Deciphering human meta-cognition in creative problem-solving

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Abstract

Previous studies on human meta-cognition, represented by confidence in perceptual decisions, often focus on over-simplified environments that yield experiences with limited semantic dimensions. However, in real-life situations such as solving a new problem, people need to make sequential decisions in a complex environment, exploring vast combinations of actions that unfold over time. How do people make meta-cognitive evaluations out of the rich, high-dimensional cognitive experiences in such situations? Here we develop a computational method that models each individual's meta-cognitive ratings (e.g., difficulty) of problem-solving experience in a visual puzzle game, using information-theoretic metrics derived from their own action sequences. Individuals are assumed to be Bayesian to update their "thought-space distributions" with their own behavioral distributions on different semantic categories. Our results show that information discrepancies between beliefs at different moments can predict individual differences in self-reported difficulty.

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