

# The texture of musical sounds:

## Cross-modal associations from musical timbres and intervals to visual textures

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### BACKGROUND

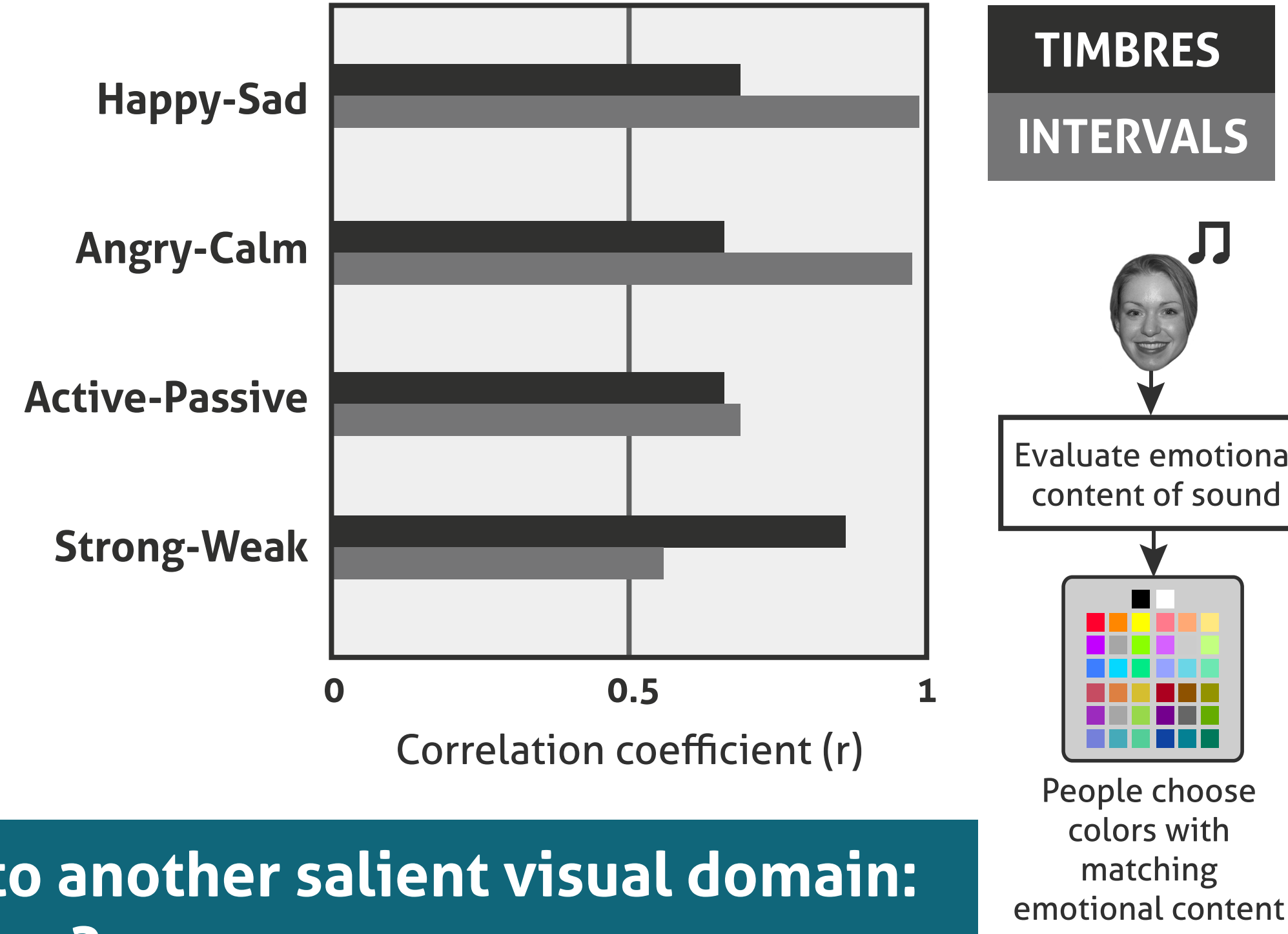
Previous research has provided evidence that cross-modal music-to-color associations are mediated by emotion, both for classical orchestral music and for a wide range of genres.

