

# The use of blink timing as a prosodic communicative marker in infant-directed singing interactions

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## Abstract

- Infant-directed singing is a universal form of social communication between a parent and their young child (Trehub, 1997).
- During infant-directed singing, parents accompany their vocal singing with emotional facial expressions, communicative gestures, and physical movements (Trehub & Russo, 2020).
- Prior work in the lab indicates that the rhythmic beats of infant-directed singing entrains infants' visual behavior, however, less work has considered how parents structure their visual social communicative cues when singing to their infants.
- In the current study, we consider one specific cue, the timing of parents' blinking when singing. When a speaker blinks, they lose access to the visual world around them, as well as block the listener's access to the information expressed by the speaker's eyes (Shultz 2011).
- Here we investigate the frequency and timing of parents' blinking during singing interactions with their infant. We hypothesize that parents will time their blinks to inhibit blinking at the beats of the songs in order to optimize their use of social communicative cues (eye gaze) at rhythmically meaningful moments.

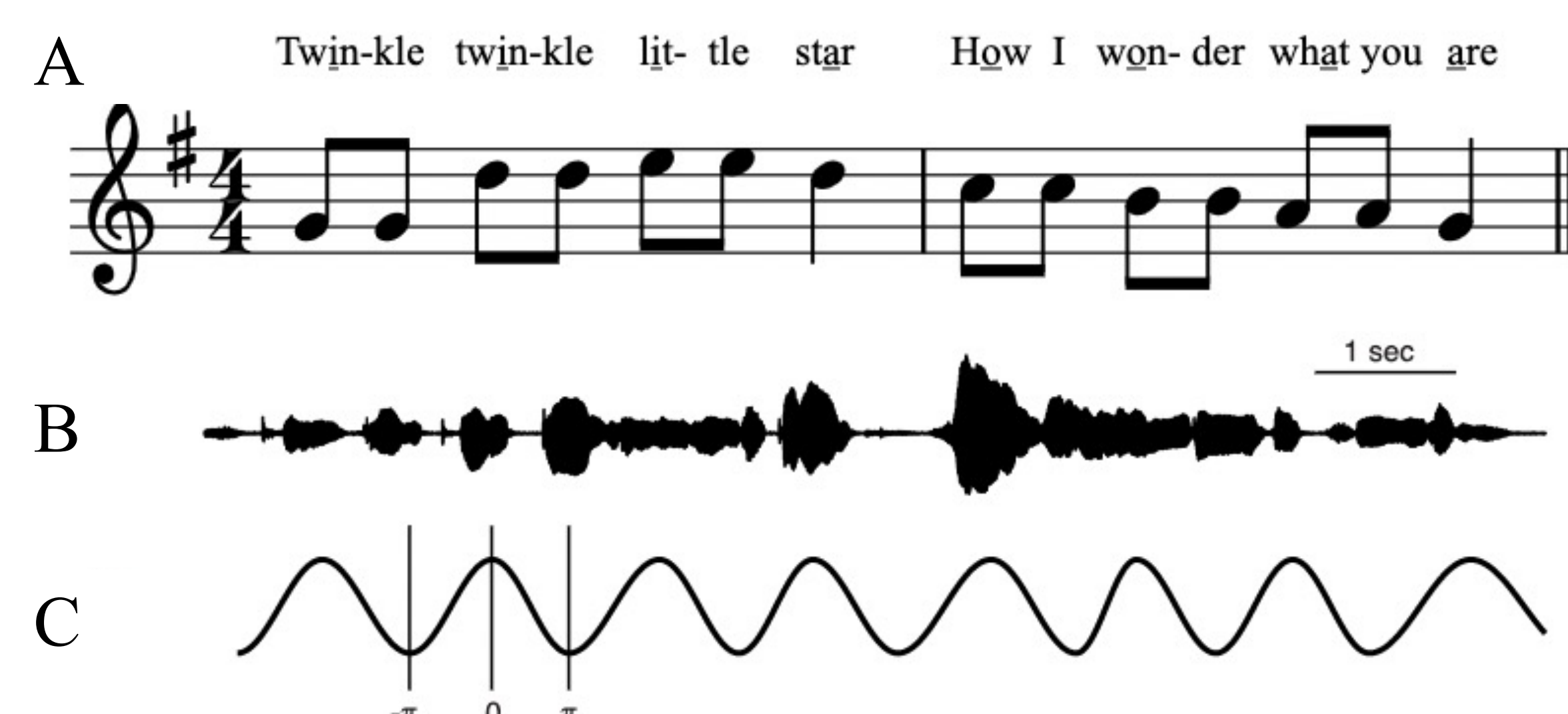
## Methods

- Participants included 14 parent-infant dyads of 9-month-old-infants.
- Parents were instructed to sing naturally to their child like they did at home.
- Parents sang an average of 2 songs to their infants.
- The timing of beats and blinks were manually coded from audio and video files.
- Peristimulus time histograms were used to analyze the alignment of the blinks and the metrically strong beats.

**Image 1: Video still of a participant singing to their infant**



**Figure 1:** Lyrics and musical notation for the first two phrases of "Twinkle Twinkle, Little Star" (A); Audio amplitude waveform for the song (B); Schematic sine wave with peaks aligned to the beat of the audio as sung (C)

