

# Memory and Consciousness: Consciousness to Unconsciousness and Back Again

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Have you ever been driving through busy streets, listening to the radio, and suddenly realized you had no recollection of driving the previous 14 blocks? All of the turns you made, the abrupt halts, the traffic cop, had been absorbed by some part of your brain separate from your conscious awareness.

Have you ever seen a familiar face but could not remember who it is or from where. These experiences illustrate how our memories, experiences, and even our sense of self filter from consciousness into unconsciousness and back again.

During a special themed symposium, “Memory and Consciousness,” at the APS 18th Annual Convention, psychological scientists Janet Metcalfe (chair), Jason Hicks, Suparna Rajaram, John Bargh, and Elliot Hirshman discussed surprising findings related to this ebb and flow between conscious and unconscious.

It has long been widely held that only humans can have conscious self-reflection. But recent research with macaque monkeys provides some of the first evidence that nonhuman primates may also be capable of self-reflective behavior.

Janet Metcalfe, Columbia University, described recent work of Lisa Son, and Nat Kornell in Herbert Terrace’s lab, where macaques were trained to make “bets” on how well they could remember an image. This required the monkeys to gauge the state of their own knowledge — essentially, how certain they were about the bets the experimenters requested them to make. This thinking about one’s own thinking, or metacognition, is considered one of the most sophisticated capacities in human thought. But Metcalfe described two macaques, Ebbinghaus and Lashley, who were essentially behaving metacognitively — or self-reflecting.

Still, Metcalfe is quick to caution: This may not be true self-reflection of the human variety. “There is no ‘self’ involved here,” she said, “it’s one system looking at another system.” But she says this research provides a striking clue to the evolution of self-reflection in humans — that metacognition in monkeys is a precursor to human self-reflection.

Inspired by studying the judgment of knowing, she has recently started research on a judgment that involves monitoring the self — a judgment of how in control one (self) is or the “metacognition of agency.” The question is, to what extent does the person feel him or herself controlling the situation? This special metacognitive decision makes direct reference to the self. From early findings she and her colleagues reported that humans have an acute sense of knowing when they are in control of their physical actions.

“We run our mental expectations simultaneously with what our body actually does,” she said, “and if

there is no dissociation, it feels wonderful.”

The pro golfer Jack Nicklaus has said he mentally imagines every detail of a swing before he takes it. Metcalfe is taking this idea down to the micro level. She hopes to show that the elusive notion of conscious self-knowledge — a feeling of agency — lies in our ability to recognize a match between imagined and actual physical movement.

While a feeling of agency appears to be quite strong in Metcalfe’s subjects, a feeling of remembering can be rather ambiguous for most people, according to research outlined by Jason Hicks, Louisiana State University. When we say we “remember” a situation we tend to have a sense of context for it, but when we say we “know” something we usually have no recollection where the memory came from. For example, there is a difference between, “I remember when I met Alexa at dinner last night” and “I know Halifax is the capital of Nova Scotia.”

Measuring the difference between the feelings of remembering and knowing is referred to as the “remember-know” paradigm, and since Endel Tulving introduced it in 1985 it has become a way to measure different states of awareness in our memory.

Hicks pointed to puzzling conclusions from recent research using the remember-know paradigm. In nearly all memory tests using this paradigm there are “false alarms” – cases in which subjects have a specific feeling of recollection for words they never studied during the test. But these “remember” false alarms surprisingly tend to increase in the space of a week after studying a list of words.

In a recent study, Hicks and colleagues Richard L. Marsh and Gabriel I. Cook asked subjects if they “remembered” a particular item but also wanted them to explain why they “remembered” the item. This specific qualifier led subjects to say they remembered fewer items.

“These findings suggest that people’s criteria for what constitutes ‘remember’ can change,” said Hicks, “but the how and why they change remains an open research question.”

Even with the malleability of “remembering” there has long been thought to be a clear line dividing the process of explicit memory — where we have an active conscious intent to remember — from the process of implicit memory, where no conscious intent exists.