(Palmer et al., 2013, Whiteford et al., VSS-2013)

Similar results suggesting emotional mediation have been found using lower level musical stimuli, including musical melodies, two-note intervals, and instrumental timbres.

(Palmer et al., VSS-2011, Griscorn & Palmer, VSS-2012)

Correlations between the emotional associations of the sounds, and the emotional associations of the colors chosen to go with the sounds.

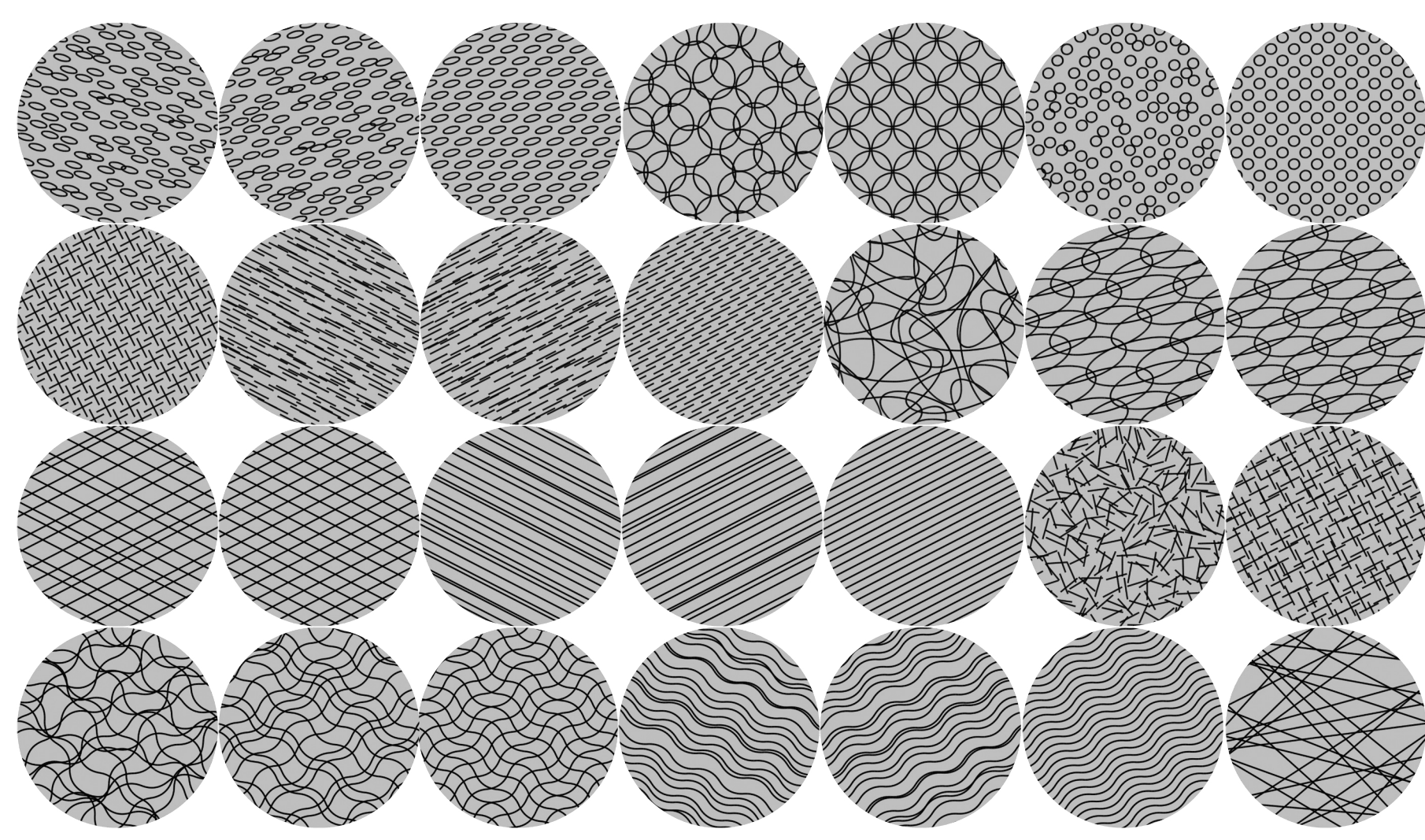


Do these findings generalize to another salient visual domain: line-based geometrical textures?

