# DOES SCARY MUSIC MIMIC BIOLOGICAL VOICE SIGNALS OF THREAT?

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# "**SCREAM-LIKE**" MUSIC IN SCARY FILMS



*Scream* (1996)

"… **SCREECHING**, UPWARD GLISSANDI…"
(BROWN, 1982, P. 46).



*Psycho* (1960)

# DO THESE SCARY FILM SOUNDTRACK EXCERPTS ***ACTUALLY*** SOUND LIKE HUMAN SCREAMS?



*The Babadook* (2014)

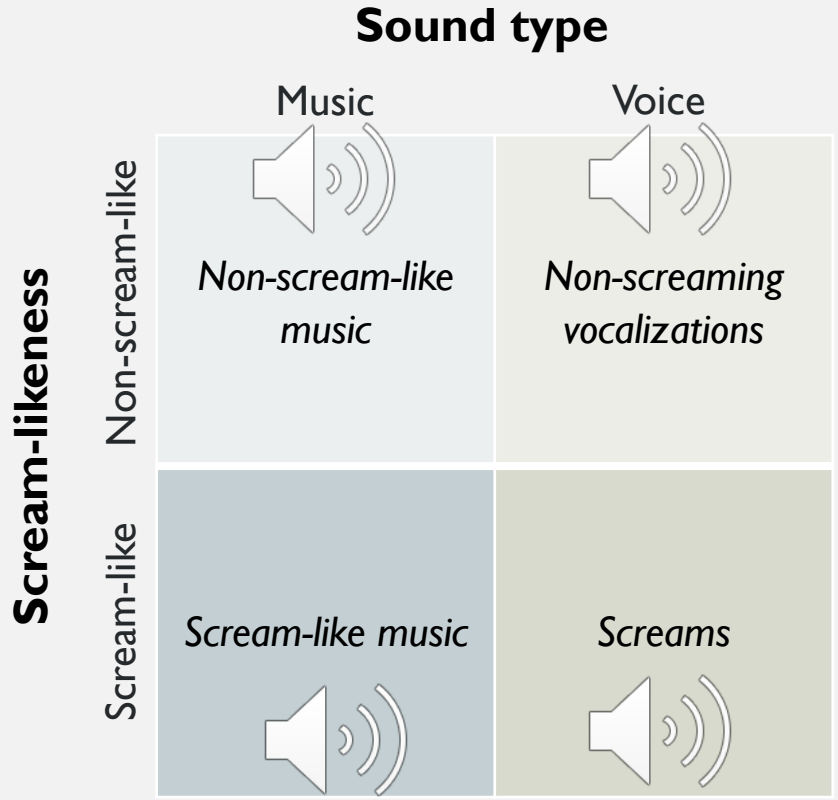
# AIM

To investigate how similarly musical imitations of vocal cues are perceived to the actual vocal cues they imitate by comparing the neural networks responding to a vocal cue (a scream) and its musical imitation (scream-like music).

# METHODOLOGY: PARTICIPANTS

- 32 healthy and non-musician participants from the University of Zürich (18 female, age: M = 27; SD = 5.46) took part in the fMRI study
- Received 60 CHF for their participation (2 hours)
- Procedure was approved by Cantonal Ethics Commission of Zurich, Switzerland

# METHODOLOGY: STIMULI




- Stimuli were RMS normalized, matched for arousal level & length (800ms), were in a wav-file format, and were categorized by affect (scream-like vs non-scream-like) and sound type (vocal vs musical) in a 2 × 2 factorial design.

