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Background

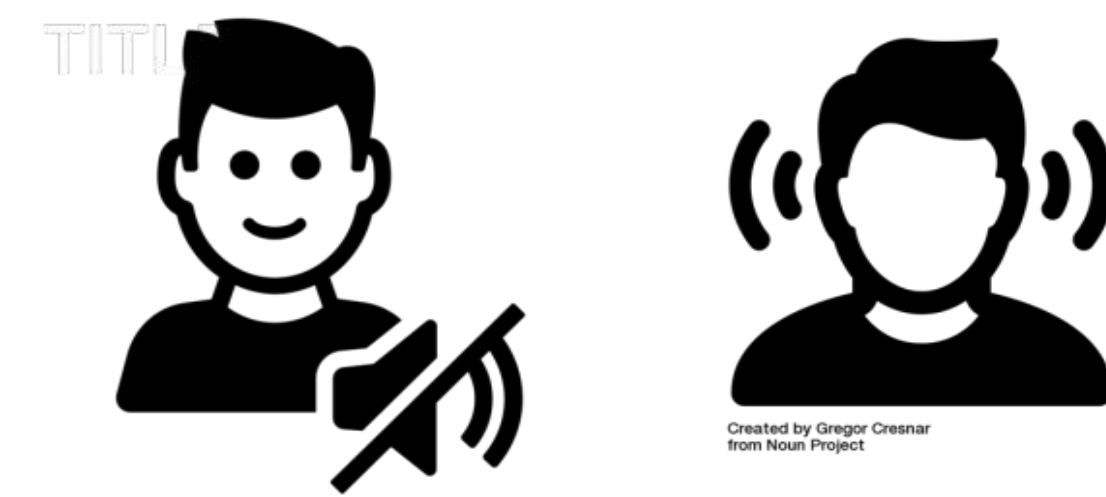
- **Deaf Gain:** “The unique cognitive, creative, and cultural gains manifested through deaf ways of being in the world”... (Dirksen, Bauman & Murry, 2014)
- Deaf Gain demonstrated through heightened performance on attentionally-demanding visual tasks, accompanied by reorganization of multisensory cortices (Bavelier, D., Dye, M. W., & Hauser, 2006)
- Although, most research examining deaf gain has focused on visual processing, some research has shown heightened response in auditory cortices to **vibrotactile** speech stimuli (Auer et al., 2007)
- **Beat perception:** The ability to perceive an isochronous pulse underlying a musical rhythm.
- Recent research has demonstrated vibrotactile beat perception in hearing individuals through the entrainment of neural oscillations (Gilmore & Russo, 2021)
- Is it possible that individuals who are deaf show enhanced beat perception to vibrotactile rhythms relative to hearing individuals?

Research Questions

1. Does beat perception to vibrotactile rhythms differ between participants with normal hearing and those who are deaf?
2. Are individuals who are deaf able to perceive a beat in temporally complex vibrotactile rhythms?