But Suparna Rajaram, Stony Brook University, reported two lines of work that show an unusual overlap between the mechanisms of explicit and implicit memory.

In collaboration with Stephanie Travers and Kavitha Srinivas, Rajaram found that short-term cognitive conflict where a person must ignore something salient in favor of something less salient – for example, reported the color in which a word is written rather than reporting the word itself – can create long-term impairment for the salient information in both explicit and implicit memory. These harmful effects of selective attention are surprising because dividing attention between different streams of information does not usually impair implicit memory.

We tend to have a better memory for things that are unusual. If we see an orangutan walking up 5th Avenue, we’d surely remember it. This is called the “distinctiveness effect” and it is thought to require

explicit memory — a conscious comparison of the unusual with the usual. But Rajaram said the distinctiveness effect can also show up in our implicit memory.

She found that if subjects encountered an unusual word in a list of common words they were faster to identify that same unusual word later, on implicit tests. This result means that the unusual can “prime” our unconscious memory system. By using a comparative process to identify the word as unusual, Rajaram said, the person was triggering the word in their implicit memory.

“It’s counterintuitive that an effect driven by conscious reconstruction shows up in implicit memory,” said Rajaram. “But this can happen if the implicit memory also requires evaluative processing — a mechanism that is usually attached to explicit memory.”

The sort of priming that occurs in implicit memory can be expanded to the macro level of social psychology, where both common and unusual features in our external environment can dramatically affect a person’s behavior without their awareness.

“Pretty much everything can be primed,” said John Bargh, Yale University. Mention the word “library” and people tend to speak more quietly. Put a photo of a loved one on your desk and you start behaving as if they were physically with you. Carry a briefcase and people may compete with you.

“We are faced with an embarrassment of riches with all these effects,” said Bargh. “Our task now is to try and make sense of them.”

Bargh likened priming to a “hypnoidal state” in which attitudes, objects, or even words can create unconscious impulses that then drive our motivations.

In one study Bargh and Grainne Fitzsimmons found that when subjects were asked to think about details of their mothers they outperformed others in specific tasks. Of course this only occurred with those participants who had previously reported having the goal of “making my mom proud.”

In the studies Bargh outlined, he noted that the primed behavior was strikingly similar to the consciously directed behavior. So is it possible that unconsciously directed behavior uses the same mental process as consciously goal-directed behavior?

Bargh says yes. He pointed to Lhermitte’s syndrome, in which damage to an area of the brain can leave patients at the mercy of priming. Bargh said Jaques Jean Lhermitte’s work in the 1920s involving stroke patients, along with more recent cognitive neuroscience research, shows that within working memory, one’s current objective is stored separately from the procedure or “program” a person is currently running in order to attain that objective. In this way, then, an individual can have a goal primed by the external environment and then behave to attain that goal, without knowing or being consciously aware of what that end result was – this is what Bargh and his colleagues find repeatedly in their studies.

Elliot Hirshman, George Washington University, proposes a possible solution: the use of benzodiazepine Midazolam as a supplemental tool to study unconscious memory systems. Midazolam is a drug that produces inhibitory effects on conscious memory, or in other words, creates temporary amnesia. Researchers can administer the drug prior to a study phase, after which they wait until the

amnesia dissipates — about 70 minutes — and then test those same subjects to see what they have retained. (To date there are few side effects, if any, said Hirshman.)

“We have tested hundreds of participants over the last four to five years,” said Hirshman. “It is also commonly used in surgical procedures where the surgeon wants the patient to be able to speak but not remember the actual surgery.”

What is most striking about this drug is its ability to allow subjects to be functioning throughout a study task yet also wipe out any memory of the task. It is similar to a drunk person who later has a “blackout” of the night’s events. Only, with Midazolam, the individual is coherent during the amnesiac phase — so much so that they often incorrectly predict they will remember everything during their study time. Later, when the researcher asks about the details of the study period, some subjects respond, “What study period?”