# METHODOLOGY: DESIGN

Stimuli duration = 800ms
Inter-stimulus-interval = 4-5s

**Trials**
(80x /run)

Each trial takes ~ 5.5s

**Runs**
(6x)



Each run takes ~ 7min

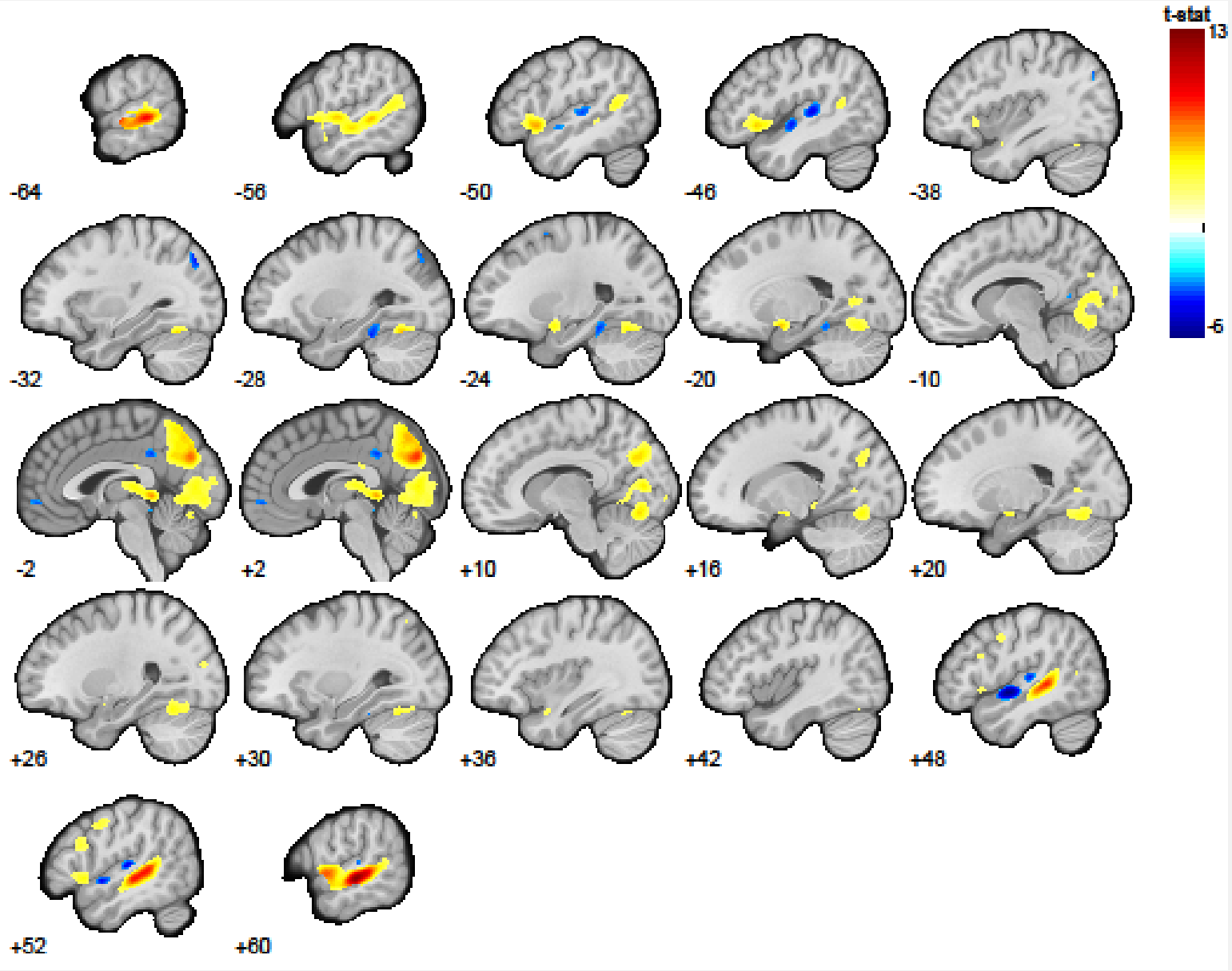
TR = 1.6s, TE = 30ms, voxel resolution = 3 x 3 x 3mm, 36 slices

Full duration: ~ 55min

# RESULTS

- SPM12 software to pre-process and analyze the neural response to the experimental conditions
- Main contrasts of interest:
  - voice > music
  - scream-like sounds > non-scream-like sounds
  - scream-like music > non-scream-like music
  - vocal screams > non-scream-like vocal sounds
  - interaction effect to compare screams > scream-like music

