Observing PFC Activation in Older Adults during Category Learning

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There are many well-known theories of category learning, one of which is the COVIS (Competition between Verbal & Implicit Systems) theory. The COVIS theory postulates that there are two systems always competing to learn the classifying rule when categorizing—regions of basal ganglia, and the prefrontal cortex (PFC). Literature supports that explicit learning is largely mediated by the PFC, while the more subcortical regions facilitates in categorizing non-verbalizable and implicit learning. Based off the assumptions of COVIS we can hypothesize that when an explicit method of categorization is being used for an implicit task, we should see greater activation, because the task is attempting a verbalizable rule. When the correct rule is applied for categorization, it should require less PFC activation.

The present study observed both implicit (information-integration) and explicit rule (rule-based) learning in older adults. Hemodynamic changes of the PFC was measured using the functional near-infrared spectroscopy (fNIRS). Participants classified squares that varied in number of shapes within (squares or circles), as well as in background color. Rule-based (RB) tasked relied on one feature changing to categorize, while the information integration (II) task relied on integrating color information with type of shape or frequency. We replicated a previous study—average number of trials participants completed before reaching criterion was 50 in the RB condition, while the average for the II condition was 128 trials. We found a significant difference in oxygenated hemoglobin between the rule-based and information-integration tasks. This difference was even stronger for the recorded deoxygenated hemoglobin.