The Development of Face-Sensitive Cortical Processing in Early Infancy

Stefania Conte[1] & John E. Richards[1,2]
[1]University of South Carolina [2]Institute for Mind and Brain

2019 BIENNIAL MEETING SRCD March 21 - 23, 2019 Baltimore, Maryland

Introduction

Human faces have unique biological structures that convey a variety of complex social messages. Multiple lines of research suggest that, in adults, faces are a class of stimuli that receives high priority from attention. Information concerning the time course of neural mechanisms for face processing has been provided by electrophysiological studies through the analyses of Event Related Potentials (ERPs).

The N290 has been identified as a face-sensitive ERP component in infancy. Its activity is systematically modulated by faces and not by non-face objects (De Haan, Johnson, & Halit, 2002). Greater N290 amplitudes have been reported in response to faces than toys in 4.5-, 6-, 7.5- and 12-month old infants (Guy, Richards, Tonnesen, & Roberts, 2018; Guy, Zieber, & Richards, 2016). The face inversion effect occurs when faces are presented vertically inverted. It has been considered a marker for expert perceptual processing, since results in an impairment in perceptual recognition of the inverted face stimuli. A selective inversion effect for human faces has been reported to modulate the amplitude of the N290 in 12-month- old infants (Halit, de Haan, & Johnson, 2003).

Another ERP component – the P400 – has been reported in response to faces during infancy. However, the role of P400 in infants' face processing is still not fully understood. Some studies found earlier P400 peaks for faces than toys (De Haan & Nelson, 1999), while others reported larger amplitude for toys than for faces (Guy, Zieber, & Richards, 2016).

We hypothesized that faces would elicit larger N290 and P400 responses compared to houses and that a possible developmental change would occur in the scalp distribution of the N290 and P400 responses to faces. Moreover, an inversion effect on N290 amplitude would be elicited by faces but not houses.

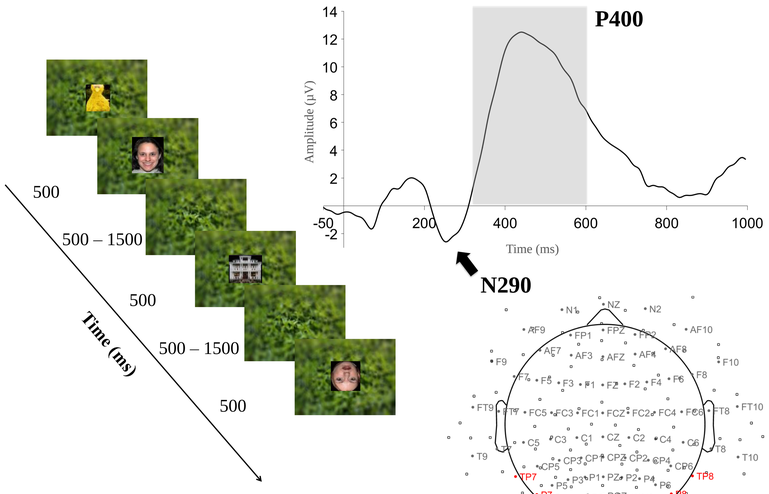
Methods

Participants

4.5 (N = 7), 6 (N = 6), 12 (N = 11) months

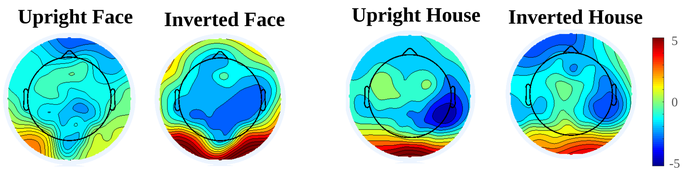
ERP Procedure

Infant passively viewed brief stimulus presentations (500 ms) while seated on parent's lap in darkened room. EEG activity was recorded from high-density EGI HGSN/GSN nets