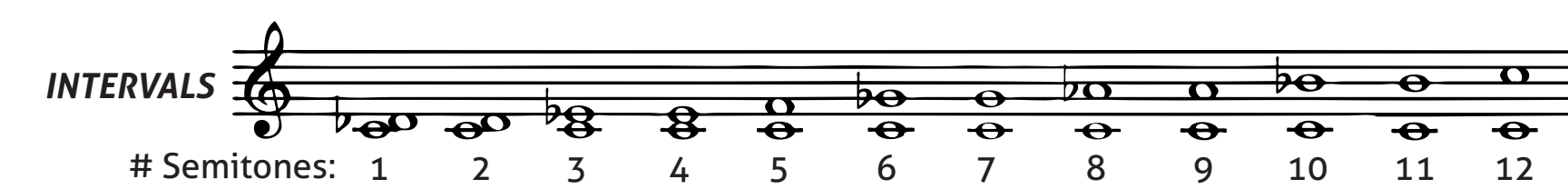
### EXPERIMENT 1

### STIMULI

28 different textures synthesized using b-splines



12 Intervals: Piano tone at middle C paired with all other possible notes in the chromatic scale

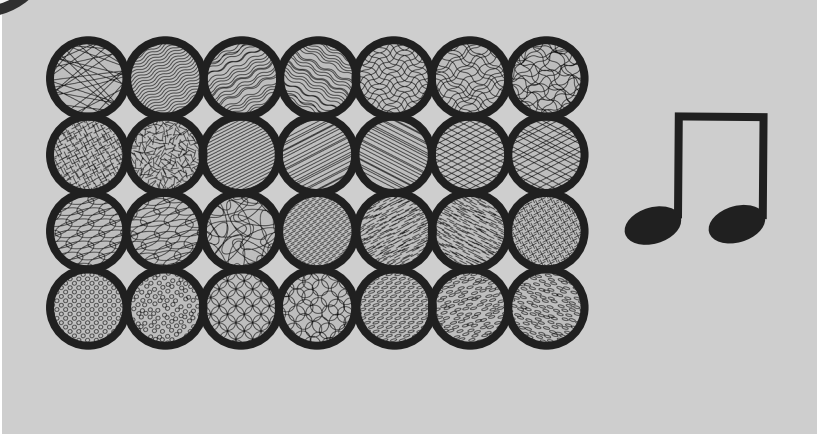


16 timbres generated using naturalistic recordings



### METHODS

#### 1 Sound-Texture Choices

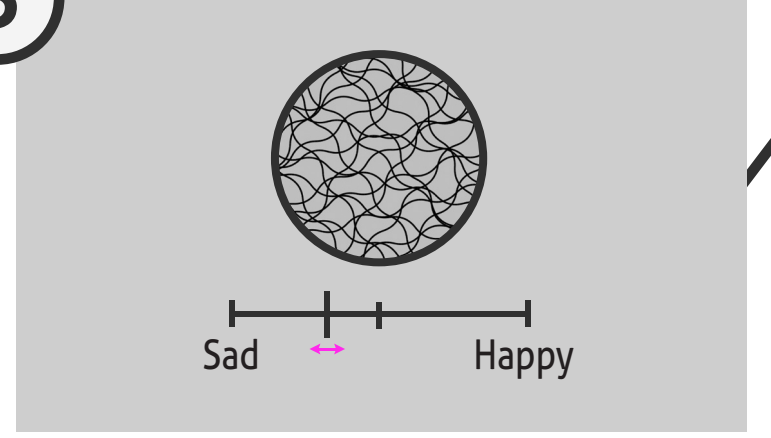


- 1. Pick 3 textures that are most consistent with the sound.