# VOICE > MUSIC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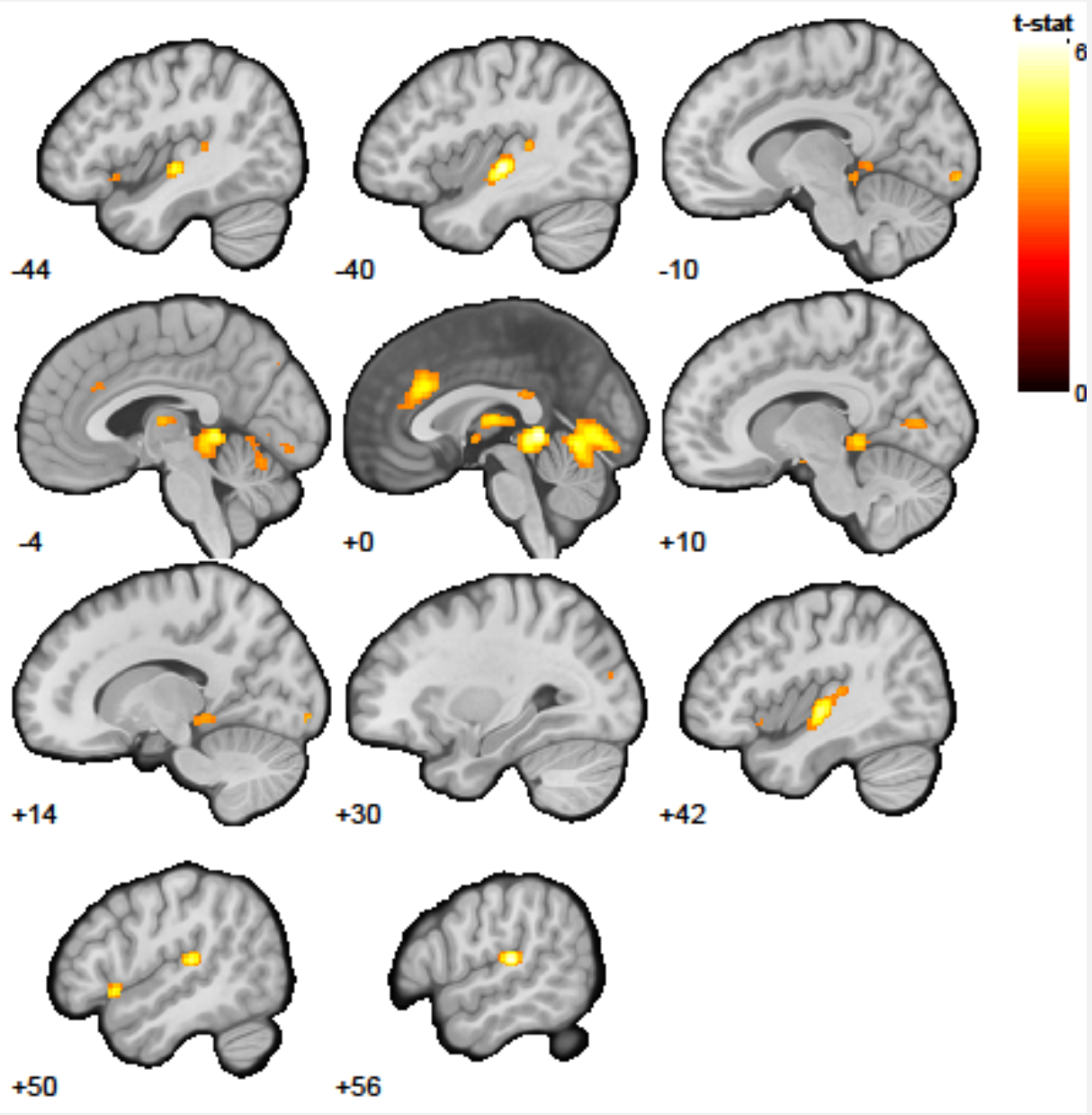
