

Visual attention of infants in early interactions:

Comparing early processing of music and language



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- Infants synchronize eye-looking gaze and track the rhythm of infant-directed singing differently from speech
- Two-stage development pattern: (1) an early processing of music and speech similarly, and (2) a subsequent differentiation

BACKGROUND

- Development of auditory and musical skills during prenatal development: melody processing (Hepper, 1991), voice recognition (Hepper et al., 1993), and rhythm processing (Edalati et al., 2023)
- Two-month infants synchronize their eye-looking to the rhythm of infant-directed (ID) singing (Lense et al., 2022)
- Rhythm also structures caregivers' cueing, enhancing their visual display of social-communicative content

AIMS & HYPOTHESES

A. Does ID speaking lead infants to synchronize their gaze and track its temporal structure?

- Infants might be sensitive to the rhythmic structure of **speech**, even in non-native languages: **stress-timed** (e.g., English) vs. **syllable-timed** languages (e.g., Spanish)

B. Are the developmental trajectories of music and speech processing different?

- **Longitudinal design:** 4, 6, and 12 months old
- Predicted shift after 6 months: more pronounced gaze synchronization and tracking for ID singing but reversed for ID speech, especially with native languages

METHOD

Participants & Materials

- Canadian infants ($n = 26$)
- **Eye-tracker task** while watching videos of actresses **singing** and **speaking** in an ID way, in **English** and **Spanish**
- Blocks of 5 videos each: types $\times$ languages (ID song/speech $\times$ English/Spanish) + interlude



RESULTS

Proportion of total time looking

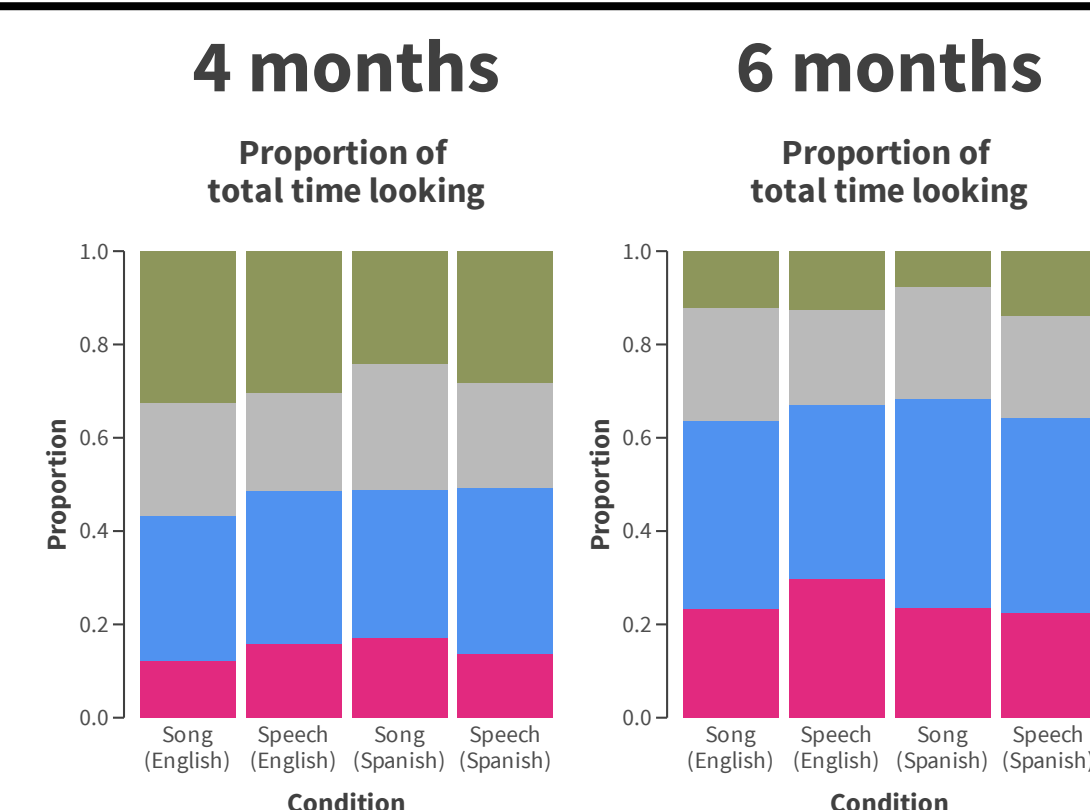
Mouth progressively attracts more attention, especially with speech in the native language

