Comparison of Eye Gaze Behaviors across Samples of 8-and 9-month-old Infants at-risk for Autism

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Introduction

- The cause of autism spectrum disorder (ASD) is unknown, but potential indicators may become prevalent early in a child’s life, as early as infancy leading to an opportunity to reliably diagnose ASD in infancy (Jones et al., 2008; Naimy et al., 2017; Patton et al., 2014).
- Social visual engagement is notably impaired in young children with ASD (Constantino et al., 2017; Pierce et al., 2011; Pierce et al., 2016).
- A growing body of evidence suggests association between infant eye gaze behaviors and ASD, but a lack of research across high-risk groups limits the scope of this evidence.

Methods

- The University of Nebraska does not discriminate based on race, color, ethnicity, national origin, sex, pregnancy, sexual orientation, or disability.

Methods

- Participants (n=10); aged 8-9 months; selected for present study from the larger pool of participants involved in the Early Diagnostic Signs of Autism study (2017-2020).

- Procedures
- Present study data collected as part of the 4th and 5th data collections (out of 9 with 8th session including Autism Diagnostic Observation Schedule [ADOS-2] administration) in the Early Diagnostic Signs of Autism study (ongoing, 2017-2020).
- Data collection took place in participants’ homes. While seated at a table on a parent’s lap 1 meter from a laptop, infants were shown three 1-minute videos of static social and nonsocial image (180 seconds total) (see Figure 1 and 3).

- Materials
- Eye Gaze Hardware: Positive Science UltraFlex headgear cap and camera (Figure 2)

Software: PS Live Capture (30Hz, Figure 4), Yarbus, GazeTag

Figure 7. Static social and nonsocial images shown in videos.

Figure 2. UltraFlex headgear and attached camera.

Figure 3. Infant sitting on lap Experimenters’ lap during data collection.

Figure 4. PSLiveCapture software recordings of eye movement and visual surroundings.

Data Analysis

- Video data obtained using the Positive Science wearable eye gaze technology including UltraFlex headgear (see Figures 2 and 3). Using Yarbus software, the eye video to scene video was calibrated based on 6-10 calibration fixation points on a tablet before after video presentation.

- GazeTag software was used to filter usable/not usable data points (e.g., not usable: eye closed, camera out of position), then code each usable fixation point into their respective categories (social 2D, social 3D, nonsocial 2D, nonsocial 3D).

- A fixation was considered 2D if it was on the laptop screen fixated on the video and 3D if it was fixated on people and objects in the environment. Fixations were coded as social if they were within the social image (2D) or on the face of someone in the environment (3D). They were coded as nonsocial if they were within the nonsocial image (2D) or anything else in the environment (3D).

- Fixations that were not coded included parts of bodies within the environment and/or parts of the recording equipment. The spatial parameters for a fixation point was set at 5 pixels and the temporal parameters at 100ms. Percentages were calculated from the output generated through GazeTag use.

Results and Discussion

- Total usable fixation points per group: PLBW range: 43-233 mean: 121 SB range: 31-304 mean: 127.
- PLBW group attended to more Social 3D stimuli and, consequently, more Total Social stimuli at 8-months than SB group (although not significantly).

- Using an exact sampling distribution for U (Dineen & Blakesley, 1973), there were no statistically significantly differences between the two high-risk groups at 8-months of age U = 8, z = -0.490, p = 0.673.

Results and Discussion (cont.)

- At 8- and 9-months, the SB group was higher for Total Nonsocial eye gaze fixations than the PLBW group (although not significantly). There were no statistically significantly differences between the two high-risk groups at 9-months of age, U = 10, z = 0.258, p = 0.906.
- Findings indicating both high-risk groups higher for nonsocial than social stimuli at 9-months offered some support of Pierce and colleagues (2011; 2016) findings in which they noted toddlers later diagnosed with ASD spent a significantly longer amount of time attending to nonsocial than social stimuli. Pierce and colleagues (2016) hypothesized a visual preference for geometric shapes (i.e., nonsocial stimuli) may be an early ASD indicator.

- Findings indicate overall differences in eye-gaze behaviors across participants may reflect factors beyond high-risk group status, consistent with results noted by Lopez and colleagues (2018). Individual variability was observed across eye gaze behavior such that eye gaze alone may not be a reliable assessment of developmental differences between groups at high-risk for later autism diagnosis. However, eye gaze could be useful for observing distinctions between high- and low-risk groups in conjunction with other assessment tasks.

Clinical Implications

- It is important for early childhood professionals to be aware of high-risk group status and differences in early behavioral signs, such as eye gaze fixation behavior, noted within the first 12 months of life. This feature may be part of early developmental profile that leads to a reduced dx age for ASD.

Limitations and Future Directions

- Unknown ASD dx status for current participants as larger study is ongoing; exploratory study with notable individual variability, in-home setting presented challenges for controlled environment (e.g., lighting, surroundings, technology).

- Given present study limitations, differences in static and dynamic fixations warrant further investigation with known participant ASD dx status, a larger sample size, and comparison of outcomes from home vs. lab environments.

Selected References

- Hearing Association Annual Conference, Boston, MA.
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Figure 6. Positive Science headgear cap and camera.

Figure 1. Positive Science headgear cap and camera.