

Assessing the relationship between rhythmic ability and perception of non-native speech contrasts using hierarchical drift diffusion modeling

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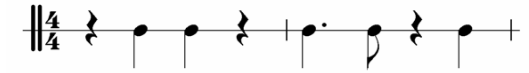
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Research Questions

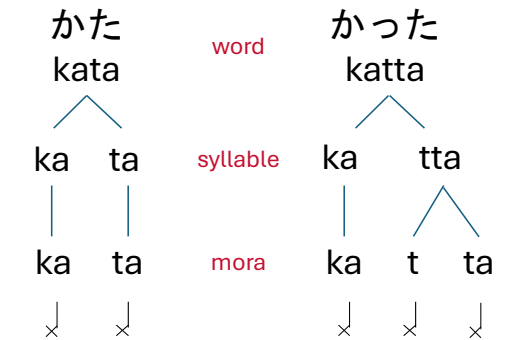
- 1) How is musical rhythmic ability related to perception of non-native (duration-based) speech contrasts? (Ongoing work – see [1])
- 2) To what extent do underlying individual differences in rhythmic ability affect decision-making in terms of drift rate (speed), threshold (boundary separation), and bias within a hierarchical drift diffusion model?

Background

Musical rhythm



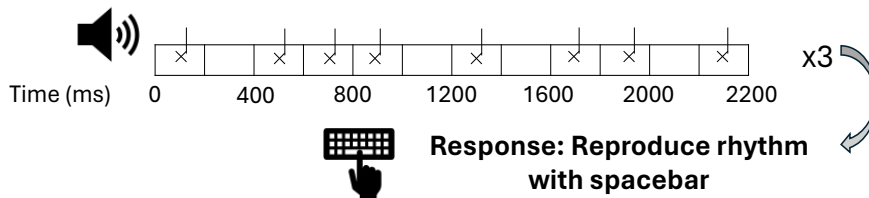
Japanese consonant length contrast



Tasks

(Order counterbalanced)

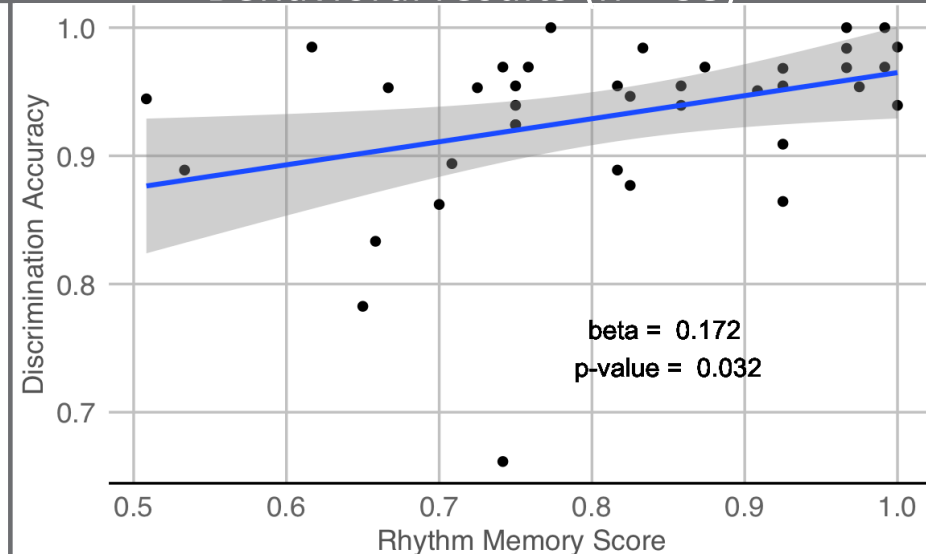
Auditory-motor rhythm memory task (13 different rhythms) [2]