2. Pick 3 textures that are least consistent with the sound.

#### 2 Sound-Feature Ratings



#### 3 Texture-Feature Ratings

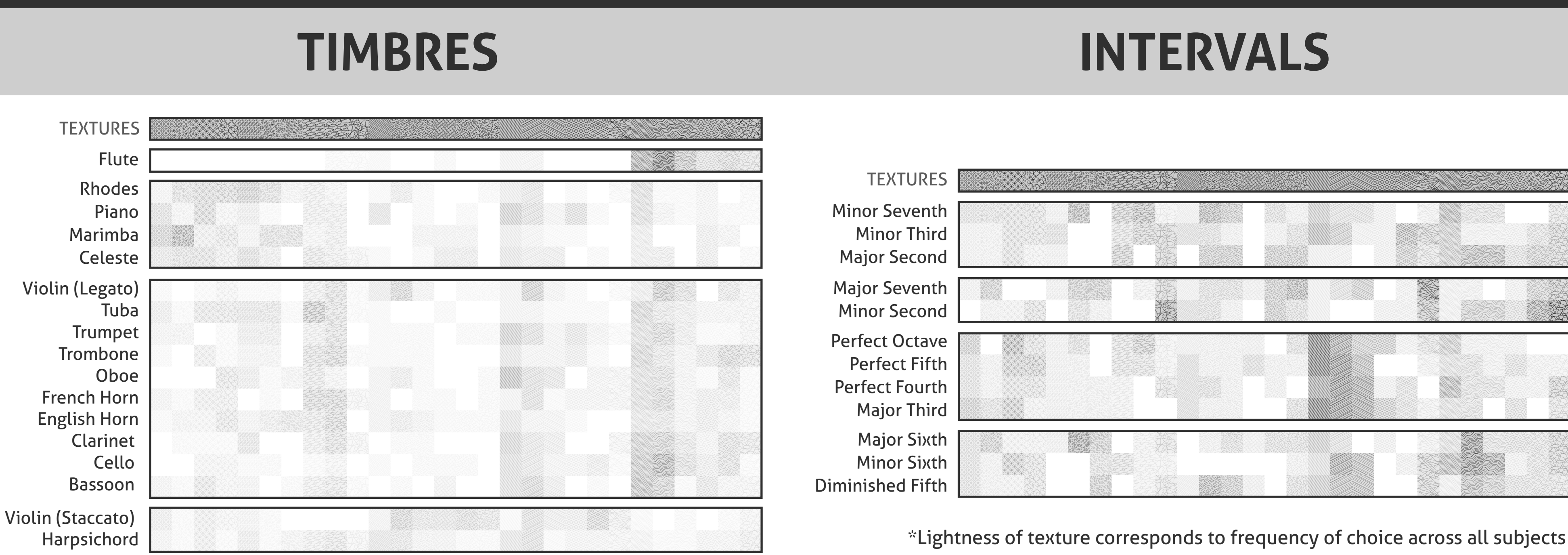


Rate features of each stimulus:

Table with 2 columns: Perceptual Dimensions (Simple-Complex, Granular-Fibrous, Slanted-Not Slanted, Curved-Straight, Separate-Connected, Sharp-Smooth, Natural-Artificial) and Emotional Dimensions (Happy-Sad, Calm-Agitated, Weak-Strong, Active-Passive, Not Angry-Angrry, Harmonious-Disharmonious).