At 4 months

- Overall preference to look at the **eyes** over the mouth, body, and background

At 6 months

- Increase in the time looking at the **eyes** and, more pronouncedly, to the mouth at 6 months
- Less eye looking with **speech**, and especially in **English**



DISCUSSION

The rhythm in language

At 4 months, infants showed a pattern of eye-looking synchronization with ID speech similar to ID music. It indicates rhythm processing with language at that age and its use in visual social information.

Singing vs. speaking

At 6 months, the synchronization to the accents in ID language disappeared, indicating its discrimination from ID music.

A rhythmic exploration

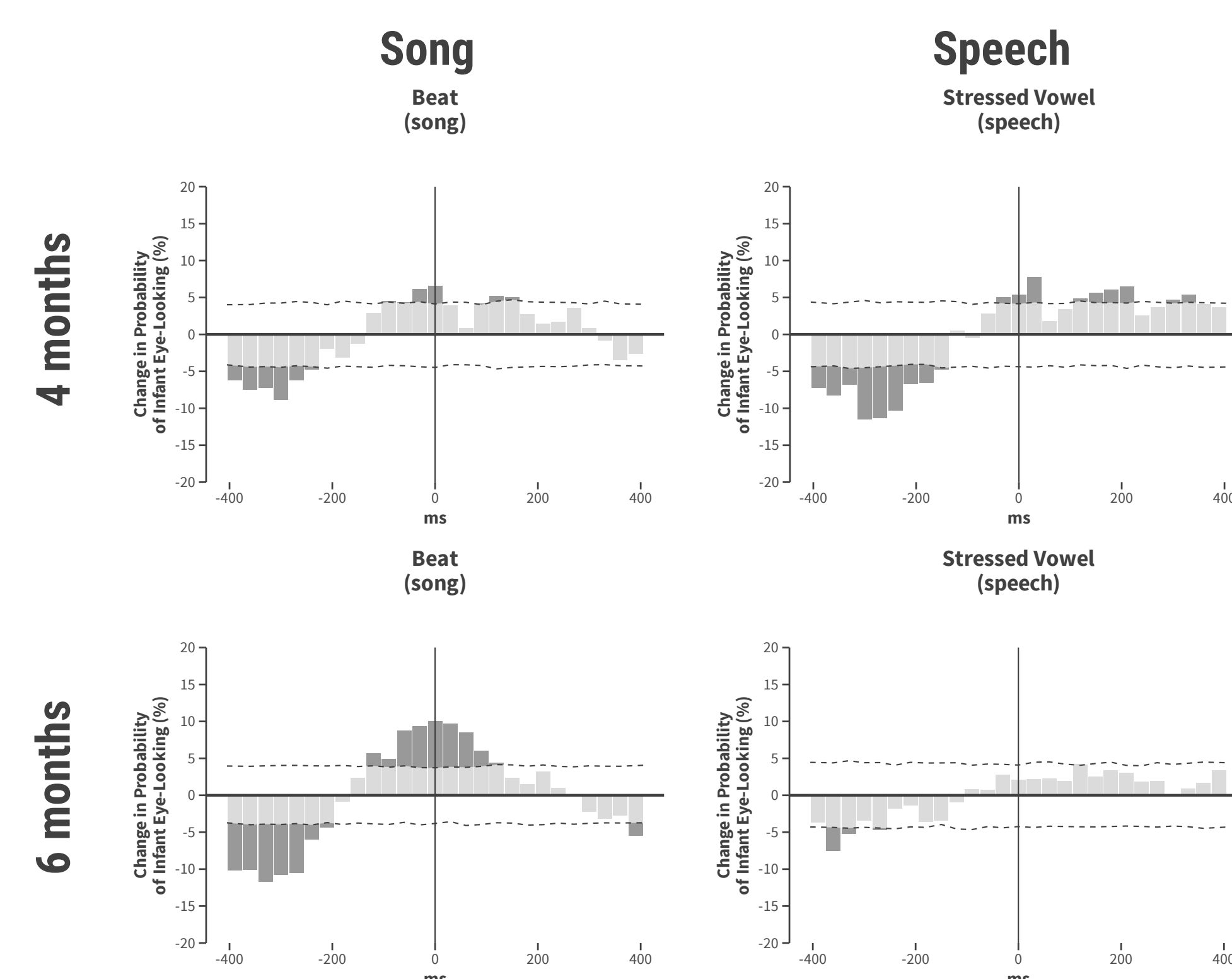
Infants showed a rhythmic pattern exploring faces in synchrony with the metrical structure of ID songs and speech. They looked more at the eyes, a region of the face key for socio-affective learning.

