Indirection Explains Flexible Tuning of Neurons in Prefrontal Cortex

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Abstract: The prefrontal cortex (PFC) is broadly seen as supporting cognitive flexibility - quickly adapting behavior in response to changing circumstances. Some PFC neurons appear to actively maintain rule-like information associated with the current task, with firing changing with task context. Some PFC neurons, however, have been found to exhibit activity related to specific stimulus features or action options, but the tuning of these neurons appears to dynamically change with task shifts (Duncan, 2001). Short-term synaptic plasticity has been proposed as the primary mechanism for rapidly adapting the response profiles of these cells. Using a computational cognitive neuroscience model of hierarchical structure in PFC (Kriete, Noelle, Cohen, & O'Reilly, 2013), an alternative account is offered in which flexible neural tuning arises not from fast synaptic change but from a frontal representational scheme involving neurons that encode references to other PFC areas rather than directly encoding task relevant sensory/motor information.