### RESULTS

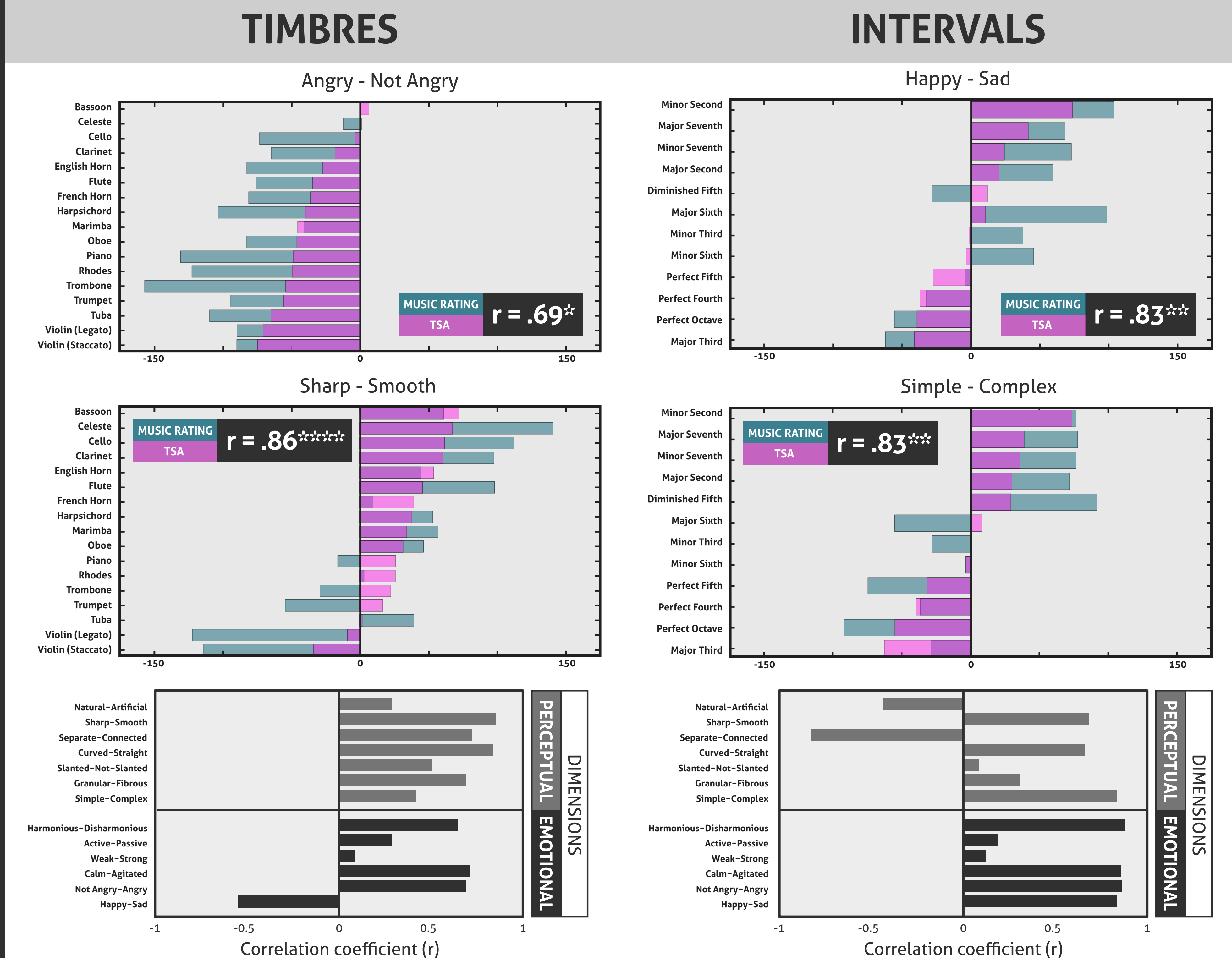
Timbres and intervals clustered by similar texture profiles\*



