Studying emotion induced by music through a crowdsourcing game

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Summary

- Emotional impact of music
- Improvement of online music streaming services
  - Automatic musical emotion recognition (MER)
- Progress of MER impeded by absence of publicly accessible data
- This paper addresses this problem
  - Dataset of 400 musical excerpts, four genres
  - Annotated with induced emotion
- Geneva Emotional Music Scale (GEMS) model (Zentner et al., 2008)
- Analyzed influence of different factors (gender, mood, musical preferences)

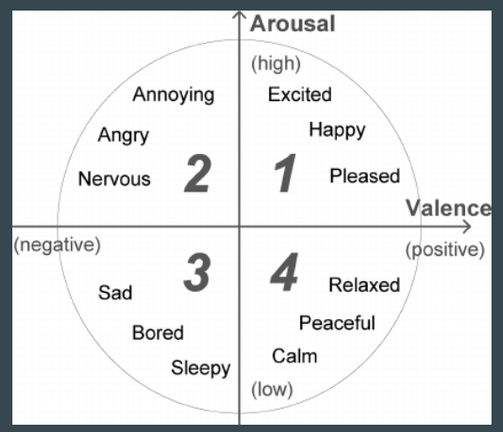
- One of the major reasons why people find music so enjoyable is its emotional impact. Creating emotion-based playlists is a natural way of organizing music.
- The usability of online music streaming services could be greatly improved by using automatic music emotion recognition (MER).
- The progress of MER in this area is impeded by the absence of publicly accessible data on musically induced emotion.
- In this paper they address these problems by creating a sizeable publicly available dataset of 400 musical excerpts from four genres annotated with induced emotion
- For the purpose of this study they used the GEMS model
  - Which was modified a little bit for ease of understanding
- They also analyzed the influence of different factors, such as gender, mood or musical preferences.

Other research (before)

- Valence-Arousal (V-A) model (Russell, 1980)
  - Two dimensions, valence and arousal
  - Lack of granularity, e.g. anger and fear are very close to each other
  - Not specific to music and was not built to reflect induced emotion
- Utilitarian vs aesthetic emotions (Scherer, 2004)
- Contradictory emotions, e.g. bitter-sweetness (Hunter et al., 2008)
- GEMS
  - Need for a big dataset on induced emotion
  - Additional studies of GEMS were needed

- For this paper they looked into different models to use for their research, and one of the them was the Valence-Arousal, or V-A model, proposed by Russell in 1980
  - It based on two dimensions: valence and arousal
  - Criticised for its lack of granularity, for example anger and fear are very close to each other
  - Is not specific to music and was not built to reflect induced emotion
- Scherer argues that everyday utilitarian emotions should be distinguished from aesthetic emotions, induced by works of art. Aesthetic emotions are usually much more subtle than everyday emotions
- Musical emotions can also be contradictory, for example bitter sweetness
- **It is impossible to present these on a valence-arousal plane.**
- For this work they decided to employ the GEMS model for two reasons
  - First, as mentioned before, there was no publicly accessible data on musically induced emotion
  - Second, in the original study that GEMS is based on, mostly classical music was used, and the study was conducted in French.

V-A model vs GEMS



- Amazement
- Solemnity
- Tenderness
- Nostalgia
- Calmness
- Power
- Joyful activation
- Tension
- Sadness

Over here we can see on the left the V-A model and on the right the 9 terms from the GEMS model used in this study

Emotify interface.

Calmness and tenderness are selected and highlighted. An explanation is shown for the hovered button. (Sensuality, affect, feeling of love.)

So, this is the game Emotify interface which was created in order to conduct the research and collect the data based on the GEMS model.

Previous knowledge

- Geneva Emotional Music Scale (GEMS)
  - Unique as it addresses induced emotion
  - Specifically for music
  - Granular
  - 45, 25 or 9 terms
- Induced vs perceived emotion
  - Focus on induced emotion
  - Relation between induced and perceived emotion (Gabrielsson, 2002)

- GEMS is unique as it addresses induced emotion and not perceived emotions
  - It is specifically designed for music
  - Is granular as opposed to the V-A model
  - The full scale consists of 45 terms, with shorter versions of 25 and 9 terms
- More knowledge on this model can be acquired by reading the paper in which it is described by Zentner
- The paper very briefly explains the difference between induced and perceived emotion
  - The research focuses on induced emotion
  - Some previous knowledge would be useful as to know the exact relation between these two types, and it can be acquired by reading Gabrielsson's paper: Emotion perceived and emotion felt: Same or different?

