Neural and acoustic characteristics of agreement vs. disagreement in dyadic debate observed using fNIRS hyperscanning

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Set Up: Two-Person Dialogue: Talking and Listening

Figure 1. Hyperscanning set up for recording live speech while acquiring functional near infrared spectroscopy (fNIRS) signals during debate under contrasting agreement and disagreement conditions. Talking and listening epochs alternated every 15 sec. Debate topics were assigned based on previously surveyed agree/disagree opinions of the partners.

Acoustical Analysis: Agreement and Disagreement

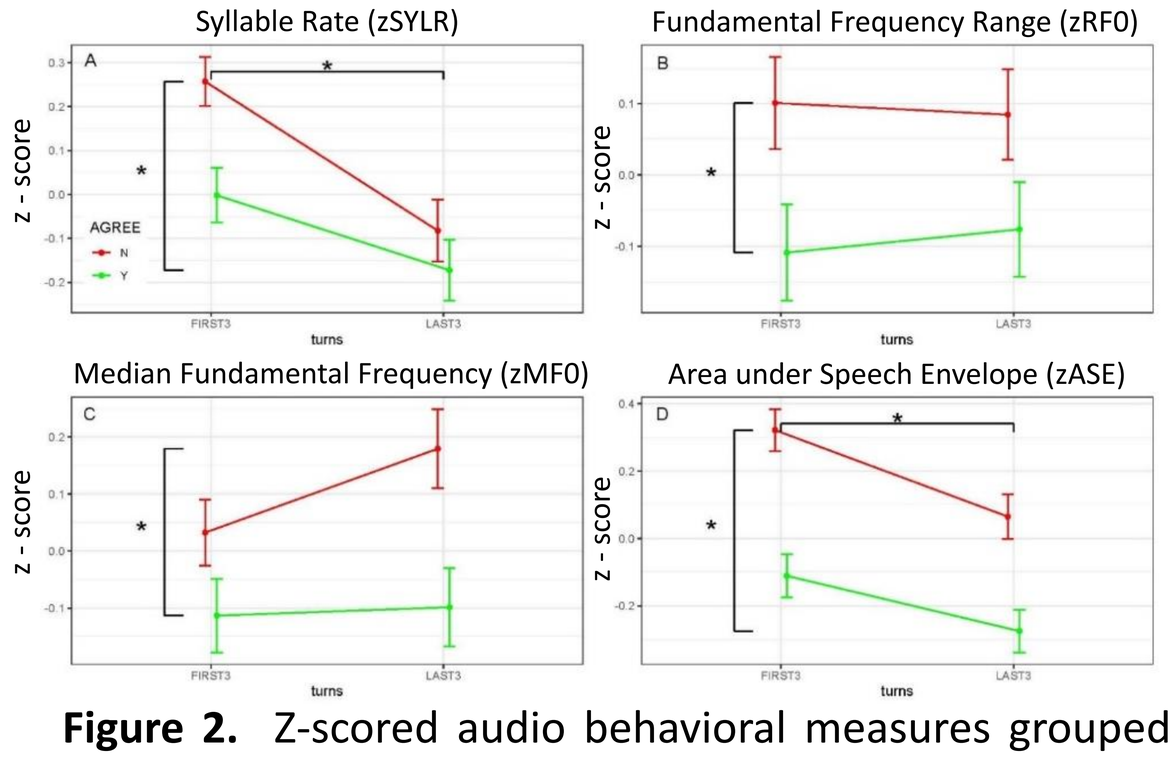

Figure 2. Z-scored audio behavioral measures grouped by agreement (yes or no) and turn (first 3 turns and last 3 turns); error bars show standard error of the mean (SEM). Asterisks mark significant comparisons per Linear Mixed Effects Model (LMM) results. Green represents agree (Yes) and red represents disagree (No). **Note the significantly increased values for the disagree condition.**

