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Eye-tracking methodology for the assessment of social function in infancy

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Introduction

- There is a need for better understanding of cognitive development in the first year as a prerequisite for early identification of deviance from typical developmental trajectories, particularly in children with known vulnerabilities.

- Existing studies of early social cognition have not taken into account factors known to affect adult social attention such as stimulus complexity (1).

- We used eye-tracking methodology to assess social functioning in infants who are typically developing. The hypotheses were; i) Attention to social information in infancy differs across stimuli of increasing social complexity; ii) Attention to social information across tasks can be quantified by social preference scores; iii) Social preference score is related to infant age at time of assessment.

Method

- 30 typically developing infants (15 female; 15 male) ; age range = 6.2 – 12.9 months (mean = 8.3 months) were tested following ethical approval by University of Edinburgh.

- A battery of visual tasks were presented on a Tobii x60 eye-tracker. The tasks were shown in three trial blocks which lasted 6 minutes, combining both novel visual tasks with previously tested tasks provided by British Autism Study of Infant Siblings (BASIS)[a].

- Analysis: Social preference scores = the percentage of mean time looking at the social area of a scene versus mean total looking time for that scene.

Figure 1 : An infant being eye-tracked.

Results

Figure 2 : Sample stimuli, regions of interest and heatmaps for the face scanning task (A-C), the pop-out task (D-F) and the social preferential looking task (G-I).

2A: Face-scanning stimulus
2B: Face-scanning RoIs
2C: Face-scanning heatmap
2D: Pop-out stimulus
2E: Pop-out RoIs
2F: Pop-out heatmap
2G: Social PL stimulus
2H: Social PL RoIs
2I: Social PL heatmap

- <u>Face-scanning</u>: Infants fixated on the eyes longer than the mouth (means = 1.82s versus 0.29s; p<.001) and looked at eyes quicker than the mouth (means = 2.32s versus 3.90s; p=.02; Figure 2A-C).

- <u>Face Pop-out</u>: Each area of interest, bird, car, face noise, phone was fixated less than the face (means = 0.36s, 0.45s, 0.43s, 0.22s versus 1.78s; all ps<.001; see Figure 2D-F). Time to first fixation was slower to the other areas bird, car, phone compared to the face (means = 4.20s, 3.66s, 4.27s versus 2.44s; all ps<.001), except time taken to fixate the face compared to face-noise (means = 2.44s versus 3.10s; p=.061).

- <u>Social Preferential Looking</u>: There was no difference in fixation duration to social scenes compared to non-social scenes (means = 1.68s versus 1.40s; p=.09; see Figure 2G-I). Time to first fixate was quicker for social scenes compared to non-social scenes (means = 1.19s versus 1.54s; p=.009).

- <u>Social Preference variables</u>: Social preference scores were all significantly correlated with each other for all three tasks (face-scanning with pop-out: r = .638, p<.001; face scanning with social PL: r = .546, p=.002; pop-out with social PL: r = .497, p=.005).

- <u>Relationship between social cognition, and infant age</u>: A single social composite score was created by averaging social preference scores across the three eye-tracking tasks. Social preference score did not correlate with infant age at testing.

Discussion

- The preference that infants show for social content in eye-tracking tasks is moderated by complexity of the display.
- Social cognition in infancy can be summarised by a composite score, derived from gaze behaviour which varies across tasks.
- The composite score may have greater utility than single tasks when developing early markers of later social cognitive impairment.

Rerences: 1. Jones W, & Klin A. (2013). Attention to eyes is present but in decline in 2-6-month-old infants later diagnosed with autism. *Nature*, doi: 10.1038.