Critical evaluation

- GEMS (modified) model validity
  - Difficult to use overall
  - Modification did not improve the understanding of categories
  - Categories are correlated
  - Categories are agreed on by the users
  - No concrete conclusion
- Personal factors
  - Mood
  - Gender
  - Language
  - Musical preference

- One of the biggest focus points is the validity of the GEMS model and if it could be used for such research on induced emotion, going forward
  - It turns out the modified GEMS model was considered difficult to use *(2.92 on a scale from 1-5 where 1 was easy and 5 difficult)*
  - Different Labels or Categories were still deemed difficult to understand; no substantial improvement was recognised after modification of the most confusing words from the original model
    - Transcendence was changed to solemnity, wonder to amazement, and peacefulness to calmness
  - Now, some categories are correlated or chosen together for a song, while some are not
    - Tenderness/nostalgia are often taken together
    - Or power/joyful activation are often taken together
    - BUT tenderness strongly differs from power and was rarely selected together as a pair
  - Also, there was an interesting analysis done on the agreement of users on the emotional categories *(via Cronbach's alpha calculation)*
    - The categories or labels were given to musical excerpts in a similar fashion among users overall (with the exception of **amazement/solemnity/sadness)**
  - Finally, the researchers really do not state if the modified GEMS model is valid for such research but just state that their model does not conform to the original model from Zentner in many regards which makes you wonder… why wasn't a concrete conclusion drawn?
- Another big focus point was examining personal factors in relation to the induced emotion
  - Mood, first of all. They found that people felt higher induced emotion while feeling similar strong feelings. Think of "User is sad, so they perceive songs to be overall more sad too"
  - Gender and mother tongue were also looked at but not really explained and it was a little unclear why it was looked at at all if not analysed (some gender X felt that genre Y was inducing emotion Z while gender Q did not comply) (*38% English, 19% Dutch, 19% Russian, the remaining 24% of the participants indicated 41 other languages)*
  - Finally, they found that liking/disliking the music so personal preference is the most important factor to consider when predicting induced emotion
    - The liked songs showed greater consistency with what the model was suggesting
    - Another interesting point to make here - the researchers excluded "disliked" music from the analysis to make the results more consistent with the model. This seems a little odd considering models should hold value even if there are outliers and data manipulation should not be conducted this way. Maybe it was just not explained enough...but the question remains.

Other research (after)

- Aljanaki, A., Wiering, F., & Veltkamp, R. C. (2014). **Computational modeling of induced emotion using GEMS**. In *Proceedings of the 15th international society for music information retrieval* (pp. 373–378).

- Paolo Rosso , Cristina Bosco , Rossana Damiano , Viviana Patti , Erik Cambria, **Emotion and sentiment in social and expressive media**, Information Processing and Management: an International Journal, v.52 n.1, p.1-4, January 2016

- Chuang Wang , Zhongyun Zhou , Xiao-Ling Jin , Yulin Fang , Matthew K.O. Lee, **The influence of affective cues on positive emotion in predicting instant information sharing on microblogs**, Information Processing and Management: an International Journal, v.53 n.3, p.721-734, May 2017

The authors themselves looked a little more into the GEMS model while not a lot of progress has been made yet.

- They give an explanation on why they have excluded disliked music as they are not interested in modeling irritation which supposedly is created by disliked music. Still questionable? How do you know the “good” music is good if you are not willing to look at what is “bad” music.
- In the conclusion they say, that it is possible to predict induced musical emotion for some emotional categories, such as *tenderness* and *joyful activation*, but for many others it might not be possible without contextual information.

Other research (after)

- Lizhen Cui , Xudong Zhao , Lei Liu , Han Yu , Yuan Miao, **Learning Complex Crowdsourcing Task Allocation Strategies from Humans**, Proceedings of the 2nd International Conference on Crowd Science and Engineering, p.33-37, July 06-09, 2017, Beijing, China

- Olga Korovina , Fabio Casati , Radoslaw Nielek , Marcos Baez , Olga Berestneva, **Investigating Crowdsourcing as a Method to Collect Emotion Labels for Images**, Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems, April 21-26, 2018, Montreal QC, Canada

Most of these touch on labelling emotion while some particularly in music.

Other research (after)