Associations among sound, texture, emotion, and non-emotional audio-visual features:

Texture-Sound Associations (TSA\_d): The weighted average of the three textures picked as being most consistent with music (C\_d,m) minus the weighted average of the three textures picked as being most inconsistent with the music (I\_d,m) along a given dimension D:

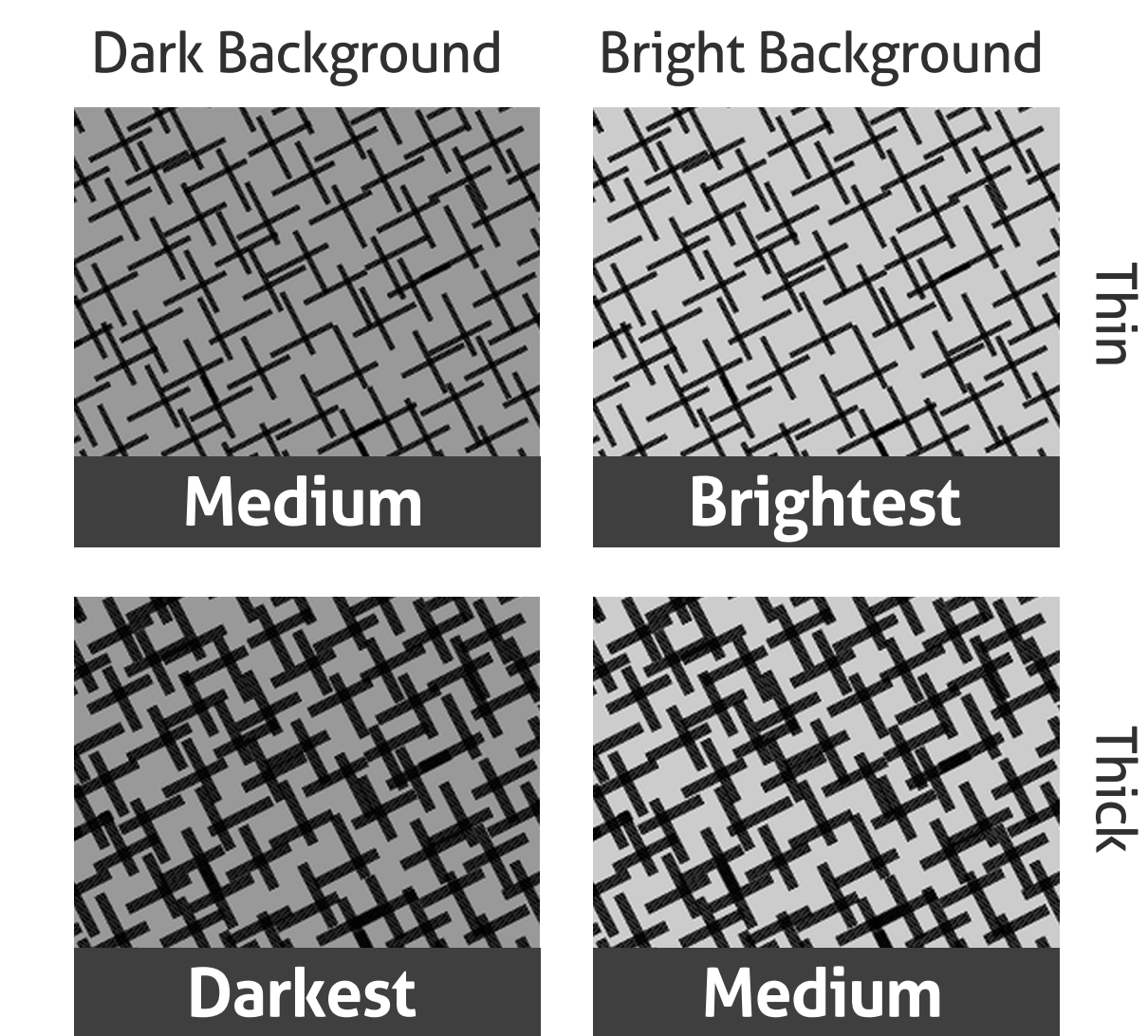
Equations for C\_d,m, I\_d,m, and TSA\_d,m.