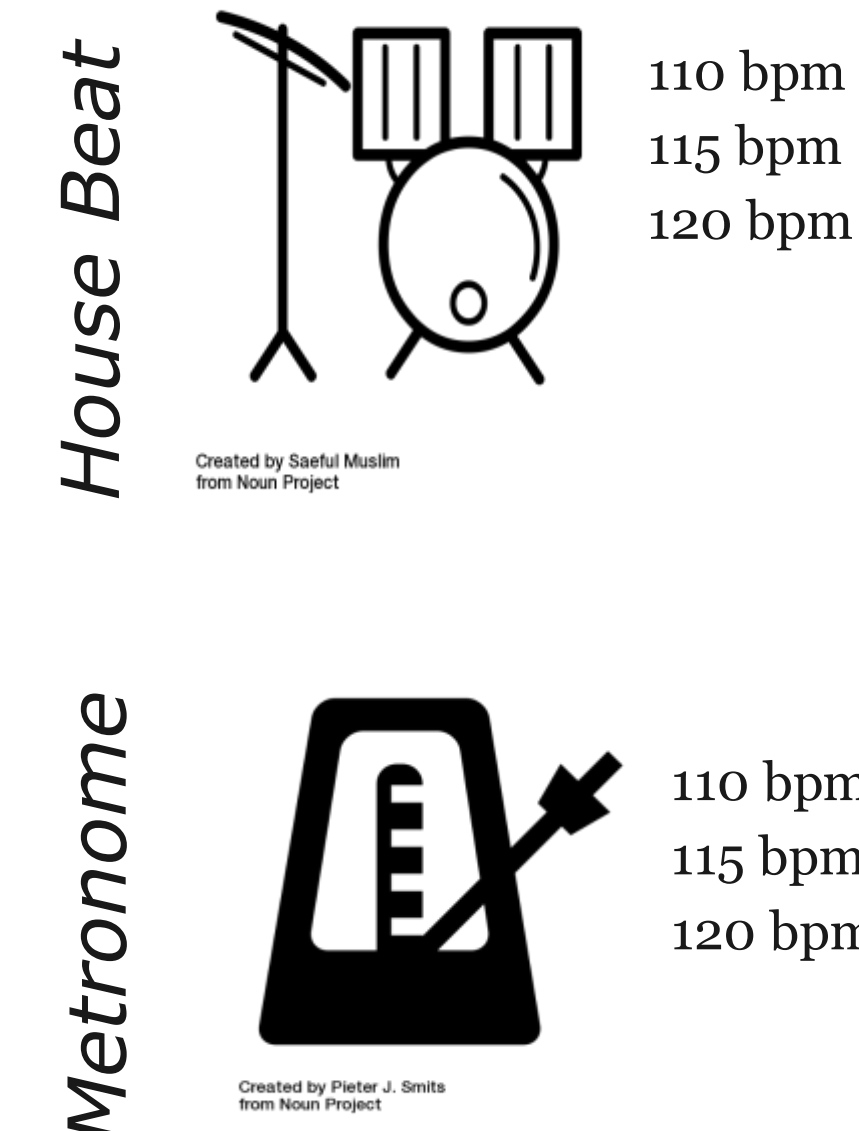
Methods

Sample



N = 32
 • 14 hearing
 • 18 deaf
 -all fluent in ASL
 -all deaf since childhood
 -all profoundly deaf
 -1 Cochlear implant/5 occasional hearing aid users

