Comparing ideal and real group mental representations: a multimodal hyperscanning study

Thursday, September 11, 2025 3:50 PM (10 minutes)

Group decision-making involves both cognitive and emotional processes shaped by how individuals mentally represent their group –either ideally or realistically. This study examined how discussing these representations impacts decision-making, as well as neural and autonomic activity. Using a multimodal hyperscanning approach with electroencephalography (EEG), functional Near-Infrared Spectroscopy (fNIRS) and biofeedback (BIO), 28 participants paired in dyads discussed group decisions while self-representing either an ideal (Phase 1) or real group (Phase 2). EEG activity (frequency bands: delta, theta, alpha, beta, gamma), hemodynamic responses, and autonomic markers (e.g., heart rate variability, HRV) were recorded and analyzed at both individual and dyadic levels. At the individual level, results showed increased frontal low-frequency EEG band activity during both interactions, indicating emotional engagement. When mentally self-representing a real group, participants exhibited higher beta/gamma activity and deoxygenated hemoglobin (HHb) levels, reflecting greater cognitive and perspective-taking effort. Greater HRV while self-representing an ideal group suggested enhanced emotional regulation. Dyadic Euclidean distance analysis showed higher delta band dissimilarity, reflecting shared emotional and cognitive engagement regardless of group mental representation. Beta band dissimilarity increased when mentally self-representing real group, suggesting elevated attentional and executive control demands. This study highlights the value of a multimodal hyperscanning paradigm in capturing the complex interplay of brain and physiological responses during communication exchange. Findings contribute to a deeper understanding of decision-making and may promote interventions to foster more effective group interactions.

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