

363.15 Infants' sensitivity to visual rhythmic-temporal patterning of language: An integrated fNIRS neuroimaging, thermal infrared imaging, and eye tracking investigation

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References in handout or upon request

INTRODUCTION

A baby's sensitivity to specific rhythmic-temporal patterning in the language input about the size of the syllable (~1.5 Hz) has been argued to be the core mechanism guiding their attention to, segmentation, and categorization of the linguistic stream around them.^{1,2,3,4} The superior temporal gyrus (STG) is the key neural site driving this peaked sensitivity^{5,6,7}

Novel Hypothesis: The STG's honed sensitivity to specific language patterns in the input is hypothesized to be linked to increased emotional attention and arousal, which, working together, may direct babies' attention to language and social engagement and, thus, comprises the powerful mechanism that propels and sustains human language learning in early life

Question: Do infants show peaked sensitivity to rhythmic-temporal patterning relevant to syllabic structure, and is there a relationship with peaked emotional attention and arousal?

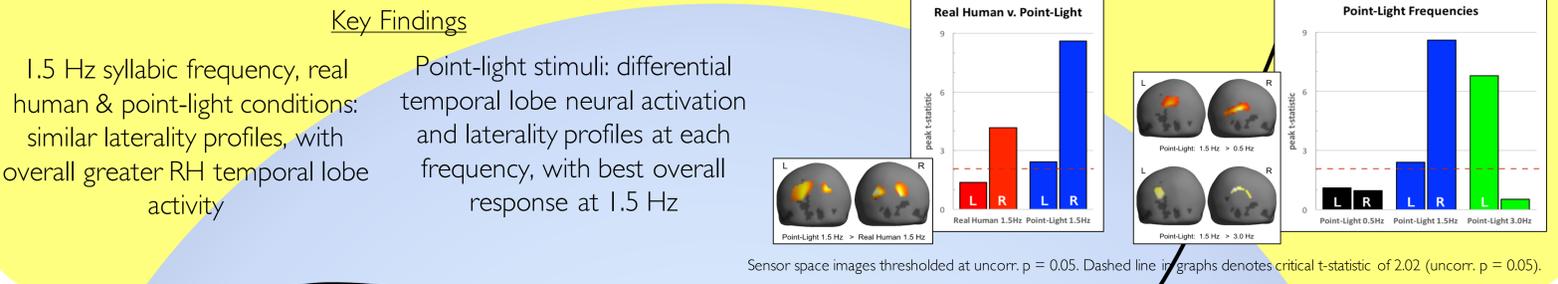
METHODS & INNOVATIONS

- Silent Syllables with Hands
- Syllabic Patterning with Point-Light Scenes
- Hearing Babies
- Powerful First-Time Integration of fNIRS, Thermal IR, & Eye Tracking

Participants: 6 infants (mean age: 6.9 months), normal hearing, no sign language experience

Stimuli: 8 s block design, 4 video conditions (ISI = 8 s). Avg length: 7.25 min

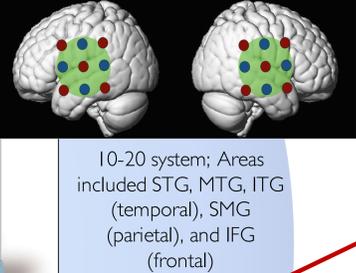
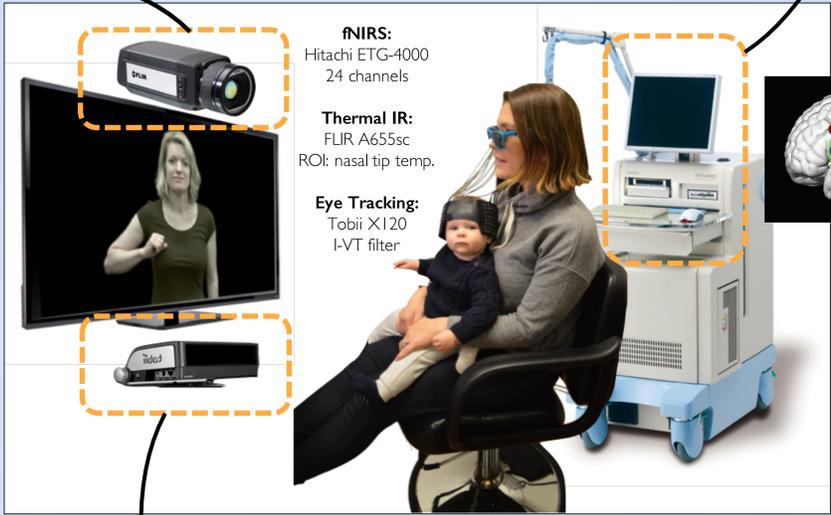
I. NEURAL ACTIVITY: Functional Near Infrared Spectroscopy (fNIRS)



2. EMOTIONAL AROUSAL Thermal Infrared Imaging

Key Findings

- 1.5 Hz real human: peaked parasympathetic activity indicating positive social engagement⁸
- 1.5 Hz point-light: similar peaked but inverted response involving sympathetic activation; possible error detection & conflict resolution
- 0.5, 3.0 Hz point-light: varying levels of disengagement



DISCOVERY

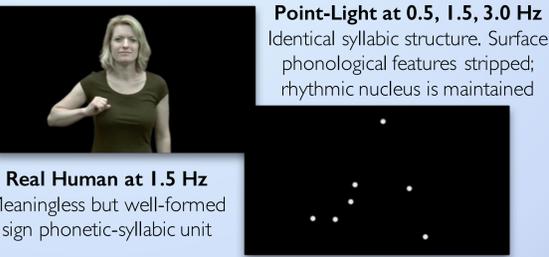
First-Time Biological Index of babies' *Readiness to Learn*

STG Sensitivity to Syllable + Heightened Emotional Arousal

DISCUSSION

Science Significance: The discovery of combined STG + emotional attention and arousal may constitute the earliest known biological marker of a human baby's "readiness to learn," with broad implications for the mechanisms that drive learning (especially language learning) and memory in early life

Technology Significance New Insights into Learning from the Power of Integration: The innovative integration of technology used to advance the present discovery has revolutionary implications for facilitating language learning in human babies, even before they have the capacity to produce language



3. COGNITIVE ATTENTION: Eye Tracking

Babies' total looking time did not differ significantly across conditions (p = 0.64). Heat map analysis: no significant spatial differences in eye gaze across frequencies

