

Hand Proximity Influences Audition

Kendra C. Smith & Richard A. Abrams
Washington University in St. Louis

Background

- Previous studies have shown altered visual processing in the near-hand space.^{1,2}
- We wanted to determine if auditory processing is also altered near the hands.
- Specifically, we examined pitch discrimination, loudness discrimination, and localization.

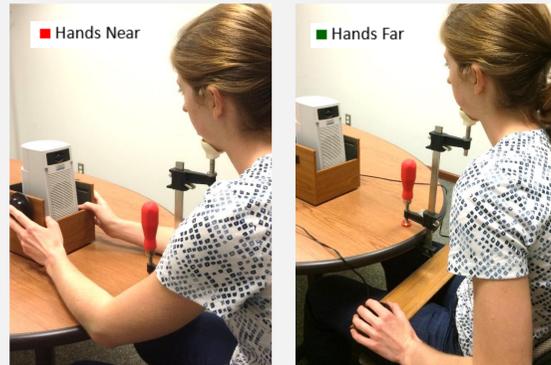
Research Questions

- Does hand proximity affect pitch discrimination, loudness discrimination, or auditory localization?
- Are there tradeoffs in auditory processing in the near hand space?

Experiment 1

Does hand proximity influence pitch discrimination?

- An audio speaker produced a 350 ms tone (between 110 and 220 Hz), followed by a 6 s delay, then another 350 ms tone
- Sometimes the tones differed in pitch
- Task: Participants indicated “same” or “different” with buttons either beside the speaker or on their lap



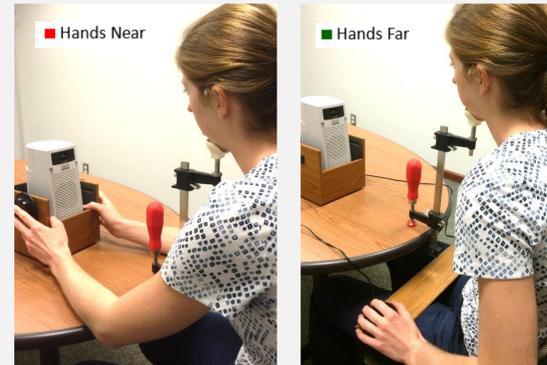
Participants were **more accurate** at pitch discrimination when their hands were **far** from the stimuli ($M = 84.74$, $SD = 11.58$) than when their hands were **near** ($M = 82.07$, $SD = 9.53$), $t(29) = 2.13$, $p = .04$.



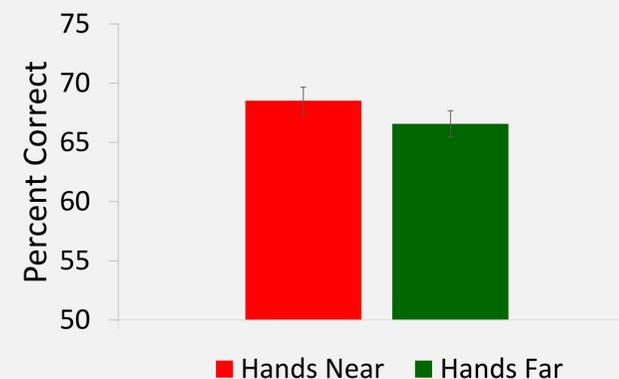
Experiment 2

Does hand proximity influence loudness discrimination?

- An audio speaker produced a 350 ms 500 Hz tone (SPL between 68 dBA and 73 dBA), followed by a 6 s delay, then another 350 ms 500 Hz tone
- Sometimes the tones differed in loudness
- Task: Participants indicated “same” or “different” with buttons either beside the speaker or on their lap



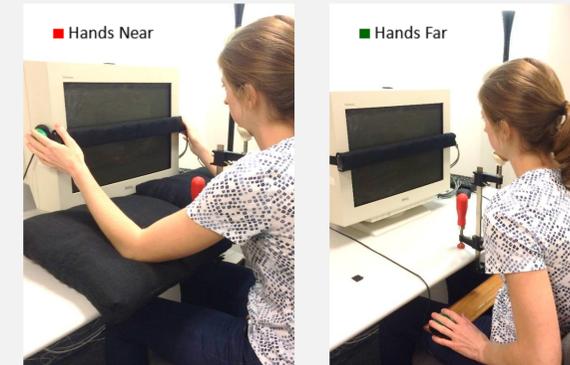
Loudness discrimination did not differ between the hands far condition ($M = 66.89$, $SD = 6.41$) and the hands near condition ($M = 69.02$, $SD = 6.55$), $t(32) = 1.61$, $p = .12$.



Experiment 3

Does hand proximity influence localization?

- One element in an array of magnetic buzzers produced a tone (2.3 kHz), followed by a 6 s delay, then another tone
- Sometimes the tones came from different locations
- Task: Participants indicated “same” or “different” with buttons either beside the buzzer array or on their lap



Participants were **more accurate** at localization when their hands were **near** the source of the sounds ($M = 74.09$, $SD = 11.16$) than when their hands were **far** from the sounds ($M = 71.08$, $SD = 10.60$), $t(27) = 1.70$, $p = .04$.



Conclusion

- Hand proximity does influence audition
- Pitch discrimination was impaired near the hands while localization was improved
- The results reveal a tradeoff in auditory processing in the space near the hands, as observed for visual stimuli
- These findings may reflect the contributions of multi-modal mechanisms in the near hand space

References

1. Abrams, R. A., Davoli, C. C., Du, F., Knapp, W. H., & Paul, D. (2008). Altered vision near the hands. *Cognition*, 107, 1035–47.
2. Reed, C. L., Grubb, J. D., & Steele, C. (2006). Hands up: Attentional prioritization of space near the hand. *Journal of Experimental Psychology: Human Perception and Performance*, 32, 166–77.

Acknowledgements

Thank you to the Washington University in St. Louis Department of Psychological & Brain Sciences for providing funding for participant payments and conference travel.