Extraction of a Reward Expectation Signal From Cortical Units Following Ballistic Movements Generated by a Brain Machine Interface.

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Movement decoding algorithms used in today's brain-machine interface (BMI) technologies require movement-related neural activity in large quantities as training data to decode with sufficient accuracy the intended movements of the user. Because of physical disability the end users of BMI systems may be unable to readily provide such training data. Moreover, variability in the neural control of movements across patients with disability may result in individually unique training data. These issues limit the generalizability of movement decoding algorithms across BMI users. One potential method of circumventing this generalizability limitation and individualizing BMI technology is the use of reinforcement learning, a group of techniques that require minimal feedback in order to find solutions to an arbitrary problem. One promising means of providing feedback to a reinforcement learning-based BMI is via a neural reward signal found in multiple cortical and subcortical areas. Particularly attractive is the idea of parallel extraction of both the movement control signal and the reward signal from the same electrode array. We examined the neural signal underlying the expectation of reward depending on the probability of successfully reaching a target given the initial ballistic movement generated by a BMI. The real-time extraction of such signal could be used to determine if the user expects a movement generated by a BMI to succeed or fail. This information could then be used to update the control architecture of the BMI to generate an output more in line with the user's intention.