The Effects of Interstimulus Intervals on Infant Attention and Face Perception: An Event-related Potentials Study

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Introduction

Does the presentation rate matter in an infant EEG/ ERP study?

- Infant sustained attention (SA) develops dramatically from 3 to 6 months[12].
- SA plays an important role in gathering and processing information[3,4]
- Increase of the complexity and amount of information presented enhanced infant SA[5]
- Shorter ISIs should elicit SA and attract visual fixation, and thus facilitate information processing in an EEG/ERP study.

What is the relation between infant attention and face perception?

- Sustained attention facilitate information processing, so it should be reflected by face-sensitive ERPs.

In this study: we examined the effect of ISIs on 1) infant engagement and attention and 2) face processing in an EEG/ ERP experiment.

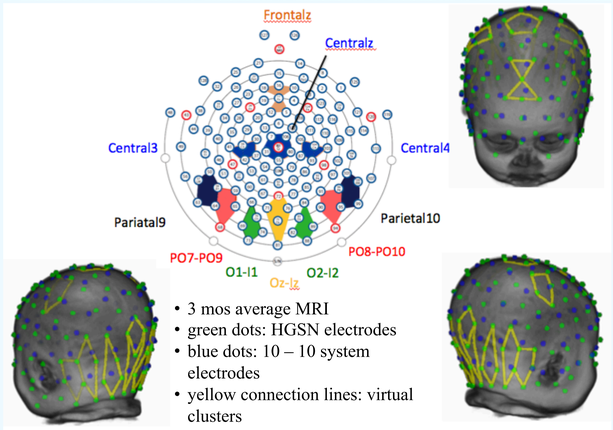
Methods

- *Participants*
  - 3 months (N=11)
  - 4.5 months (N=9)
  - 6 months (N=10)
- *Stimuli*
  - 
- *ISI types*
  - Short: 400 – 600 ms
  - Medium: 600 -1000 ms
  - Long (traditional): 1500 – 2000 ms
- *ECG & EEG acquisition and analysis*
  - ECG → HR information
  - EGI High-density 128 channel net
  - EEG data Filtered with 0.5 – 45 Hz
  - EEGLAB, ERPLAB, Matlab for data processing

- *Procedures*

—Each block contains all three types of stimuli
—Each block uses one ISI type
—Each block lasts for 60s.
—Program balances the total number of trials presented for each ISI type.

Bird's eye and 3D view of the virtual channels created with HGSN electrodes



- 3 mos average MRI
- green dots: HGSN electrodes
- blue dots: 10 – 10 system electrodes
- yellow connection lines: virtual clusters

N290: Parietal9,10, PO7-PO9, PO8-PO10
P400: O1-I1,Oz-Iz,O2-I2
Nc: Frontalz, Centralz, Central3,4

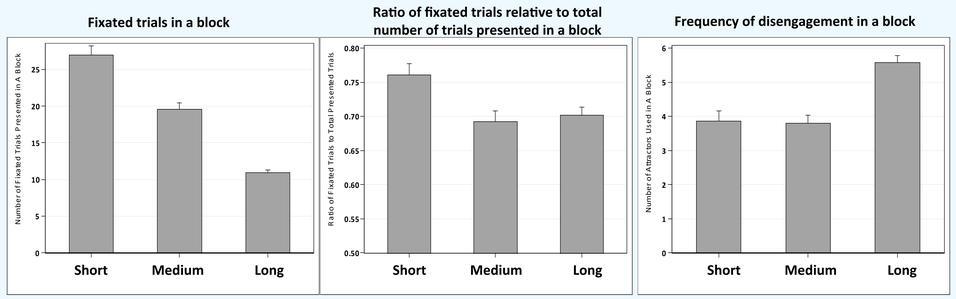
Note: electrodes were chosen based on the review of previous literature. We covered most of the common used electrodes for these ERPs

Results

Q1: Does ISI affect infant engagement in an EEG study?

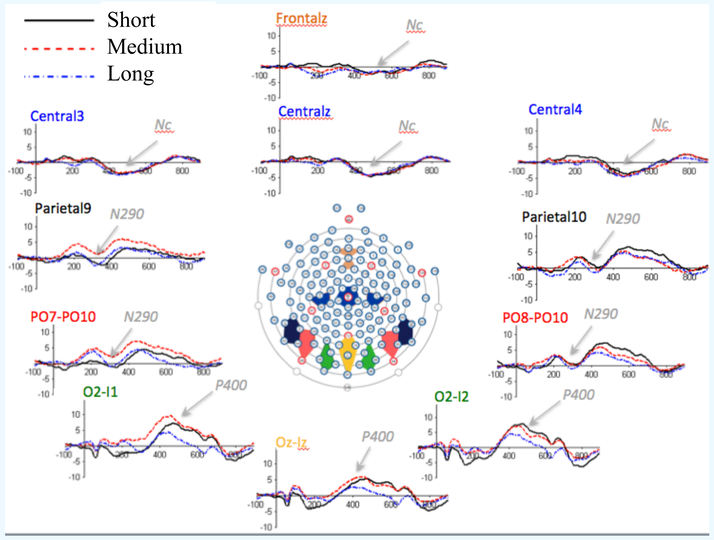
Finding 1: Main effect of ISI type on visual fixations, ratio of fixations, and disengagement, *ps* < 0.05

FIGURE 1 | Behavioral results of infant engagement as a function of ISI type



- The average clean trials that infants contributed to the final ERP averaging was 130.11 (SD = 36.76).
- Very close numbers of good trials were obtained for different ISI types (short ISI, M = 41.19; medium ISI, M = 43.78; long ISI, M = 49.15) and stimulus types (female face, M = 46.26; infant face, M = 43.96; toy, M=43.89).