Neural Findings

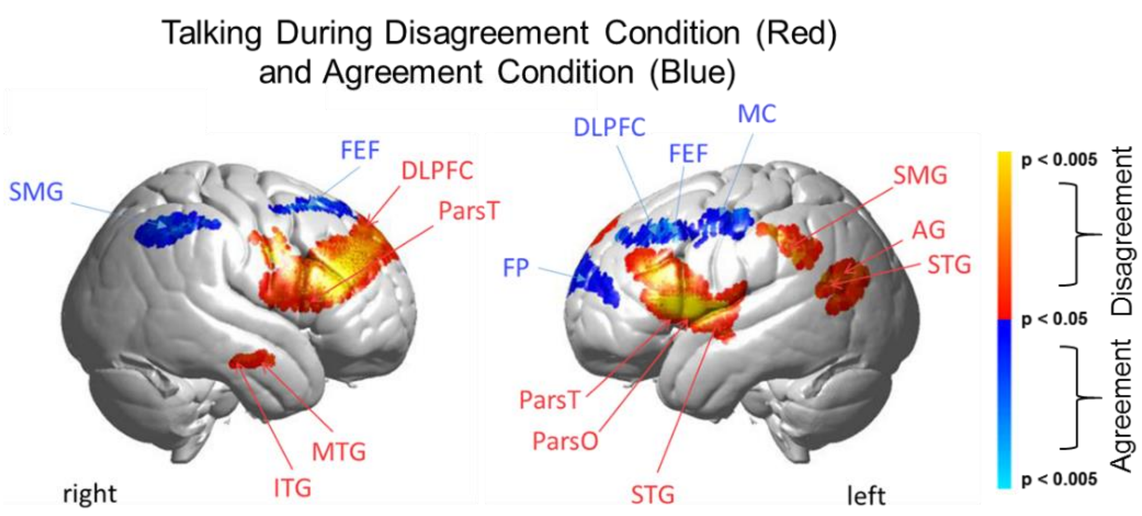

Figure 3. Talking Condition. Brain activity clusters represent functions of Disagreement [talking > listening] (red) and Agreement [talking > listening] (blue). Neural systems most active during talking and disagreement conditions (red) include bilateral frontal regions (dorsolateral prefrontal cortex (DLPFC), pars triangularis (ParsT), and pars opercularis (ParsO)). Left hemisphere supramarginal gyrus (SMG), angular gyrus (AG), and superior temporal gyrus (STG) are also included. Neural systems most active during talking and agreement conditions (blue) include bilateral frontal eye fields (FEF) right supramarginal gyrus (SMG) and left frontopolar (FP) activity.

Conclusion: Neural systems engaged during spoken language, supported by behavioral measures, show significant differences depending upon the agree / disagree polarity of the debate.

Coherence Findings

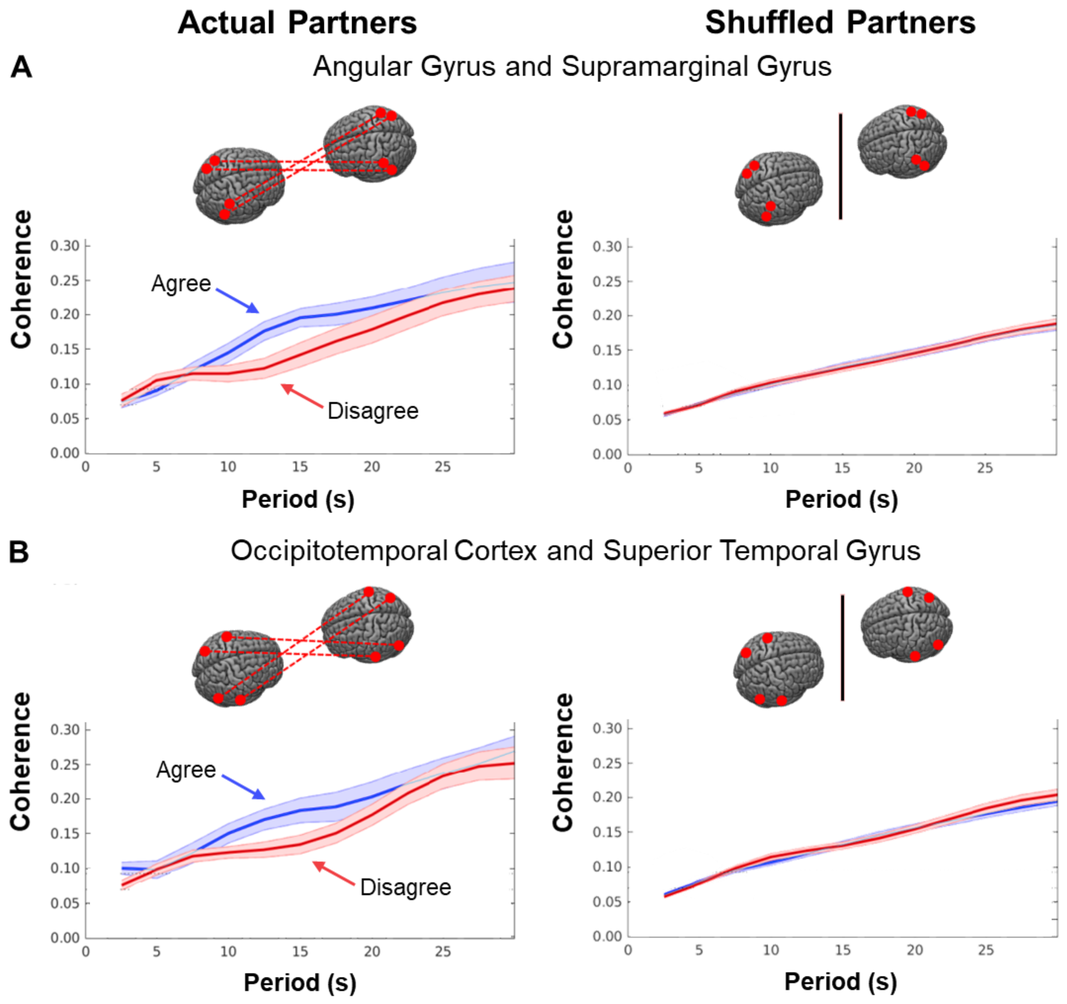

Figure 4. Cross-brain coherence. Signal coherence between dyads (y-axis) is plotted against the period (x-axis) for the Disagree (red) and Agree (blue) conditions (shaded areas: ±1 SEM). The left column shows coherence between actual partners, and the right column shows coherence between shuffled partners. Greater signal coherence was observed between actual partners in **(A)** angular gyrus to supramarginal gyrus and **(B)** occipitotemporal cortex to superior temporal gyrus. In contrast, no significant differences were found in coherence between shuffled partners during either condition. **Cross-brain coherence was highest during agreement as compared to disagreement.**