REFERENCES

Edalati et al. (2023). *Journal of Neuroscience*. <https://doi.org/10.1523/JNEUROSCI.1100-22.2023>
Hepper (1991). *Irish Journal of Psychology*. <https://doi.org/10.1080/03033910.1991.10557830>
Hepper et al. (1993). *Journal of Reproductive and Infant Psychology*. <https://doi.org/10.1080/02646839308403210>
Lense et al. (2022). *PNAS*. <https://doi.org/10.1073/pnas.2116967119>

Peristimulus time histogram

Infants synchronize their eye-looking gaze to the rhythm ID singing and speech

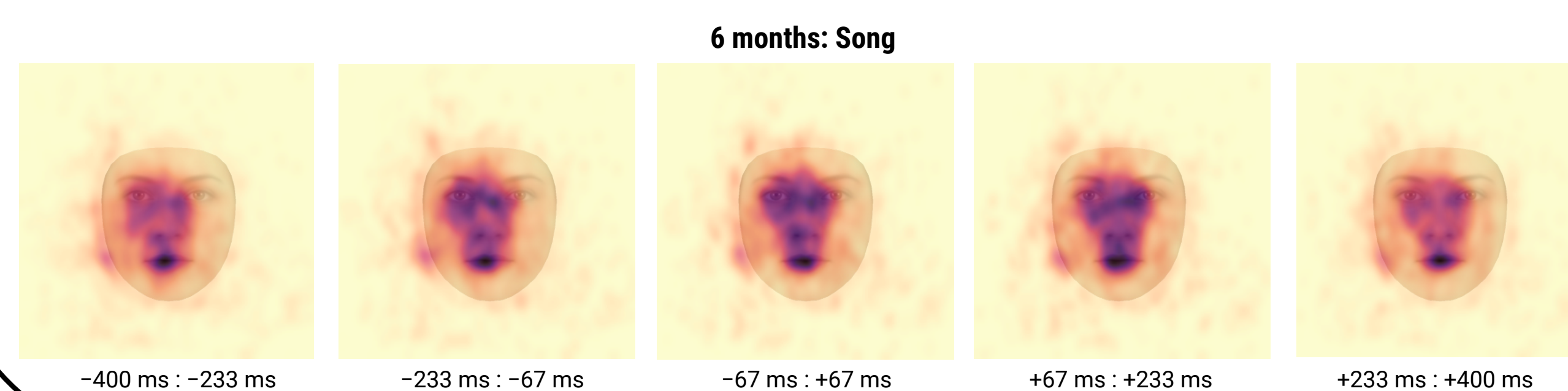


At 4 months

- Similar pattern of eye-looking entrainment with ID music and speech

At 6 months

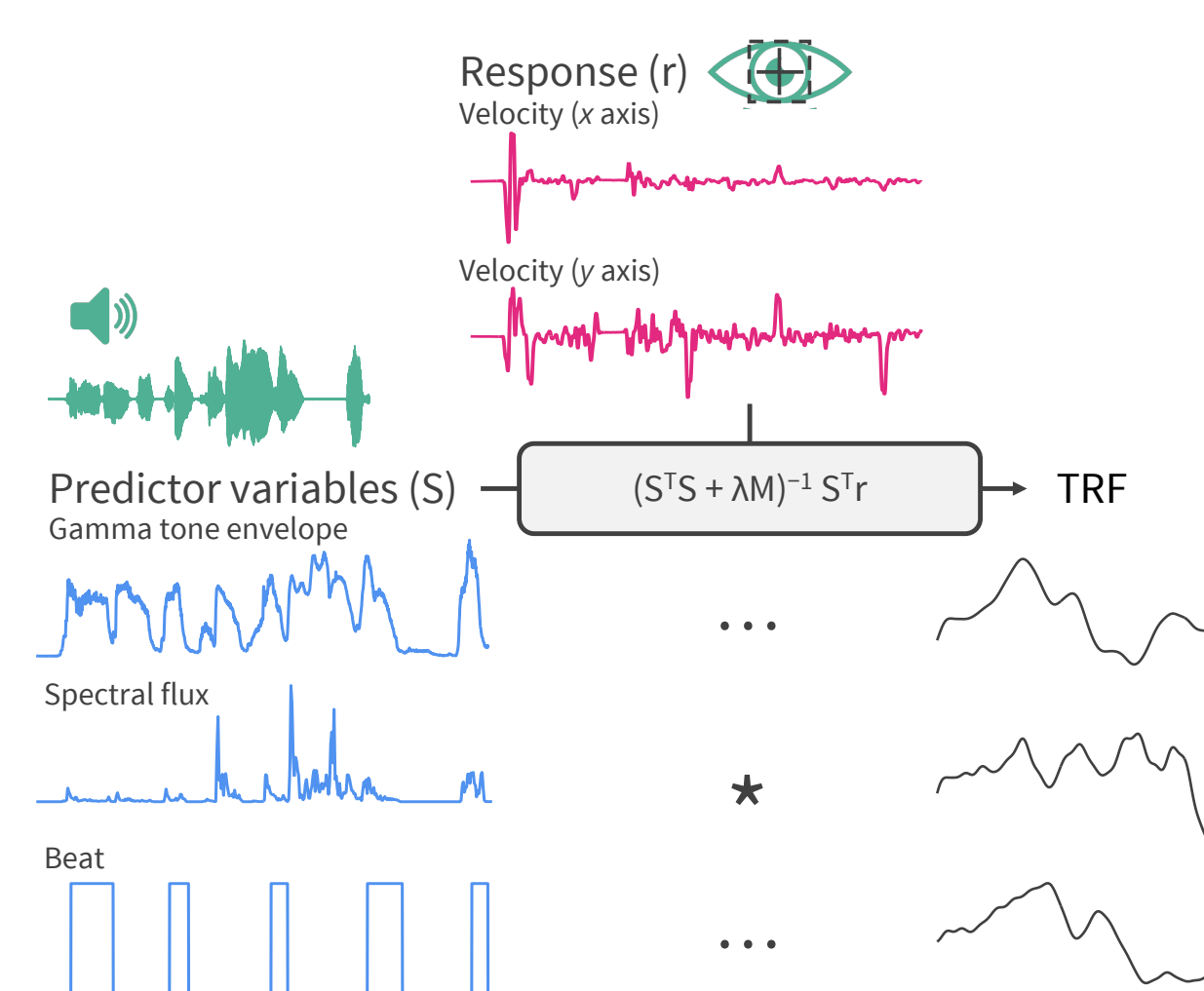
- More pronounced eye-looking entrainment with ID songs but no synchronization with ID speech