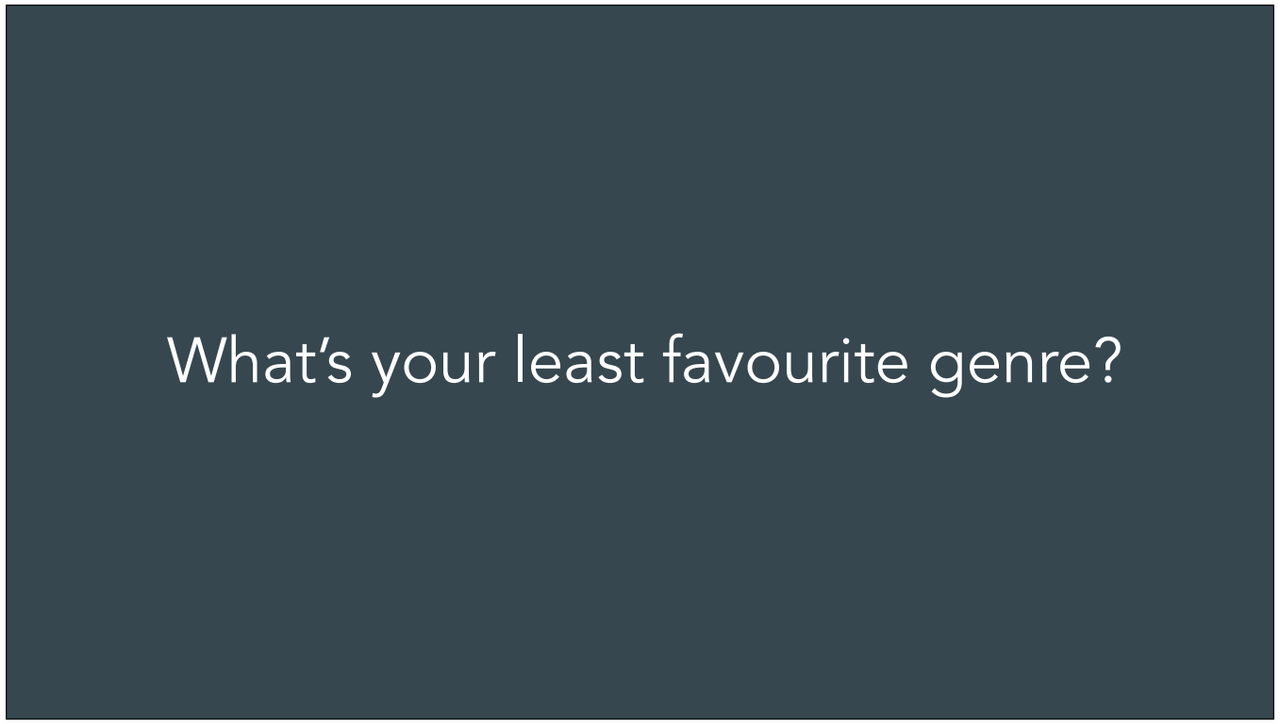
- Kejun Zhang , Hui Zhang , Simeng Li , Changyuan Yang , Lingyun Sun, **The PMEmo Dataset for Music Emotion Recognition**, Proceedings of the 2018 ACM on International Conference on Multimedia Retrieval, June 11-14, 2018, Yokohama, Japan

- Chihli Hung, **Word of mouth quality classification based on contextual sentiment lexicons**, Information Processing and Management: an International Journal, v.53 n.4, p.751-763, July 2017

Future research

- Proposed by the authors:
  - GEMS model augmentation
- Proposed by us:
  - GEMS model in relation to personal interpretation of emotions
  - Does extreme emotional states introduce new ways of inducing emotions
  - What is likeable music in terms of genres and music?

- So, for the future research authors proposed a few smaller topics for GEMS model and it's augmentation:
  - For example, some labels may be missing from the model based on feedback
  - Also, some labels like "transcendence" from the original model need additional investigation to pinpoint the emotion better as the researchers' effort to wing it and get it right off the bat did not turn out that great.
- Also, we got many questions about what could be investigated so here are some of our proposed topics:
  - One. GEMS model could be checked against personal emotion description? Think of a very personal question "What is sadness in music FOR YOU?"
  - Two. Does a strong emotional state introduce a new way of inducing emotions? Think of "If you are sad, are you looking for compassion and while finding it in music, tend to recognise an abstract conversation partner rather than just a soundtrack to your day?"
  - Three. What is the relation between personally likeable music genres and personally likeable songs? It is easy to say "I like classical music, so probably, I will like this classical piece X as well." But if you think about it - every genre has likeable and unlikeable music. What is the role of bias and how and even more importantly WHY do we create it?



So, to open up a discussion - what is your least favourite genre? Is there anyone bold enough to say there is such a genre for them?

Now, is there someone who takes the other side and can say that they like the [GENRE]? How does it make you feel when someone says the genre is not likeable?

From the research, we could argue that people who dislike a genre, rate it lower than the songs from the liked genre. Also, they rate it with words that confuse them so with less consistency overall. So we could argue that the people who dislike particular genres are just confused about them. At the same time, could it be that if you really like a genre, you see it as a personal conversation partner rather than background music or a soundtrack?

References

Gabrielsson, A. (2002). Emotion perceived and emotion felt: Same or different? Musicae scientiae, 5(1), 123–147

Hunter, P. G., Schellenberg, E. G., & Schimmack, U. (2008). Mixed affective responses to music with conflicting cues. Cognition & Emotion, 22(2), 327–352

Russell, J. A. (1980). A circumplex model of affect. Journal of Personality and Social Psychology, 39(6), 1161–1178

Scherer, K. R. (2004). Which emotions can be induced by music? What are the underlying mechanisms? And how can we measure them? The Journal of New Music Research, 33(3), 239–251.

Zentner, M., Grandjean, D., & Scherer, K. R. (2008). Emotions evoked by the sound of music: Characterization, classification, and measurement. Emotion, 8(4), 494–521.