completed (e.g., Ilie & Thompson, 2006) and therefore an overview of a large number of factors and their main effects is clearly motivated and only achievable by using optimal design.

Manipulations

The design matrix is available as `design_matrix.csv` file where the nro indicates the stimulus number and the other columns refer to factors and their levels, explained below. The audio files were created by Anders Friberg and the optimal values for the factor levels came from a production study and Friberg and Bresin (2011).

1st col = **Register**, 6 levels (53, 59, 65, 71, 77, and 83 in MIDI pitch, see the paper for details).

2nd col = **Mode**, 2 levels (1 major, 2 minor)

3rd col = **Tempo**, 5 levels (1.2, 2, 2.8, 4.4, and 6 NPS, see the paper for details)

4th col = **Sound level**, 5 levels (-10, -5, 0, +5, +10 dB)

5th col = **Articulation**, 4 levels (1, 0.75, 0.5, 0.25 from legato to staccato, see paper for details)

6th col = **Timbre**, 3 levels (1= trumpet, 2 = flute, 3 = horn)

7th col = **Melody**, 4 categories (1 = Sad [T01.mid], 2 = Happy [G04.mid], 3 = Scary [P02.mid], 4 = Peaceful [A02.mid], filenames refer to Montreal battery of composed emotion examples (Vieillard et al., 2008. Note that the musical excerpts can be used for research with ackowledgements of the copyright, © Bernard Bouchard, 1998.)

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Nro     REG MOD TEM SOU ART TIM MEL
1       4   1   4   4   2   2   4
2       5   1   4   1   1   2   2
3       2   2   5   1   1   2   1
.... etc. (see `design_matrix.csv`)
```

References

Bresin, R. & Friberg, A. (2011). Emotion rendering in music: range and characteristic values of seven musical variables. *Cortex, 47(9)*, 1068-1081.

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