Western listeners' perception of music and speech is reflected in acoustic and semantic descriptors

Lauren Fink^{1,2}, Madita Hörster^{3,4}, David Poeppel^{2,4,5,6}, Melanie Wald-Fuhrmann^{1,2}, Pauline Larrouy-Maestri^{1,2,4}

- ¹ Music Dept., Max Planck Institute for Empirical Aesthetics, Frankfurt am Main, Germany ² Max-Planck-NYU Center for Language, Music, and Emotion (CLaME), New York, USA & Frankfurt am Main, Germany
- ³ Department of Psychology, Ludwig-Maximilians-University, Munich, Germany ⁴ Neuroscience Department, Max Planck Institute for Empirical Aesthetics, Frankfurt am Main, Germany
- ⁵ Psychology Department, New York University, New York, USA ⁶ Ernst Struengmann Institute for Neuroscience, Frankfurt am Main, Germany



Background

Listeners show remarkable abilities when asked whether a sound should be classified as music or speech but the mechanisms underlying this ability remain speculative.

Our previous work [1]:

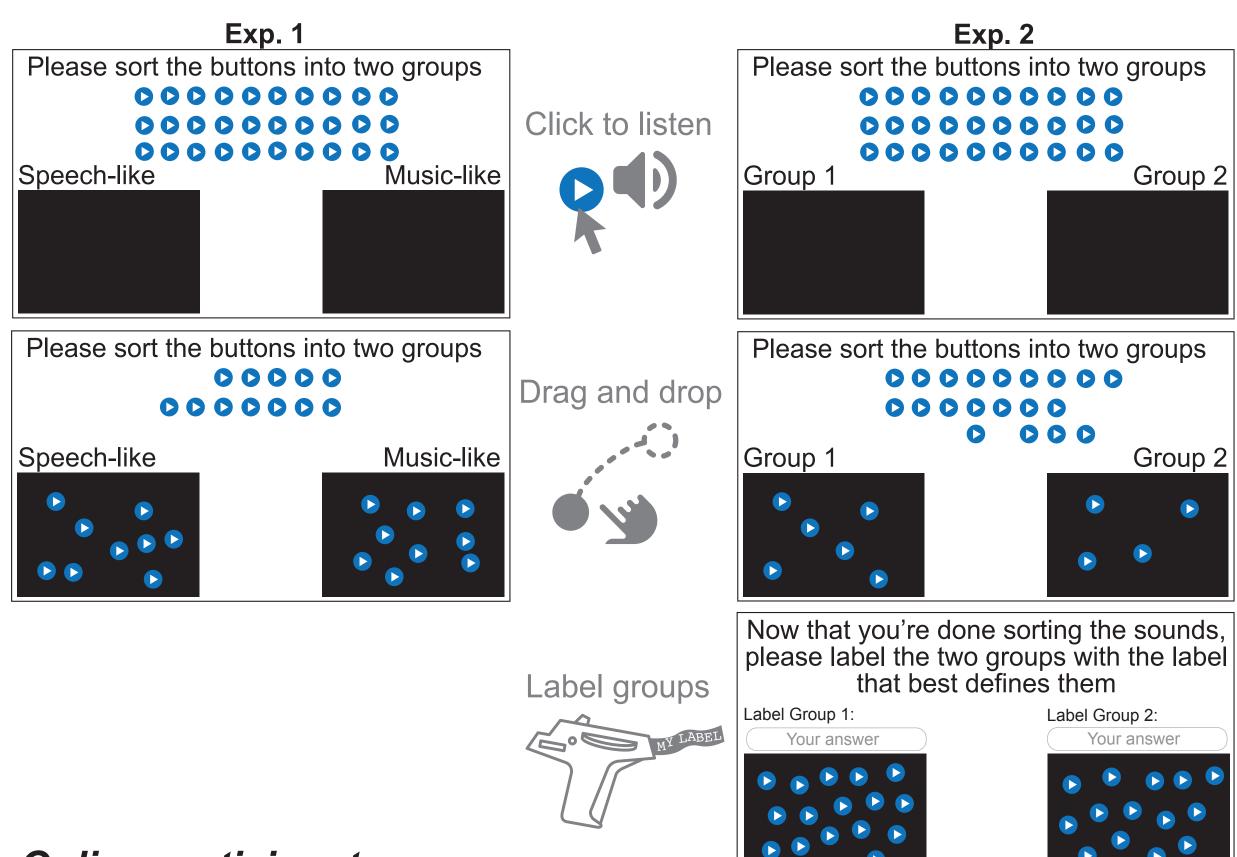
- used 6-10 sec recordings of Nigerian dùndún talking drum performances that were intended to be speech or music
- a categorization task: is the sequence music- or speech-like?

We found: familiarity and acoustic features shape listeners' categorizations. However, even unfamiliar participants could categorize above chance whether the drum was talking or playing music.

BUT the labels "speech" and "music" were given to participants, whereas categorization of our auditory environment is usually label-free.

HERE we depart from the usual experimental procedure and explore the role of task demands and acoustic features in predicting participants' categorization.

