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Neural entrainment as a measure of speech segmentation in infants

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Abstract

Before infants can learn what words mean, they need to break down the continuous stream of sounds they hear in speech into individual words, a process called speech segmentation. While traditional end state measures of speech segmentation are informative at a group level (e.g. determining what 8-month-old infants as a group can do), there are concerns about their suitability to capture individual differences (Aslin, 2007; Pérez-Edgar et al., 2020). For instance, standard looking preference measures have large within subject variability (DeBolt et al., 2020). There is also an increased risk that related cognitive abilities may confound segmentation based on end state measures (Kabdebon et al., 2022). As an alternative, neural entrainment (NE) can measure speech segmentation while infants discover word boundaries in real-time (Choi et al., 2020; Kabdebon et al., 2015, 2022). The current study investigates whether infants' neural entrainment, captured with electroencephalogram (EEG), is a robust measure of speech segmentation. More specifically, it measures the test-retest reliability of NE as well as compares NE to ERPs and a concurrent and future CDI measure. Eight to 9-month-old infants complete two testing sessions 5-7 days apart. Each session includes two experiments that test different cues to word boundaries: transitional probability and syllabic stress pattern. For each experiment, participants listen to a continuous stream of an artificial language for 3.6 minutes followed by 32 test trials in which words and part-words are presented in isolation. NE (quantified as power and inter trial coherence) is calculated from the familiarisation phase while ERP analysis is performed on the test phase data. Data collection and analysis is ongoing. Preliminary analyses of the incomplete dataset revealed significant entrainment at the word rate primarily over electrodes in the centrofrontal region ($p < 0.05$, FDR corrected). Preliminary Pearson's correlations comparing NE averaged across all electrodes at the two time points were not significant for the incomplete dataset (Power: $r(12) = .19$; ITC: $r(12)= .33$). Although specific conclusions cannot be drawn yet, this study will inform our understanding about whether NE can be used to study individual differences in speech segmentation.