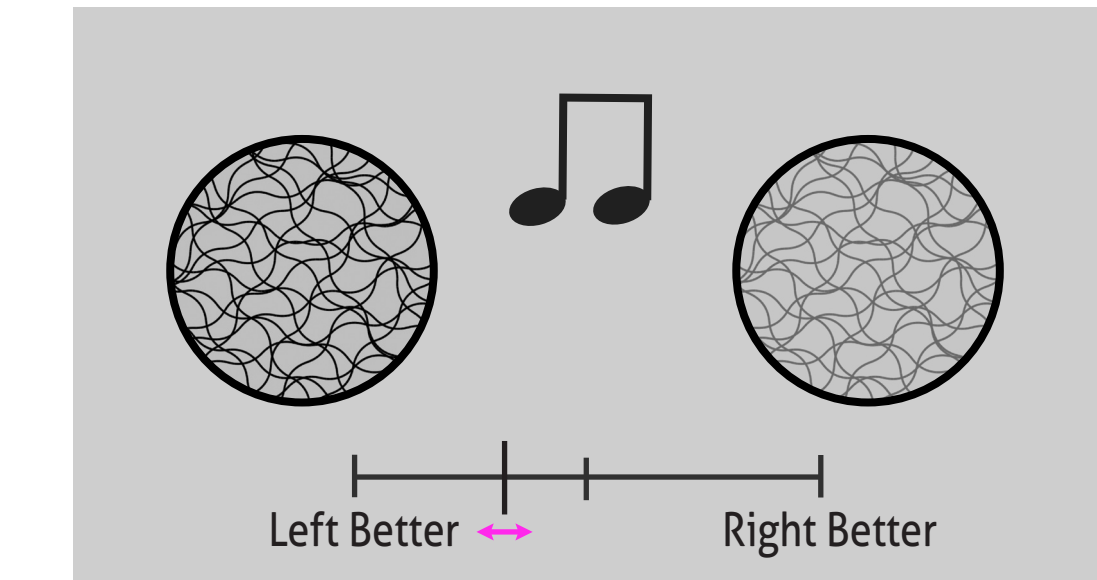
### METHODS & RESULTS

#### EXPERIMENT 2

Stimuli: 40 textures (10 patterns x 4 variations)