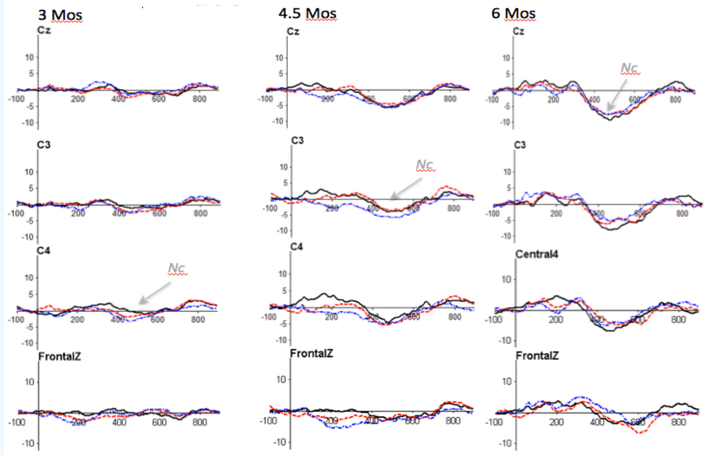
FIGURE 2 | Overall ERP results as a function of ISI type summed across ages



Q2: Does ISI affect infant attention-related Nc response?

Finding 2: Interaction effect of ISI type and age on the Nc, *F* (4, 96) = 2.46, *p* = 0. 0478.

FIGURE 3 | Nc responses as a function of ISI type and age in four virtual channels



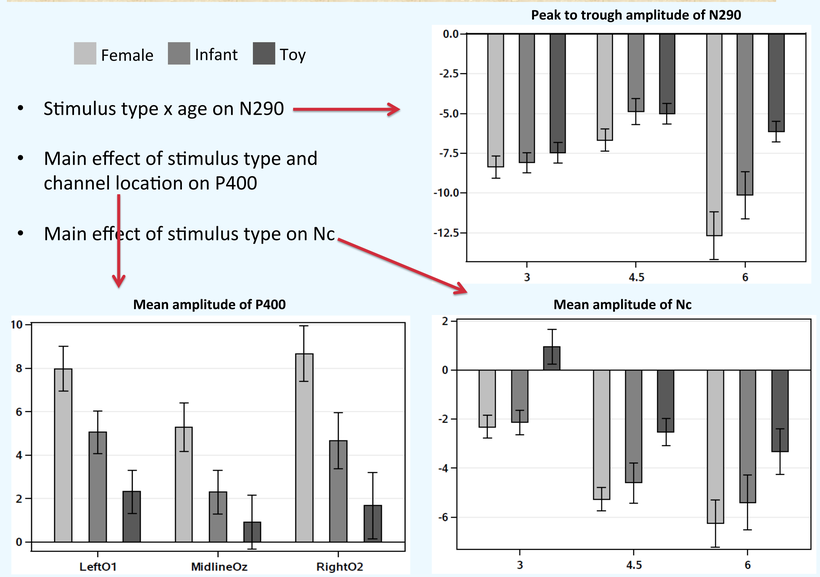
Q3: Does ISI affect face processing?

Finding 3: main effect of ISI type on the P400 response, *F* (2, 48) = 5.42, *p* = 0. 0075 (see Figure 2)

Q4: Development of face-sensitive ERPs (Nc, N290, P400)?

Finding 4: Effect of stimulus type, age, and channel location on ERP responses, *ps* < 0.05

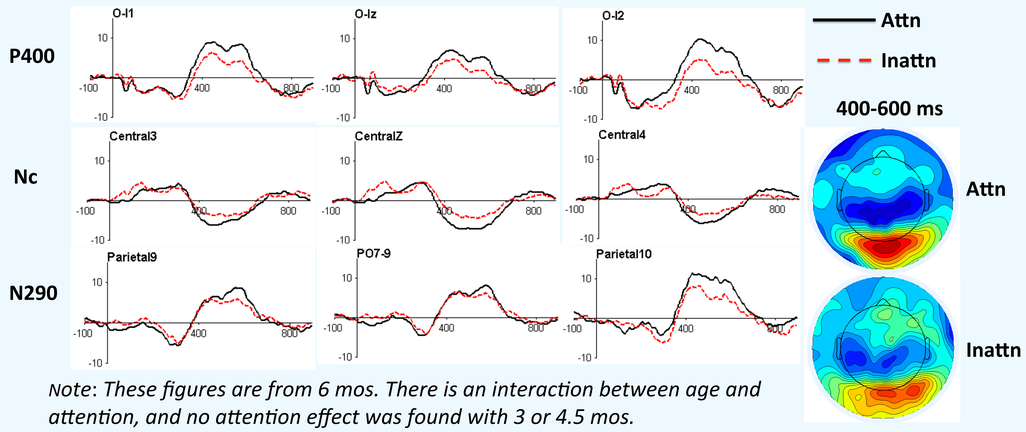
FIGURE 4 | ERP responses as a function of stimulus type, age, and channel location



Q5: Is P400 a face-sensitive component or an index of attention, or both?

Finding 5: Main effect of attentional phase on the P400, *F* (1, 24) = 4.73, *p* = 0.0397, but not N290

FIGURE 5 | P400, Nc, and N290 responses as a function of attentional phase



Note: These figures are from 6 mos. There is an interaction between age and attention, and no attention effect was found with 3 or 4.5 mos.

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