Mathematical Modeling and Brain Activations Characterize Differences in Human Pattern Recognition under Conditions of Ambiguous Feedback

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This experiment developed a technique for improved quantitative diagnosis of mental disorders using intentionally ambiguous feedback in traditional pattern recognition testing. Pattern recognition is a cognitive phenomenon characterized by great variation among humans. Specifically, people with mental disorders exhibit fringe behavior in regard to pattern recognition: people with schizophrenia often see many “false patterns” that they extrapolate to hallucinations or delusions, and people with autism spectrum disorders often are unable to see existing patterns. Despite considerable research in pattern recognition, most studies are limited because subjects are given absolute feedback (“correct” or “incorrect”) on their hypothesized pattern. However, realistic situations of pattern recognition involve ambiguous feedback, where one is not completely sure of the correct answer. Our study addresses this limitation; we created a pattern recognition task that gives subjects ambiguous feedback. A lab group (excluding us) tested human subjects with our task. We used the lab group’s data to create two mathematical models by analyzing connections between neurological phenomena and behavioral manifestations. Both models have parameters that determine variations in an individual’s cognition. These parameters may be used in quantitative diagnosis of people with mental disorders, specifically Schizophrenia and Asperger’s Syndrome. In addition, the task we created may someday replace brain imaging as the primary tool to analyze an individual’s cognitive ability to recognize pattern.

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