Exploring Face Inversion Effects and Attentional Biases in Infants at High Risk for ASD

Chloe Brittenham[1,2], Jennifer B. Wagner[1,2], Helen Tager-Flusberg[3], and Charles A. Nelson[4,5]

[1]Department of Psychology, College of Staten Island, City University of New York, [2]Department of Psychology, The Graduate Center, City University of New York, [3]Department of Psychological & Brain Sciences, Boston University, [4]Developmental Medicine Center, Boston Children's Hospital/Harvard Medical School, [5]Harvard Graduate School of Education

BACKGROUND

- Though widely studied, it is still unknown whether visual processing abilities in ASD are characterized by enhanced featural processing, configural processing deficits, or both (e.g., Simmons & Todorova, 2018).
- Configural processing is indicated by both face inversion effects (e.g., Freire et al., 2000) and attention to the left side of the face (e.g., Guo et al., 2009). Infants show configural processing of faces by the second half of the first year of life (e.g., Scott & Nelson, 2006).
- In ASD, face inversion effects are diminished (e.g., Falck-Ytter, 2008), as are biases to the left side of the face (e.g., Dundas et al., 2012a).
- Though face processing differences in ASD have been established by many past studies, it is not clear how early in life these differences emerge.
- Examining visual attention to faces in infants at high-risk for ASD (HRA; by virtue of an older sibling with ASD) can help us to understand the developmental course of these differences.
    - For example, work by Dundas et al. (2012b) found that biases to the left side of upright faces differ in 11-month-old HRA and low-risk control infants (LRC).

The current study expands on past work to examine inversion effects and left vs. right attention in 6-, 9-, and 12-month-old HRA and LRC infants during visual scanning of faces in order to evaluate patterns of attention related to configural and featural processing that may indicate risk for ASD.

METHOD

Participants

- Fifty-three 6-month-olds (HRA: $n = 23$; LRC: $n = 30$)
- Fifty-seven 9-month-olds (HRA: $n = 22$; LRC: $n = 35$)
- Sixty-two 12-month-olds (HRA: $n = 20$; LRC: $n = 42$)

Stimuli and Procedure

- Twelve faces (6 male, 6 female) were presented upright and inverted for 3.5 sec each, totaling 24 trials.
- Infants viewed faces on a 17-inch Tobii T-120 eye-tracker using Tobii Studio software for presentation.

Data Processing

- Areas of Interest (AOIs) were drawn around the face as well as the left and right halves of the face (see below).
- Total looking time to the face, left, and right AOIs was calculated for each infant, separately for upright and inverted faces.

RESULTS

Overall Attention to Upright and Inverted Faces

- A repeated-measures ANOVA with Orientation (Upright, Inverted) as the within-subjects factor and Group (HRA, LRC) and Age-months (6, 9, 12) as the between-subjects factors was conducted.
- A significant Orientation x Group interaction for attention to the face was found, $F(1,166) = 4.797$, $p = .03$; $\eta_p^2 = .005$ (see Figure 1).
    - For LRC, a non-significant trend was found, with longer looking to upright than inverted faces ($p = .12$; $d = .15$) .
    - In contrast, for HRA a marginal trend was found in the opposite direction, with longer looking to inverted than upright ($p = .074$; $d = .23$).

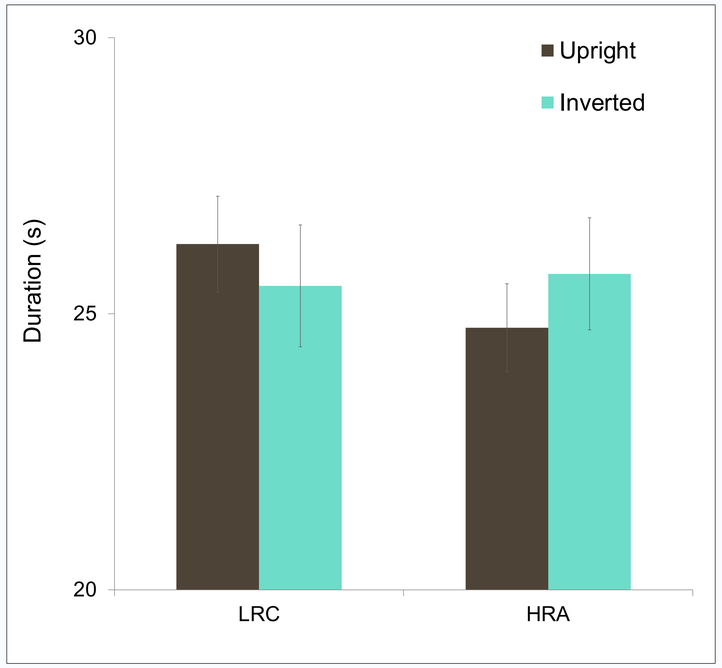

Figure 1.

Attention to the Left vs. Right for Upright and Inverted Faces

- A second ANOVA added Face-region (Left, Right) as a within-subjects factor.
- A significant Orientation x Face-region x Age-months x Group interaction for attention to the face was found, $F(1,166) = 3.364$, $p = .037$; $\eta_p^2 = .039$, and follow-up ANOVAs were conducted for each age group separately.
    - At 6 and 9 months, there was no significant Orientation x Face-region x Group interaction ($ps > .20$).
    - At 12 months, there was a significant Orientation x Face-region x Group interaction ($p = .049$; $\eta_p^2 = .063$; see Figure 2), with different patterns of attention to the left and right side of the face depending on orientation for HRA and LRC.

RESULTS, continued

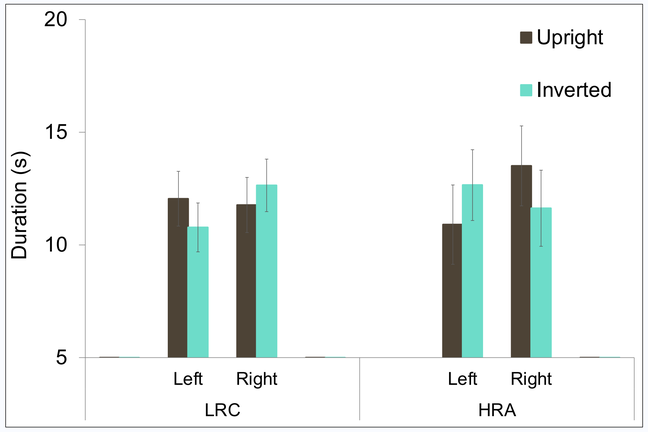

Figure 2.

DISCUSSION

- Results showed that face inversion effects differed between groups in the first year of life.
    - HRA showed a marginal effect for increased attention to the inverted compared to upright faces.
    - LRC showed a trend in the opposite direction, with more attention to upright than inverted faces.
- In examining left vs. right biases in attention, patterns of differences between groups emerged at 12 months.
    - Low-risk 12-month-olds appear to show greater attention to the left side of upright faces compared to inverted faces.
    - In contrast, high-risk 12-month-olds appear to show greater attention to the left side of inverted faces compared to upright.
- The interaction between group and orientation therefore might be related to patterns of attention to the left side of face.
- More work is needed to understand whether these differences might indicate enhanced featural or disrupted configural processing in HRA and how this might relate to later developmental outcomes.

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- Please address all correspondence to cbrittenha@gradcenter.cuny.edu.

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