Hyperscanning during natural dialogue between two individuals with high socioeconomic disparities

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Introduction and Methods

Neural substrates and mechanisms that mediate online¹ social cognition are poorly understood largely due to challenges of neuroimaging in natural conditions. However, recent developments in functional near-infrared spectroscopy (fNIRS) enable simultaneous neuroimaging (hyperscanning) of dyads during live social interactions.² Prior behavioral findings suggest that social disparities signal “in” and “out” group memberships, although neural encoding of social disparities during dynamic interpersonal interactions has not been investigated.

In this study, 84 individuals (19 high and 23 low disparity dyads) of mixed gender, race, and age (Table 1) were scanned during natural dialogues using an 84-channel fNIRS system (Shimadzu LABNIRS) with 42 channels covering both hemispheres of each person (Fig. 1). We test the hypothesis that interpersonal interaction with variation in social disparity will modulate rule-based neural systems such as those associated with speech production.

ROI Results

Regions of Interest (ROI) determination:

- ROIs: [Talking > Listening] (Red)
- [Listening > Talking] (Blue)

Figure 3

All data were combined for the ROI determinations of Broca's and Wernicke's regions (Fig. 3).

Figure 4

High Disparity > Low Disparity for ROIs

This finding suggests that conversation between high disparity individuals constitutes a greater load on regions associated with cognitive control and rule-based systems than low disparity dyads.

Cross-Brain Coherence Results

Cross-brain coherence: A measure of neural synchrony

High disparity dyads demonstrate greater cross-brain coherence for Broca’s Area.

Figure 5

Cross-brain coherence is shown between pars triangularis and pre-motor cortex. A greater level of coherence was observed in the high disparity dyads than the low disparity dyads. There was no difference in coherence for the scrambled partners (Fig. 5).

Figure 6

Low-Disparity dyads show greater cross-brain coherence between regions associated with face processing ( fusiform gyrus) and typical interpersonal interaction processing (subcentral area), as previously observed for eye-to-eye contact (Fig. 6).

Summary and Conclusion

- Left hemisphere Broca's Area and DLPFC were upregulated during dialogue between high disparity dyads relative to low disparity dyads.
- Cross-brain synchrony for high (relative to low) disparity dyads is consistent with the ROI findings. Coherence between pars triangularis (Broca's Area) and pre- and supplementary motor cortex is observed for high disparity dyads.
- These findings suggest that social disparity in interpersonal interaction upregulates rule-based systems associated with speech production, such as Broca's Area and DLPFC.

Table 1. Demographic summary

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<th>GENDER</th>
<th>N</th>
<th>AGE</th>
<th>DIAG PAR TYPE</th>
<th>RACE</th>
<th>HANDEDNESS</th>
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<tr>
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<td>32 ± 11</td>
<td>EF</td>
<td>AI</td>
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<tr>
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<td>15</td>
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There is no evidence for group differences based on demographics.

References


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