

Theme: Cognitive Neuroscience

Mapping Sibling Empathy via Inter-Brain Synchrony: An fNIRS Hyperscanning Study

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Abstract:

Empathy serves as a key predictor of positive interpersonal relationships and emotional growth. Here, we utilize a multimodal hyperscanning approach to examine the neural correlates of empathy, with a focus on inter-brain synchrony as a potential marker of empathy-related neural processes. We focus specifically on the relationships between twin and non-twin siblings as a potential model for shared empathy.

Sibling pairs were presented with dynamic facial expressions (happy,sad,neutral) from their sister/brother or from a stranger while sitting back-to-back in a shared room, and asked to imagine the facial expressions they had just seen. Perceptual-imagery cycles were interleaved with a resting condition, while we simultaneously recorded EEG-fNIRS data.

Here, we present our preliminary interbrain synchrony (IBS) results from fNIRS data collected from 10 sibling pairs (4 twins), with 8 sources and 7 detectors, covering the right dIPFC, FPC, and TPJ. Using pre-processed HbO data, we estimated the IBS based on the Wavelet Transform Coherence, within the 0.14-0.2Hz band, for the emotion perception and imagery moments.

Preliminary results suggest that, among the studied brain regions, the TPJ exhibited higher IBS in real sibling pairs compared to false pairs during the proposed task. Additionally, IBS in this region was significantly higher for twin pairs than for nontwin pairs during the recognition of their sibling's facial emotions ($p=0.04$). This effect was not observed in the control conditions, which involved recognizing facial expressions of an unknown person. During imagery the differences between siblings seem to be attenuated, as non-significant differences were found when comparing both.

Despite the exploratory nature of these data and the limited literature on IBS patterns among siblings, our findings align with previous hypotheses suggesting greater interpersonal brain synchronization in the rTPJ, underscoring its role in individuals' inferences about others.

Keywords: fNIRS, inter-brain synchrony, empathy.