Methods



Online participants.

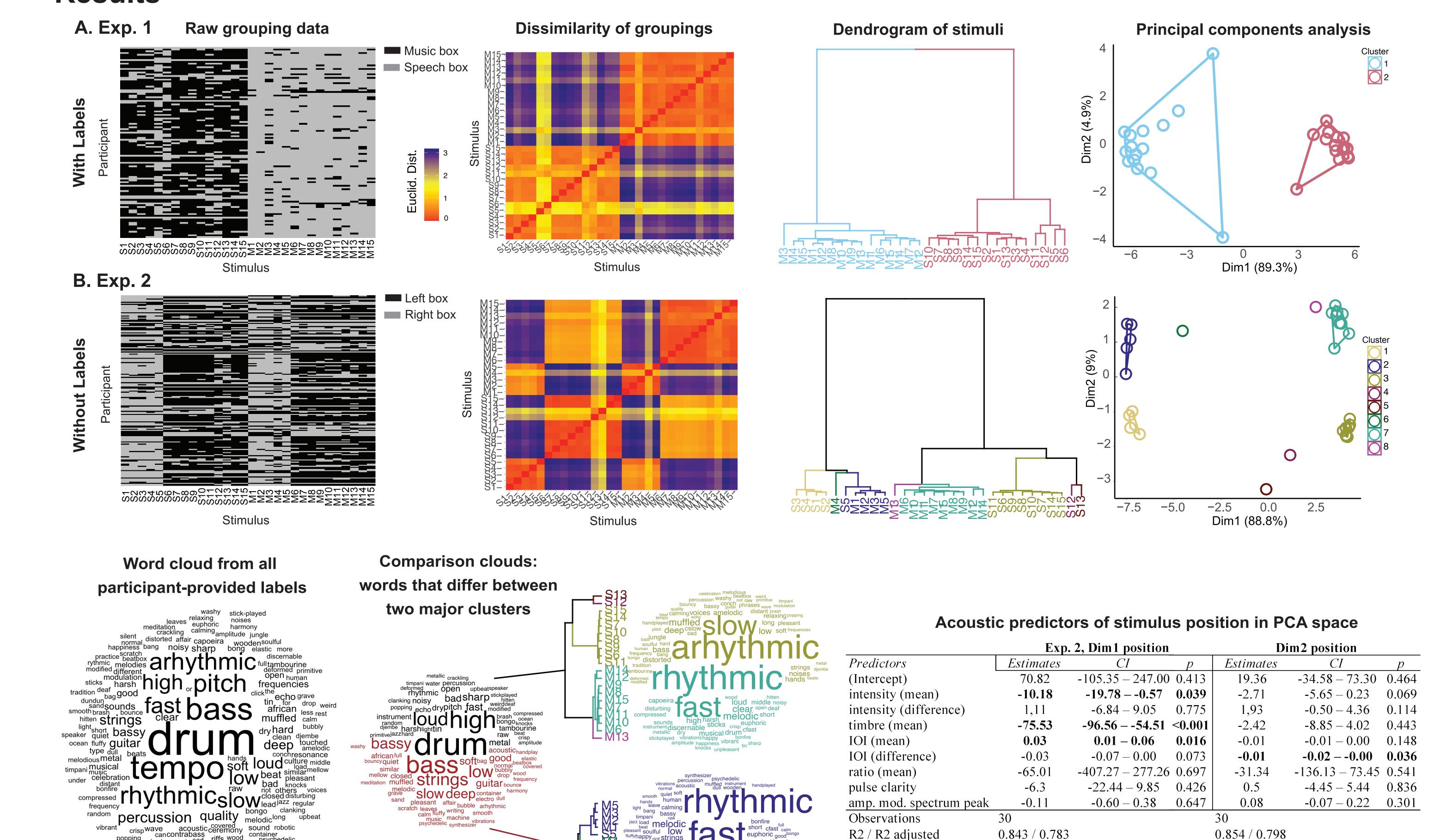
Exp. 1: N = 108 (age M = 25.5, SD = 9)

Exp. 2: N = 180 (age M = 26.2, SD = 8)

Material. Cleaned versions (removed background noise, clipping, etc.) of the recordings used in [1].

Feature extraction. Pitch, spectral entropy (timbre), amplitude envelope (intensity), inter-onset-intervals (IOI), ratio of IOIs, amplitude modulation spectrum (AMS) peak, and pulse clarity, were calculated using custom scripts and third-party toolboxes in MATLAB.

Results



Discussion

- Results of Exp. 1 replicate Durojaye et al. (2021). Participants categorize well above chance which stimuli fall into speech or music categories.
- However, Exp. 2 shows that this speech/music distinction is not the most salient one. Thus, task demands influence acoustic categorization.
- When no labels are presented, participants first tend to form mixed groups of speech-like and music-like stimuli, along timbral and intensity dimensions.
- The speech/music distinction emerges on a lower hierarchical level; it is associated with labels like "arhythmic" / "rhythmic" and is predicted by timing characteristics.
- Participant labels converge with acoustic predictors.