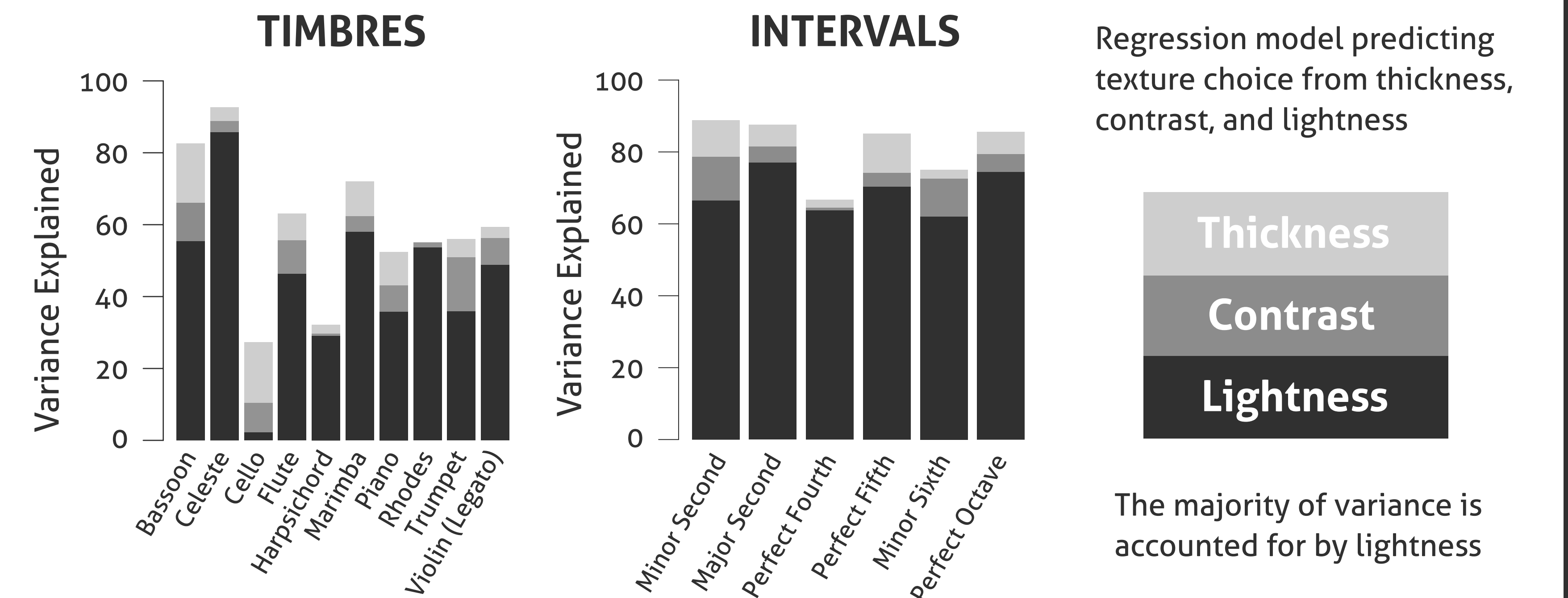
2AFC Task



PROCEDURE: Subjects compared every pair of the 4 variations of the same texture for fit with each sound.

#### FOLLOW-UP QUESTION

Do perceptual features of the textures such as lightness, contrast, and line thickness influence the fit of the texture with the sound?



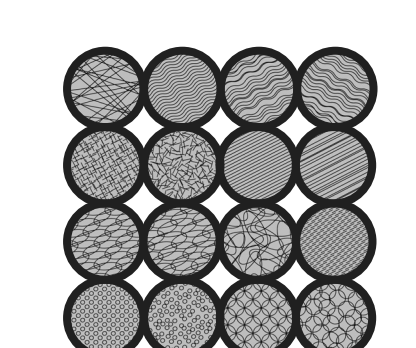
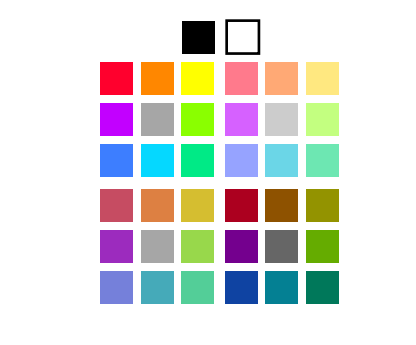
### CONCLUSION

The results suggest that associations from low-level musical stimuli to visual textures may be mediated by corresponding dimensions in particular perceptual and emotional qualities.



Listen to sounds

Evaluate emotional content and other features of the sound



Color-Music Association Task: People chose colors with matching emotional content

Texture-Sound Association Task: People chose textures with matching emotional content, and matching non-emotional audio-visual content

### REFERENCES

List of references including Griscorn, W., Palmer, S., (VSS-2013), Whiteford, K., Schloss, K., Palmer, S., (VSS-2013), Griscorn, W., Palmer, S., (VSS-2013), Palmer, S. E., Schloss, K., Bu, X., Xu, Z. & Prado-Leon, L., (2013).

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