Concurrent associations between parent-infant engagement and cortical selectivity to social stimuli in five-month-old infants

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Introduction

- Infants show selective processing of social vs non-social visual and auditory stimuli in the first year of life [1].
- Infant (e.g. ASD), caregiver (e.g. parenting) and familial (e.g. SES) factors have been linked to selective processing of social stimuli [2, 3].
- While most studies quantify these factors using global measures, observable behaviours in parent-infant interactions (PCI) were linked to various aspects of brain development [4].
- **Aims:** (1) to test whether infant-caregiver behaviours coded from PCI are related to cortical specialization to social stimuli (Study 1); (2) replicate and extend the findings toward a socially diverse sample (Study 2).

Methods

- **British infants, 4-5 months old, final sample** after pre-processing:
  - Study 1 - BRIGHT project (https://www.globalfns.org/); n= 28;
  - Study 2 – BASIS project (https://www.basisnetwork.org/); n=59.
- **PCI measures (IVs):** 4 min of unstructured no-toy play coded for:
  - Individual social behaviours of infant and caregiver
  - Dyadic behaviours: mutual gaze (MG) and dyadic engagement (DE).
- **fNIRS paradigm:**
  - **Signal** pre-processing pipeline:
    - Raw signals: Channel rejection (Ch1-2, power, oriented & unoriented), Motion detection (MotorL, MotorR, Visual, Orientation 6, Visual motion), Spectral correction - 641 & 805 nm, Low pass filter (0.03 Hz - 0.24 Hz).
    - Data reconstruction: Bandpass filter (0.03 Hz - 0.24 Hz).
    - Data analysis: Trial rejection (10 %), Visual data analysis & Statistical analysis.
  - **ROIs:** Channel groups were based on previous studies [1, 3]
  - **Measures of selectivity (DV’s):** Visual – visual social relative baseline; Auditory – auditory vocal relative to auditory non-vocal sounds.

Discussion and Conclusions

- Contrary to initial predictions, parent-infant behaviours – measured individually and dyadically – were negatively associated with cortical selectivity to social stimuli (in HbO) in both studies, meaning that more engaged interactions were linked to reduced socially selective responses.
- One interpretation is that babies who experience engaging interactions need fewer resources to process social stimuli. Study 2 further demonstrated that these associations may differ for infants at EL for ASD, for whom engaging interactions could have mitigating effects on cortical responsivity, which was reported to be reduced in previous studies [3].

References

[1] Lloyd-Fox et al., Developmental Cognitive Neuroscience 5;
[2] Purdie et al. (2018), Developmental science, 00:e28398;
[3] Lloyd-Fox et al. (2019), The European journal of Neuroscience, 47(10), 736-740;

Abbreviations

ASD = Autism Spectrum Disorder; TL = typical likelihood; EL = elevated likelihood
PCI = parent-infant interaction; MG = mutual gaze; DE = dyadic engagement
IVs = independent variables
DV s = dependent variables
HbO = hemoglobin O2
HbR = hemoglobin R
ROIs = region of interest
VS = visual-selective
pSTS-TPJ = posterior superior temporal sulcus – temporoparietal junction
aMTG-STG = anterior middle temporal gyrus – superior temporal gyrus

Results

Study 1: Results from the BRIGHT project

- Only HbO findings are presented in these graphs.

- **HbO:** Negative associations with MG and social visual selectivity in the right pSTS-TPJ (8-12 sec); infant behaviours/MG/DE and social auditory selectivity in the left pSTS-TPJ (8-12 sec, 12-16 sec) and right aMTG-STG (8-12 sec);
- **HbR:** Positive associations with social auditory selectivity and MG/DE in the left ROIs (8-12 sec, 12-16 sec).

Study 2: Results from the BASIS project (17/59 TL infants)

- **HbO:** Negative associations with caregiver behaviours and social visual selectivity in the left pSTS-TPJ (8-12 sec, 12-16 sec), and social auditory selectivity in the right aMTG-STG, esp. for TL infants (8-12 sec; 12-16 sec).
- **HbR:** No associations