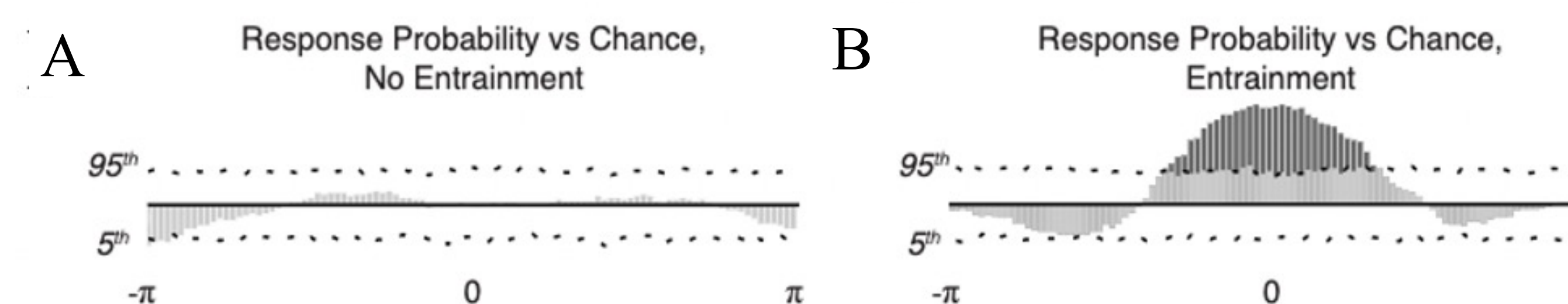


## Results

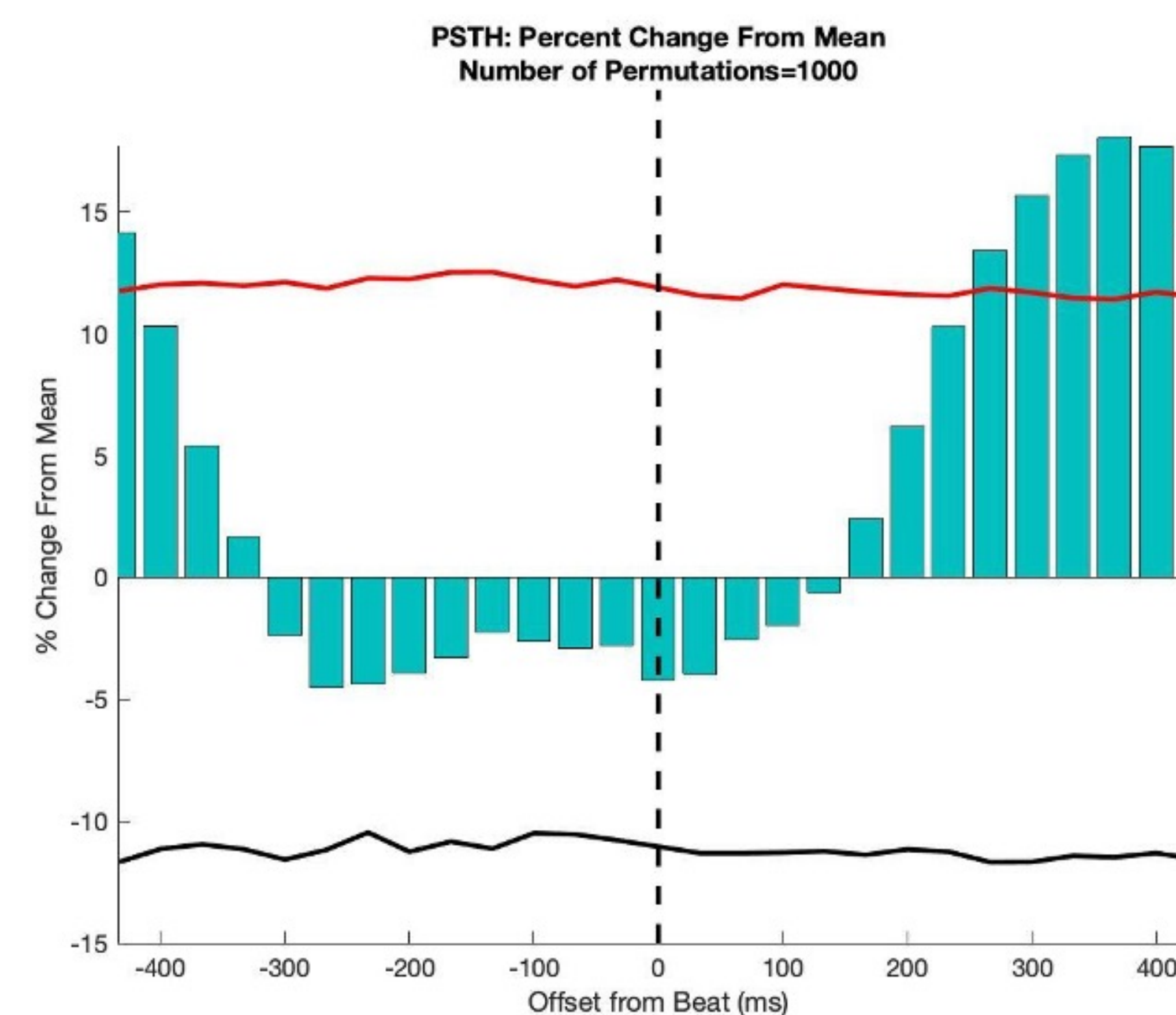
**Table 1: Blink & Song Related Information**

	Mean (SD)
Number of Blinks (per video)	26.5 (20.4)
Blink Rate (blinks/minute)	18.2 (9.9)
Duration of Singing (seconds)	81.8 (33.4)
Tempo of Singing (inter-onset interval of beats; ms)	422.9
Coefficient of Variation of Inter-Onset Intervals (temporal stability)	11.0%

**Figure 2:** Example peristimulus time histograms summarizing raster data for archetypal response that are either unaligned (A) or aligned (B) with the beat



**Figure 3:** Peristimulus time histogram for the parent sample examining timing of parent blinks relative to metrically strong beats



## Results, cont.

- Parents' average blink rate was 18.2 blinks/minute. However, blinks were not evenly distributed across their singing.
- Preliminary analyses reveal that parents' blink rate at the metrically strong beats did not differ from chance; however, parents' blink rate significantly increased before and after the strong beats, consistent with the times around the beats being of reduced salience relative to the strong beats themselves.
- Despite individual differences in how parents sang to their infants (e.g., song choice, tempo, etc.), we observed synchronization in blink timing across parents.

## Discussion

- Parents' visual cues during singing likely play a role in the success of infant-directed singing at maintaining infants' attention.
- Infant-directed singing has a clear rhythmic structure. Times before/after metrically strong beats are of reduced salience relative to the beats themselves.
- **When singing to their infants, parents unconsciously time their blinks based on the rhythmic structure so that their eyes (important for social cueing) are available to their infants at rhythmically important moments.**
- Future work will examine how blink patterns and metrical structure relate to the song phrases (e.g., inter-phrase intervals)
- Future work will also investigate this alignment of visual cues to rhythmic structure in parent-child dyads of toddlers with and without ASD to examine how social communicative attunement impacts parent behavior during multimodal singing interactions.

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