

Cognitive scientists able to isolate implicit from explicit learning processes

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(Medical Xpress)—Cognitive scientists may have produced the strongest evidence yet that humans have separate and distinct cognitive systems with which they can categorize, classify, and conceptualize their worlds.

"Our finding that there are distinct, discrete systems has implications for the fields of child development and cognitive aging," says lead researcher, cognitive psychologist J. David Smith, PhD, of the University at Buffalo.

"These distinct systems may have different developmental courses as the cortex matures," he says, "meaning that children may categorize differently than adults, using different systems at different ages. This would have educational and training implications in cases of developmental disability."

He says the systems also may have different courses of decline in cognitive aging, which would have ramifications for remediation and compensation in dementia.

The study "Deferred Feedback Sharply Dissociates Implicit and Explicit Category Learning," was conducted by Smith and colleagues at UB and at the University of California at Santa Barbara. It was published in the Feb. 7 edition of the journal *Psychological Science*.

The age-old question of whether humans have discrete cognitive systems operating on different levels that are more or less conscious, more or less

available to introspection, and so forth, has been debated for years.

"This issue of whether there are separate cognitive systems famously arose regarding humans' declarative and procedural memory and in the field of categorization," Smith says.

"Cognitive neuroscientists have hypothesized that humans have distinguishable systems for categorizing the objects in their world—one more explicit (i.e., conscious and available to introspection), one less so, or more implicit," says Smith.

To grasp the differences between these two types of learning, Smith recommends that we remember certain distinctions in our performance of the tasks of daily life.

"For instance, when you select a cereal named 'Chocoholic' from the store shelf," he says, "consider why you are doing so. Is it a deliberate, explicit choice, or is it possibly an implicit-procedural chocolate reaction, one triggered by processes, memories and so on, of which you are generally unaware?"

"Because of the considerable controversy surrounding the question of whether we have more than one [cognitive system](#), researchers have continued to seek models that distinguish the processes of explicit and implicit category learning," Smith says, "and this study presents the clearest distinction yet found between these systems.

"To make this discovery," he says, "we borrowed an influential model from our studies of macaque monkeys, which illustrates the valuable synergies that exist between primate and human research."

Their technique was to ask humans to work for blocks of trials without any corrective feedback, and then deliver feedback when they were

finished. Smith likens this process to an undergraduate testing situation in which the student taking a test does not get item-by-item feedback, but receives a summary score once the test is completed.

Because this manipulation, he says, prevents the formation of automatic (implicit) stimulus-response associations, Smith and his colleagues hypothesized that it would undermine the processes of conditioning and eliminate the possibility of implicit category learning.

"Implicit category learning," he says, "is a system that depends on trial-by-trial feedback of response correctness and incorrectness to establish the stimulus-response associations that allow [implicit learning](#) and responding.

"In fact," Smith says, "the blocked-feedback technique made implicit category learning impossible. We then used extensive trial-strategy analyses and formal-mathematical modeling to demonstrate this conclusively.

"So we were able to selectively unplug one category-learning system—the implicit system—but leave the explicit-conscious system functioning and intact," he says.

Smith et al. even found that, facing a task that could only be learned implicitly, participants with blocked feedback turned futilely to conscious strategies that were inadequate, because this was all they could do when implicit category learning was defeated.

"In the area of categorization research," Smith says, "the issue of single vs. multiple systems is nearly closed. The evidence is now very strong that there are multiple category-learning systems—in particular, the explicit-conscious and the implicit-procedural system."

Smith says it is fascinating to consider where in cognitive evolution the roots of the explicit-declarative categorization system lie. He and his colleagues have found the beginnings of this system in non-human primates like rhesus macaques and capuchin monkeys. Interestingly, though, thus far pigeons have shown no evidence of having distinguishable explicit and implicit systems.

More information: J. David Smith, Joseph Boomer, Alexandria C. Zakrzewski, Jessica L. Roeder, Barbara A. Church, and F. Gregory Ashby. "Deferred Feedback Sharply Dissociates Implicit and Explicit Category Learning." *Psychological Science* 0956797613509112, first published on December 13, 2013 [DOI: 10.1177/0956797613509112](https://doi.org/10.1177/0956797613509112)

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