Stimuli



Setup

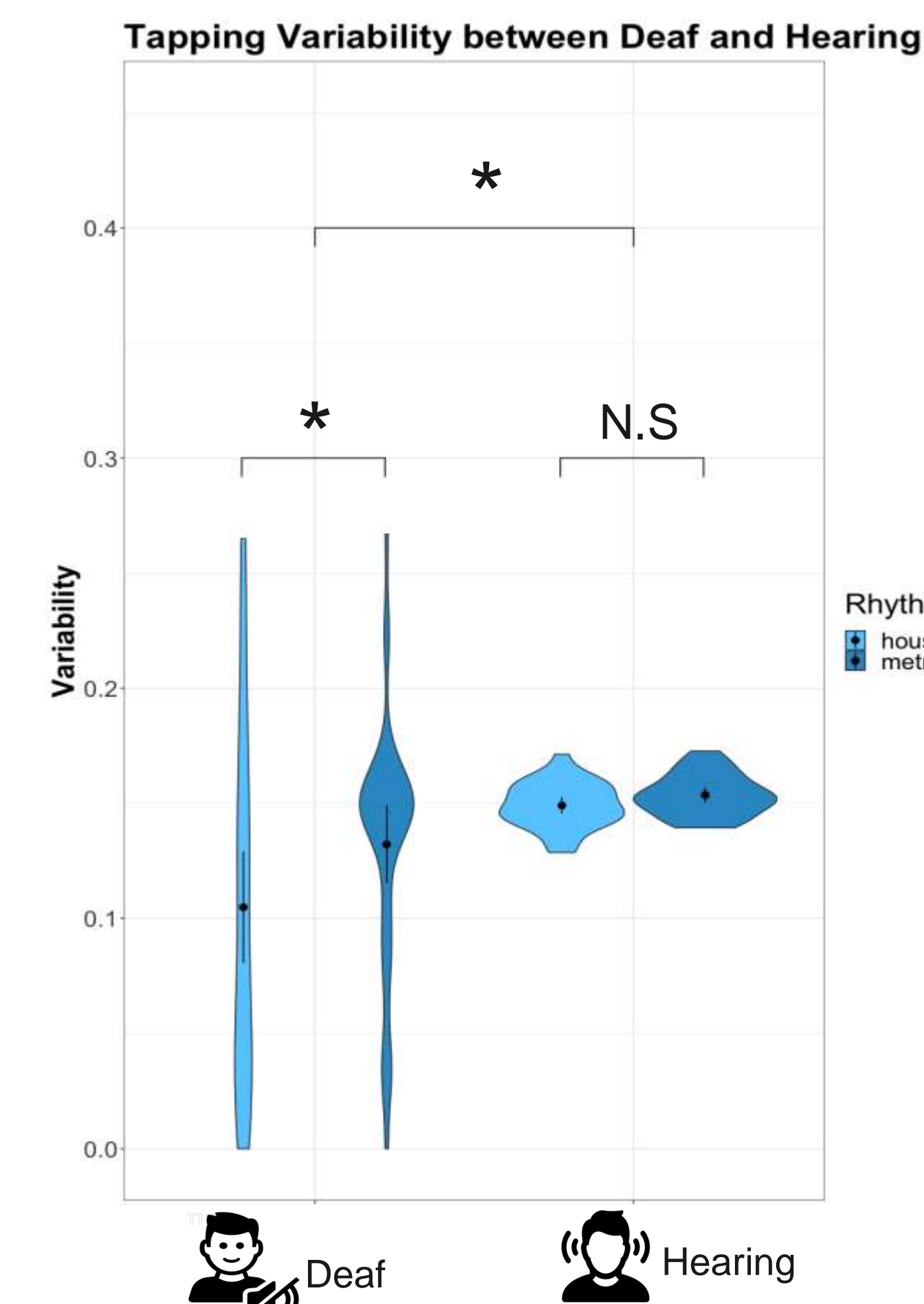


Analysis

- Tapping → Mean Asynchrony → Tapping Variability → MLM model
- EEG → Preprocessing → ICA → Entrainment Across all electrodes → MLM model