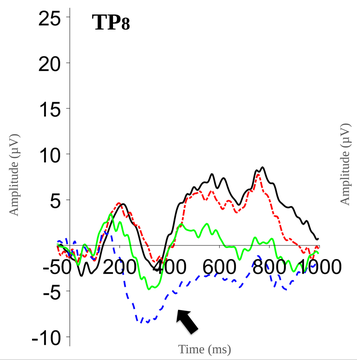
N290

4.5 months

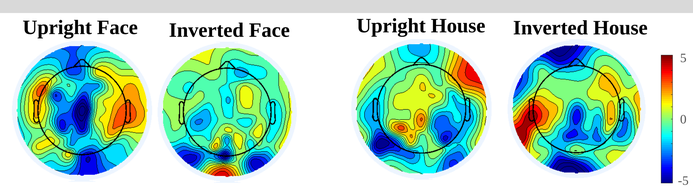


Stimulus*Electrode, p = .0001

House < Face



6 months

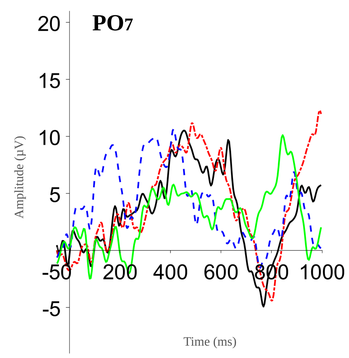


Side*Electrode, p = .031

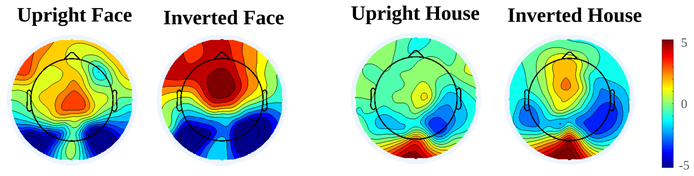
Right > Left

Orientation*Electrode, p = .002

Upright > Inverted

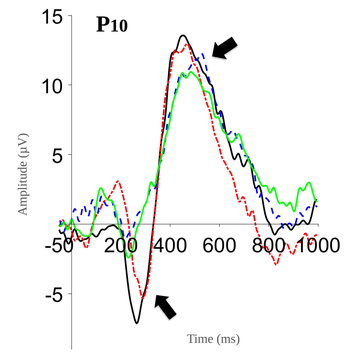


12 months



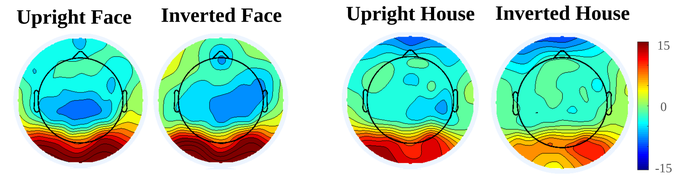
Stimulus*Electrode, p = .002

Face < House



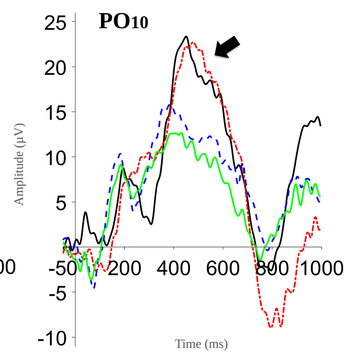
P400

4.5 months

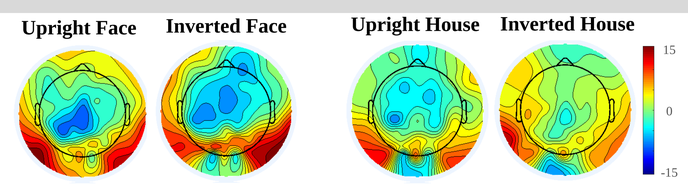


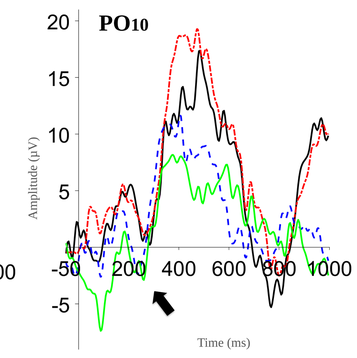
Stimulus*Electrode, p = .015

Face > House
only over inferior electrodes

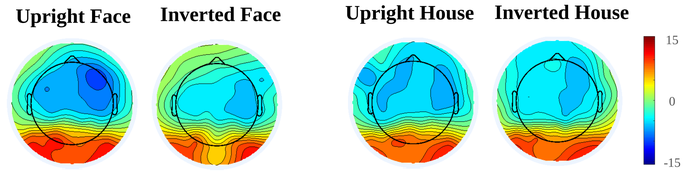


6 months



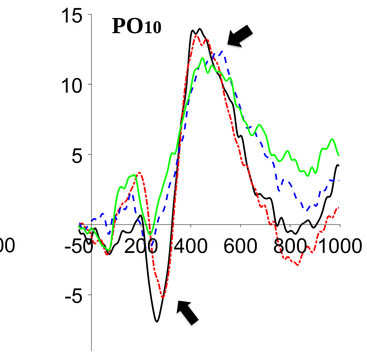


12 months



Orientation, p = .052

Upright > Inverted



References

de Haan, M., Johnson, M. H., & Halit, H. (2003). Development of face-sensitive event-related potentials during infancy: a review *International Journal of Psychophysiology*, 51(1), 45-58.

Guy, M. W., Richards, J. E., Tonnsen, B. L., & Roberts, J. E. (2018). Neural correlates of face processing in etiologically-distinct 12-month-old infants at high-risk of autism spectrum disorder. *Developmental cognitive neuroscience*, 29, 61-71.

Guy, M. W., Zieber, N., & Richards, J. E. (2016). The cortical development of specialized face processing in infancy. *Child development*, 87(5), 1581-1600.

Halit, H., De Haan, M., & Johnson, M. H. (2003). Cortical specialization for face processing: face-sensitive event-related potential components in 3-and 12-month-old infants. *Neuroimage*, 19(3), 1180-1193.

De Haan, M., & Nelson, C. A. (1999). Brain activity differentiates face and object processing in 6-month-old infants. *Developmental psychology*, 35(4), 1113.

contact: contes@mailbox.sc.edu