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Regret-Driven Adaptation: How Humans Solve the Breadth-Depth Dilemma Through Trial-by-Trial Learning

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Abstract

Adaptive decision-making requires solving the breadth-depth (BD) dilemma: balancing exploring more alternatives and evaluating each one more carefully. While normative models define optimal search set sizes given finite cognitive resources, the psychological mechanisms enabling individuals to achieve this remain unclear. In this study, we propose that subjective regret functions as a critical learning signal for solving the BD dilemma. Computational simulations demonstrated that search set size optimization is achievable by monitoring two distinct types of regret: one reflecting opportunity costs from narrow searches, and another reflecting evaluation errors from broad searches. A laboratory experiment using a sequential decision task showed that participants adjusted their search set sizes toward the theoretical optimum, with both regrets predicting these adjustments in complementary directions. Taken together, these findings suggest that regret is not merely a negative outcome but a signal that enables autonomous optimization of resource allocation in multi-alternative decision-making.

Keywords: breadth-depth dilemma; regret; decision making; resource allocation; bounded rationality; laboratory experiment