Results

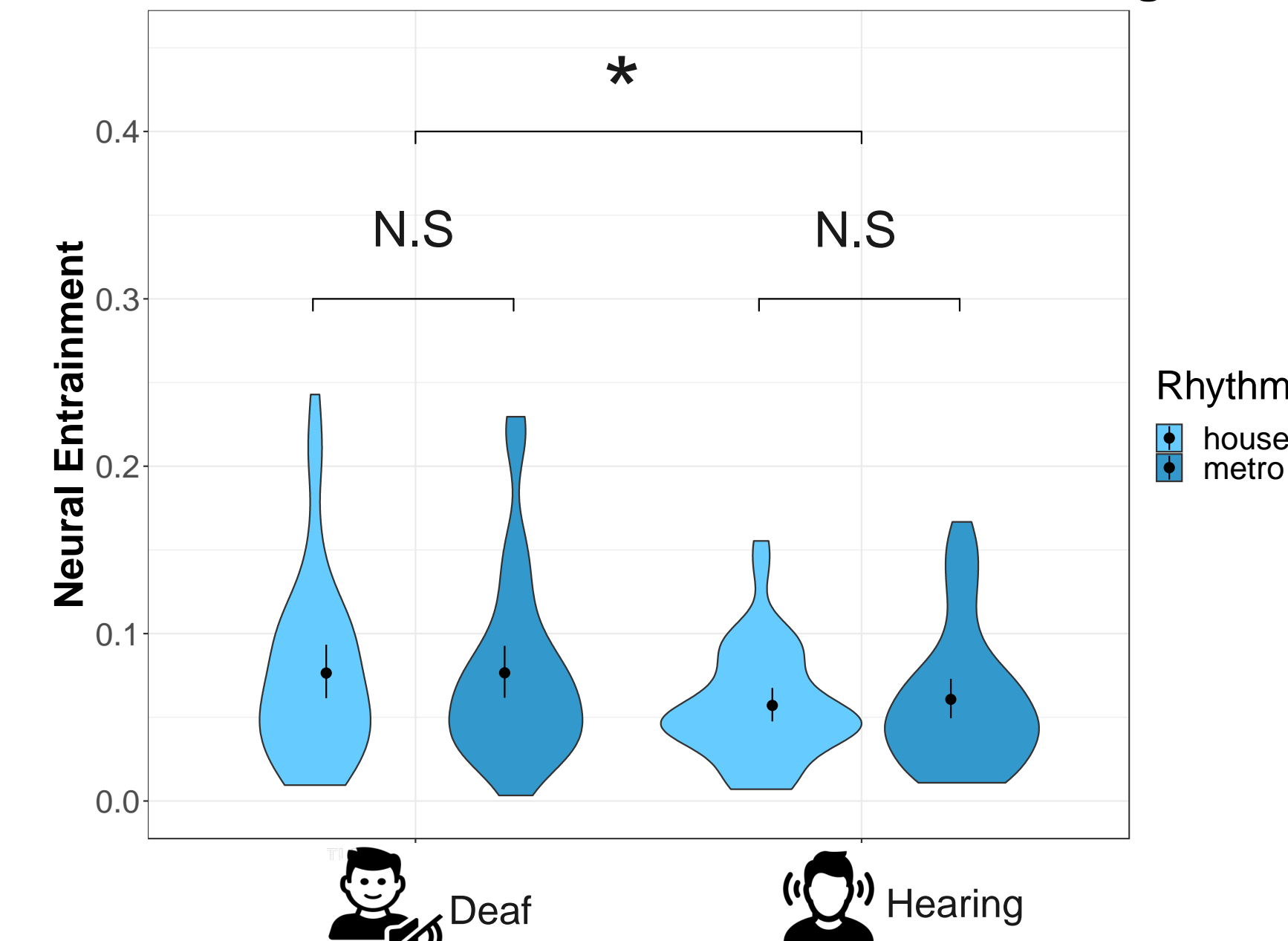
Tapping



EEG



Neural Entrainment across Deaf and Hearing



Discussion

- We found **enhanced ability to tap and higher neural entrainment to vibrotactile rhythms in individuals who are deaf** suggesting heightened vibrotactile beat perception of in deaf individuals
- These results are possibly explained by **compensatory plasticity in auditory cortices** leading to enhanced temporal processing of vibrotactile stimuli in individuals who are deaf

Future Directions

- Examine functional changes in brain activity using concurrent EEG-fNIRS
- Examine the role of experience and exposure to vibrotactile rhythms in vibrotactile beat perception

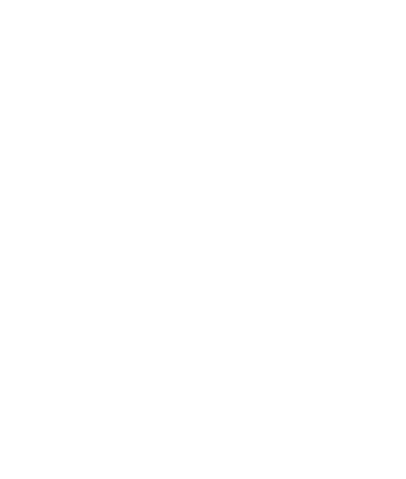
References

1. Bauman, H. D. L., & Murray, J. J. (Eds.). (2014). Deaf gain: Raising the stakes for human diversity. U of Minnesota Press.
2. Bavelier, D., Dye, M. W., & Hauser, P. C. (2006). Do deaf individuals see better?. *Trends in cognitive sciences*, 10(11), 512-518.
3. Auer Jr, E. T., Bernstein, L. E., Sungkarat, W., & Singh, M. (2007). Vibrotactile activation of the auditory cortices in deaf versus hearing adults. *Neuroreport*, 18(7), 645.
4. Gilmore, S. A., & Russo, F. A. (2021). Neural and Behavioral Evidence for Vibrotactile Beat Perception and Bimodal Enhancement. *Journal of Cognitive Neuroscience*, 33(4), 635-650.

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