The costs of mental effort

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The Stroop task is a classic experimental design for understanding cognitive control. Successful completion of Stroop task 3 requires overriding your reflex to read the word in cases where the text and its color are mismatched. Credit: Duke Research Blog

Every day, we are faced with countless decisions regarding cognitive control, or the process of inhibiting automatic or habitual responses in order to perform better at a task.

Amitai Shenhav, Ph.D., of Brown University, and his lab are working on understanding the factors that influence this decision making process. Having a higher level cognitive control is what allows us to complete hard tasks like a math problem or a dense reading, so we may expect that

the optimal practice is to exert a high level of control at all times.

Experimental performance shows this is not the case: people tend to choose easier over hard tasks, require more money to complete harder tasks, and exert more mental effort as the reward value increases. These behaviors all suggest that the subjects' automatic state is not to be at the highest possible level of control.

Shenhav's research has centered around why we see variation in level of control. Because cognitive control is a costly process, there must be a limit to how much we can exert. These costs can be understood as tradeoffs between level of control and other brain functions and consequences of negative affective changes related to difficult tasks, like stress.

To understand how people make decisions about cognitive control in real time, Shenhav has developed an algorithm called the Expected Value of Control (EVC) model, which focuses on how individuals weigh the costs and benefits of increasing control.

Employing this model has helped Shenhav and his colleagues identify situations in which people are likely to choose to invest a lot of cognitive control. In one study, by varying whether the reward was paired only with a correct response or was given randomly, Shenhav simulated variability in efficacy of control. They found that people learn fairly quickly whether increasing their efforts will increase the likelihood of earning the reward and adjust their control accordingly: people are more likely to invest more effort when they learn that there is a correlation between their own effort and the likelihood of reward than when rewards are distributed independent of performance.

Another study explored how we adjust our strategies following difficult tasks. Experiments with cognitive control often rely on paradigms like

the Stroop task, where subjects are asked to identify a target cue (color) while being presented with a distractor (incongruency of the word with its text color). Shenhav found that when subjects face a difficult trial or make a mistake, they adjust by decreasing attention to the distractor.

A final interesting finding from Shenhav's work tells us that part of the value of hard work may be in the work itself: people value rewards following a task in a way that scales to the effort they put into the task.

Provided by Duke University

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