Temporal Response Function (TRF)

Continuous oculomotor tracking of stressed moments in ID songs and speech

Predict oculomotor tracking from the auditory input via TRF



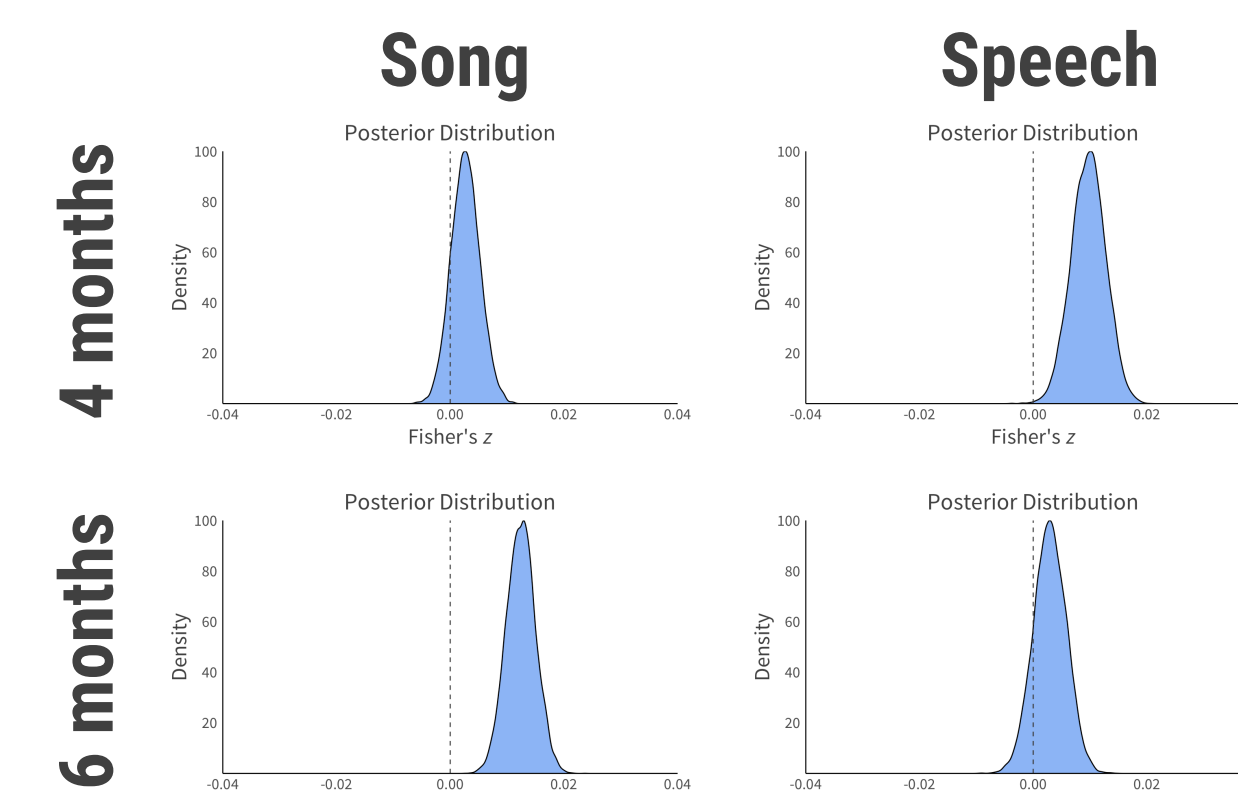
At 4 months

- Oculomotor tracking to the accents in ID music and speech

At 6 months

- More pronounced oculomotor tracking with ID songs but not with ID speech
- TRF weights predicted upward movements in response to the beat

Model's prediction accuracy (values > 0: sign. prediction)



Model's weights (values $\neq$ 0: changes in velocity)

