Improving sound discrimination through Gestalt binding of inharmonic frequencies

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Introduction

- Sound detection and discrimination is fundamental to perceiving the surrounding environment.
- Inharmonic frequencies are particularly attention grabbing, and conductive to detectability (Bonin & Smilek, 2016; McPherson et al., 2022).
- Adding inharmonic frequencies to simple tones could form a partial Gestalt binding through duplex perception (Liberman et al., 1981; Moore et al., 1985)
- This research aims to test whether adding high, inharmonic frequencies to sounds will improve their discriminability in noise.

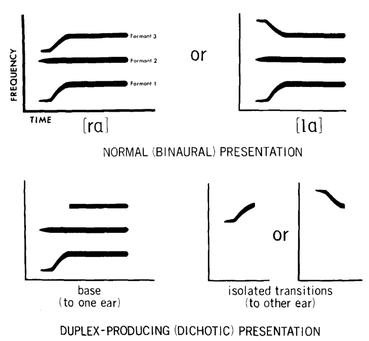

Figure 1: Duplex perception example from Liberman et al. (1981)

Stimuli

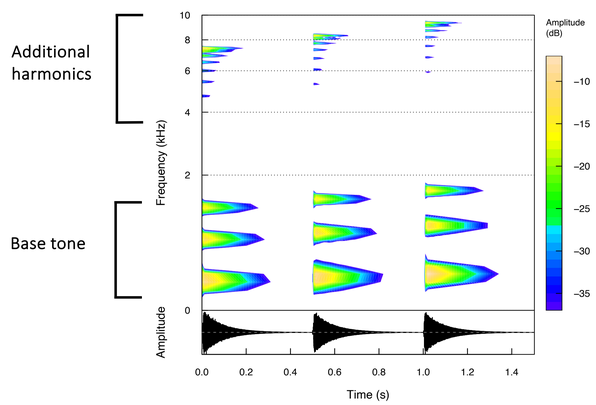

Figure 2: Sound example

Method

- 60 McMaster students recruited online.
- Listened to sounds during speech noise.
- Ascending or descending?
- Absent, tracking, or stationary additional harmonics
- Six signal-to-noise ratios.

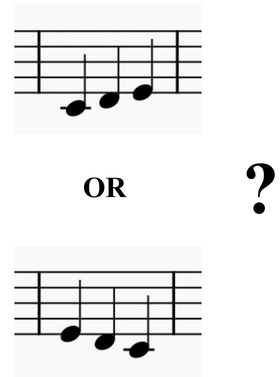

Figure 3: Participants hear one of two melodic sequences

Results

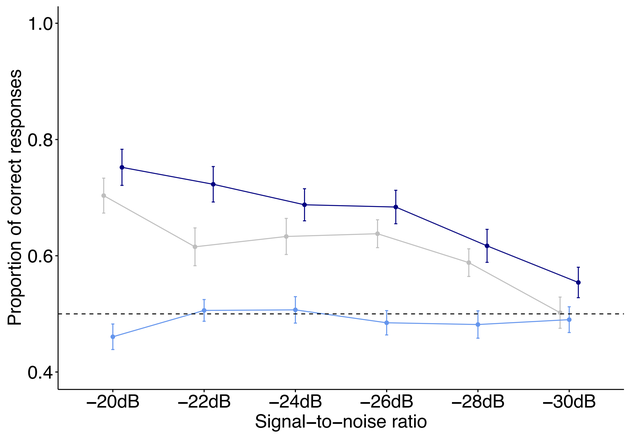

Figure 4: Mean accuracy at each level of signal-to-noise ratio, with and without higher harmonics. Dashed line is chance performance.

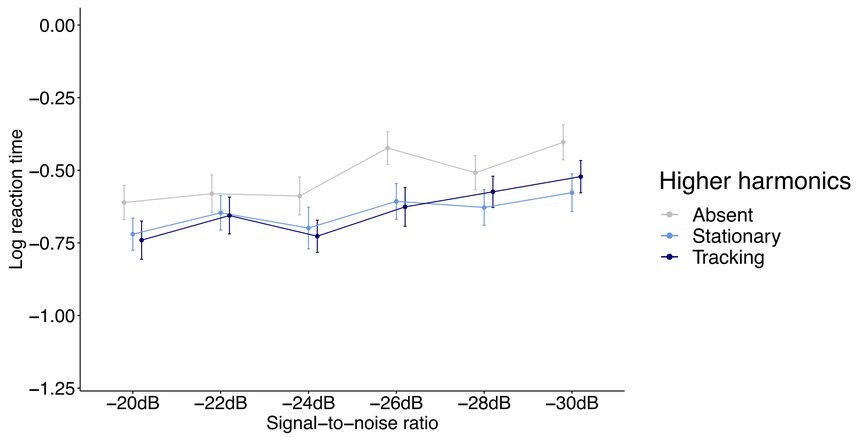

Figure 5: Mean log reaction time at each level of signal-to-noise ratio, with and without higher harmonics.

Conclusions

- The higher harmonics are detected faster compared to the base sequence.
- Improvements to discrimination accuracy are context specific.
- Higher harmonics must be congruent to improve accuracy, otherwise they are detrimental to performance.
- Why did the stationary higher harmonics lead to chance level performance?

Acknowledgements

Thank you to Andres Elizondo Lopez, Cameron Anderson, Max Delle Grazie, and the rest of the MAPLE Lab for their help and contributions to the project. Funding provided by NSERC and CFI.

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