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Poster title: Experiences Elicited by Intracortical Microstimulation delivered in the Human Anterior Intraparietal Area

Abstract: Bidirectional brain-machine interfaces (BMIs) are typically controlled by decoding movement intent from primary motor cortex and delivering information to primary somatosensory cortex (S1) via intracortical microstimulation (ICMS). Compared to S1, however, parietal cortical regions like the anterior intraparietal area (AIP) encode more complex information including entire hand conformations for grasping, specific reach trajectories (e.g., reaching toward the mouth versus the chin or cheek), and even properties about objects. Therefore, BMI performance might be improved by delivering feedback directly to such higher-level encodings via ICMS compared toprimary areas like S1. Here, we investigated whether ICMS in human AIP (≤100 μA, 300 Hz, 1000 ms) could reliably elicit experiences using a two-alternative forced-choice task. If the participant could repeatedly choose in which of two otherwise identical periods ICMS was delivered, we concluded the ICMS reliably elicited experiences. The participant correctly identified the period with ICMS on at least 9/10 trials involving 41/64 (64%) AIP electrodes. As a positive control, the task was then performed with ICMS delivered on each of 32 channels across two S1 arrays, all 32/32 (100%) of which enabled the participant to correctly identify the period with stimulation on at least 9/10 trials. Whereas experiences elicited by S1-ICMS were described as “pressure”, “touch”, or “tingles” on the hand, experiences elicited by AIP-ICMS were often difficult for the participant to describe. Rather, the experiences commonly manifested as “pre-sensations” or “gut feelings” about locations on the hand. The reported locations following AIP-ICMS were somatotopically organized, and AIP-ICMS could be detected at amplitudes below 20μA, similar to detection thresholds for S1-ICMS. Given that AIP neurons encode complex movements, electrodes positioned in AIP may be used to concurrently decode such movements and deliver somatosensory feedback related to those higher-level encodings. Ultimately, ICMS can be used to safely deliver information to human AIP, which may be an effective cortical territory for improving BMIs.