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**“Think before you act... but prepare an assortment of partial actions before you think!”**

Many theories of biological motor control inherit two central concepts from engineering: a functional architecture distinguishing a “planner” from a “controller”; and a representation of a motor plan (or “desired trajectory”). However, despite their theoretic appeal, these engineering concepts do not find strong support in neurophysiological data. As I will briefly review, the processes of planning and execution appear to overlap in the motor system both temporally and anatomically, and no *explicit* pre-planned representation of a desired trajectory appears to govern biological behavior.

As an alternative to these concepts, I will present a neural architecture inspired by neurophysiological data from frontal and parietal cortical regions. This architecture is based on a key distinction between processes of *action specification* and *action selection*. Action specification involves parallel sensorimotor transformations which use sensory information about the spatial layout of the environment to crudely specify potential actions which are currently available (potential reaching actions, potential grasp points, potential gaze targets, etc). Action selection involves processes which narrow down these potential actions, eliminating many from further sensorimotor processing on the basis of salience, attention, behavioral relevance, expected reward, and other cognitive factors. When an action is selected for execution, it is not pre-planned in detail before movement onset, but rather specified crudely and then fine-tuned *on-line* using rapid feedback through the parietal lobe and predictive feedback through a cerebellar forward model.

I will describe a hypothesis of how and where specification and selection take place in the primate brain during visually-guided voluntary behavior. Action specification draws upon information gathered by the “dorsal” visual stream to define potential actions in a series of parameter fields, each of which is a neural population in which the activity of a cell indicates the likelihood of performing an action with the parameter values preferred by that cell. Distinct potential actions appear as islands of activity in such parameter fields, which exist in fronto-parietal regions. Action selection involves a competition between these potential actions, biased by various influences. These selection influences include information on stimulus identity gathered by the “ventral” visual system and processes involving the basal ganglia and prefrontal cortex.

I will discuss how this framework addresses some features of cortical activity which are difficult to interpret within traditional frameworks (such as the mixture of variables within single cells and cell populations) and how it may reconcile some persistent debates (such as whether parietal activity reflects attention or intention). Finally, I will discuss how the framework makes a number of testable predictions and how it provides a context for developing formal computational models that are strongly anchored in neural data.