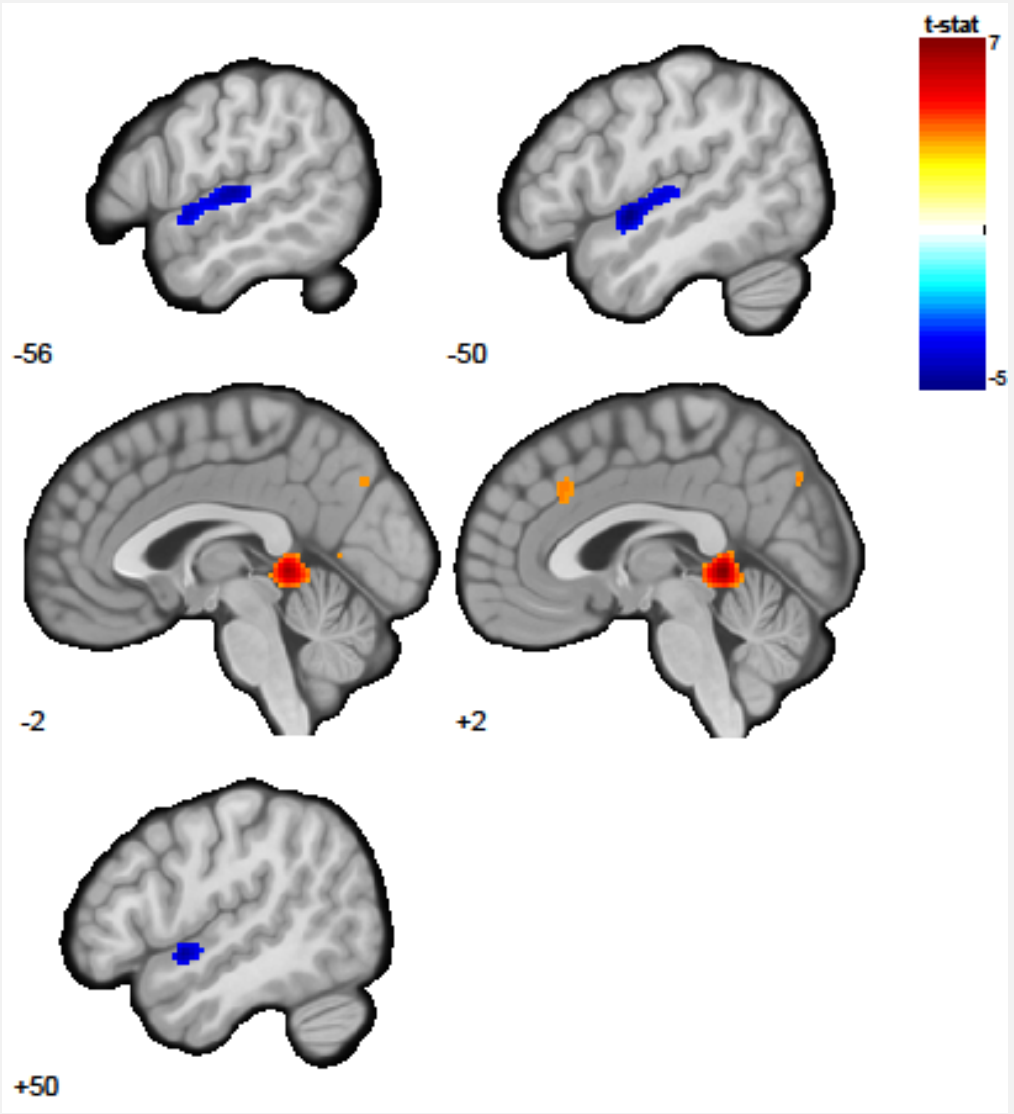
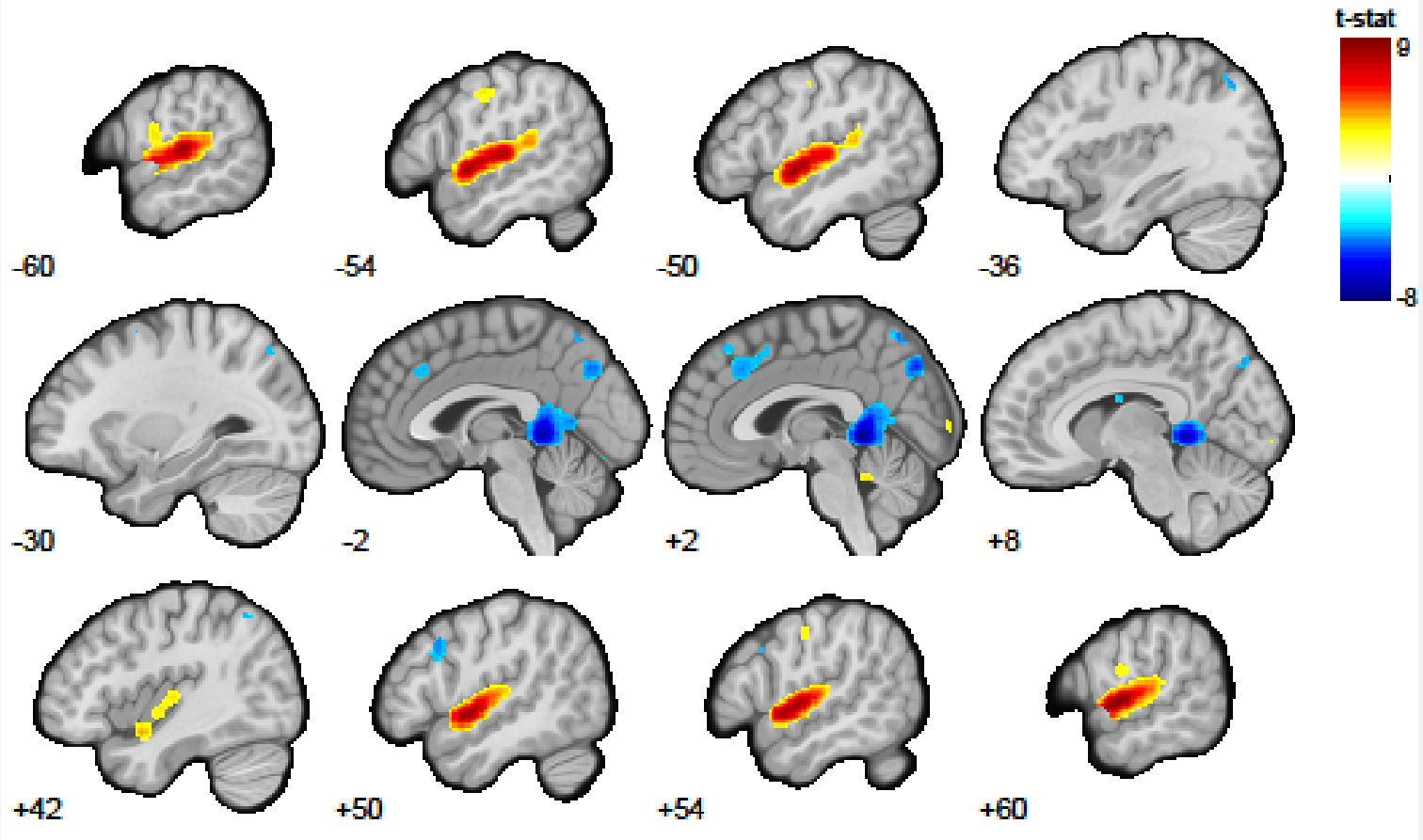
# SCREAM-LIKE > NON-SCREAM-LIKE