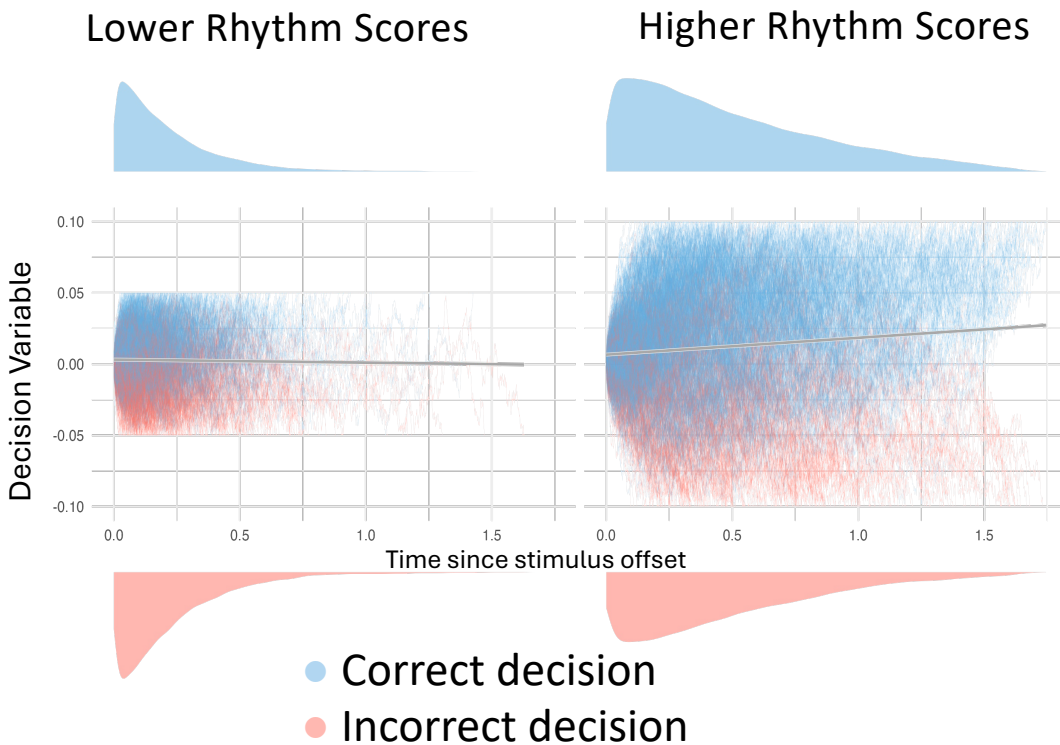
Speeded AX discrimination of Japanese speech (33 pairs, repeated 2x) Stimuli from [3]



Behavioral results (n = 38)



Hierarchical drift diffusion modeling (HDDM)



Drift rates are equivalent but:

- Higher rhythm scores (right) - **higher** decision thresholds, which leads to longer decision times but **more accurate** responses.
- Lower rhythm scores (left) - **lower** decision thresholds, which leads to shorter decision times but **less accurate** responses.
- **Interpretation:** having better musical rhythm enables listeners to listen more carefully, take more time, and accumulate more evidence to make the correct discrimination decision

Potential implications for assessment

More research in listening assessment to understand bottom-up, lower-level processes: HDDMs help us understand how listeners make decisions during speech perception.

Placement tests/needs assessment: Assessing musical skills can be a simple way to assess baseline perceptual skills and give students individualized training with perception of difficult phonemes based on need.

Sources

- [1] Bramlett, A. A., Brown, B., Dueck, J., & Wiener, S. (2024). Measuring music and prosody: Accounting for variation in non-native speech discrimination with working memory, specialized music skills, and music background. *Proceedings of Speech Prosody 2024*, 482–486.
- [2] Kachlicka, M., Saito, K., & Tierney, A. (2019). Successful second language learning is tied to robust domain-general auditory processing and stable neural representation of sound. *Brain and Language*, 192, 15–24.
- [3] Tsukada, K., Cox, F., Hajek, J., & Hirata, Y. (2018). Non-native Japanese learners' perception of consonant length in Japanese and Italian. *Second Language Research*, 34(2), 179–200.