A41. Neural Representations of Hierarchical Rule Sets: the Human Control System Represents Rules Irrespective of Their Hierarchical Level

Doris Pischedda[1*], Kai Görgen[2], John-Dylan Haynes[2], Carlo Reverberi[3]
[1] *Center for Mind/Brain Sciences - CIMeC, University of Trento, Italy*
[2] *Bernstein Center for Computational Neuroscience Berlin, Germany*
[3] *Department of Psychology, University of Milano-Bicocca, Italy*
[*] *doris.pischedda@unitn.it*

Keywords: Cognitive control, Rule representation, Task sets, Ventrolateral, prefrontal cortex, MVPA decoding

Humans use rules to organize their actions to achieve specific goals. While simple rules that link a sensory stimulus to one response may suffice in some situations, often the application of multiple, hierarchically organized rules is required. Recent theories suggest that progressively higher level rules are encoded along an anterior-to-posterior gradient within PFC. While some work supports the existence of such a functional gradient, other studies argue for a lesser degree of specialization within PFC. We used fMRI to investigate whether rules at different hierarchical levels are represented at distinct locations in the brain or encoded by a single system. Participants (N = 37) had to represent and apply hierarchical rule sets containing one lower-level stimulus-response rule and one higher-level selection rule. We used multivariate pattern analysis to directly investigate the representation of rules at each hierarchical level in absence of information about rules from other levels or other task-related information, thus providing for the first time a clear identification of low- and high-level rule representations. We could decode low- and high-level rules from local patterns of brain activity within a wide frontoparietal network. However, no significant difference existed between regions encoding representations of rules from both levels, except for precentral gyrus that represented only low- level rule information. Our findings suggest that the brain represents conditional rules irrespective of their hierarchical level and thus that the human control system is not organized according to this dimension.