**Encoding of object weight in human motor cortex during object transport**

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Millions of people in the U.S. live with spinal cord injury or limb loss, limiting their autonomy. Brain-computer interfaces (BCIs) offer a path to restore function by decoding neural signals to control prosthetic limbs. While most BCI work targets limb kinematics, grasp force – essential for stable object manipulation – remains understudied. Although force can be decoded from neural activity, recent evidence suggests that motor cortex (MC) representations of force weaken during object transport, impairing decoding. We hypothesized this reflects the lack of somatosensory feedback during control of BCIs.

To investigate this, we worked with a unique BCI participant possessing residual grasping ability through finger flexor contractures and coordinated wrist motions, as well as partial hand sensation. The participant was previously implanted with Utah arrays in the motor and sensory cortices targeting hand and arm representations as a part of a clinical trial. They were instructed to grasp and transport a cylindrical object between three locations in peripersonal space while holding it with a minimal necessary force. On each trial, the weight of the object, its starting and target locations were randomized. The object was instrumented with four pressure sensors on the sides to monitor the time-varying grasp force, and a bottom sensor to detect the liftoff and landing. We used three levels of object weight, 0.5-1.2 kg, which naturally elicited different grasp forces, while the participant maintained a consistent grasping strategy. We found that object weight could be classified above chance from the activity in the motor cortex using a linear decoder. The classification accuracy remained similar throughout the trial – from the initial grasp to release. These findings suggest that somatosensory feedback may assist with maintaining the grasp force representation in MC, highlighting its importance for improving BCI-based prosthetic control.