# SCREAM-LIKE MUSIC > NON-SCREAM-LIKE MUSIC



# SCREAMS > SCREAM-LIKE MUSIC



# CONCLUSIONS

- These results suggest that the original vocal cue is processed by lower-order areas of the brain, suggesting that it is potentially the more powerful or potent signal of the two (consistent with our previous findings in our JASA-EL publication).

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# REFERENCES


Brown, R. S. (1982). Herrmann, Hitchcock, and the Music of the Irrational. *Cinema Journal, 21*(2), 14.

Huron, David. "Cues and signals: An ethological approach to music-related emotion." Signata. Annales des sémiotiques/Annals of Semiotics 6 (2015): 331-351.

Juslin, P. N. & Sloboda, J. Handbook of Music and Emotion: Theory, Research, Applications. (Oxford University Press, 2011).

Juslin, P. N., & Laukka, P. (2003). Communication of emotions in vocal expression and music performance: Different channels, same code? Psychological Bulletin, 129(5), 770–814.

Lorenz, K. (1939). Vergleichende Verhaltensforschung. Zoologische Anzeiger, Supplement, 12, 69-102

Lorenz, K. (1970). Studies in Animal and Human Behaviour, Vol. 1. London: Methuen.

Ohala, J. J. Ethological theory and the expression of emotion in the voice. in Fourth International Conference on Spoken Language Proceedings 3,1812–1815 (IEEE, 1996).

Trevor, C., Arnal, L., & Frühholz, S. (2020). Terrifying film music mimics alarming acoustic feature of human screams. The Journal of the Acoustical Society of America, 147(6), EL540–EL545.