Mining the Unconscious

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The sentences that you are reading are in plain English. They are short. They contain simple words. And yet, while you read them you entertain no other thought or feeling (unless your mind is wandering). You do not think about your work. You do not think about something that bothered you earlier in the day. You do not experience happiness or sadness.

As this example illustrates, cognitive scientists have known for a long while that consciousness can only do very little at any given point in time. So if we want to understand human behavior, broadly defined, we have to understand the human unconscious.

The word *unconscious* usually brings to mind Sigmund Freud. But while Freud and his followers had a considerable impact on Western culture, he wasn't the first to stress the importance of unconscious processes, nor was he able to provide convincing scientific data to support his claims. There are, however, plenty of scientific advances that shed light on the unconscious.

Integrating the work of many laboratories around the world, we recently proposed a simple view; we suggested that, at least for adults, every fundamental, basic-level cognitive function that we can perform consciously, we can also perform nonconsciously. Can we think nonconsciously? Yes. Make decisions? Yes. How about integrating information from different sources, battling with temptations, planning our futures? Yes, yes, and yes, respectively. We called this view "YIC," short for "Yes It Can."

While YIC is a framework for thinking about the human unconscious, it has implications for how we think about human consciousness, too. Many of us are trying to figure out what is so special about human consciousness; what are the unique functions that human consciousness allows us to do, those

that we wouldn't be able to do without the kind of consciousness that we have? YIC implies that there are no such fundamental, basic-level functions.

This does not mean, however, that consciousness doesn't make a difference. YIC is perfectly compatible with the idea that there are huge differences between your wakeful, conscious, cheerful, lovely self, and a zombie that has no consciousness, whatsoever. But these differences do not require a set of functions that, by virtue of mysterious characteristics of consciousness, only conscious processes can perform.

Changing Attitudes

The notion of nonconscious processing is intimately associated in the public's eyes with drinking Coca-Cola. Back in the 1950s, market researcher James Vicary purportedly showed that moviegoers drank more Coke after being subliminally primed with words related to Coke. The results were fake. Yet they created a cultural myth so widespread that even advisors on George W. Bush's 2000 presidential campaign team seem to have known about it (as evidenced by the fact that during a short TV ad that dealt with the issue of prescription drugs for the elderly, the word RATS was flashed very briefly near Gore-related stimuli).

Anecdotes aside, only in the last dozen years have we learned that subliminal persuasion works, and how. In 2002, the laboratory of Mark Zanna at the University of Waterloo, Canada, provided the first evidence: Priming thirst-related words led people to drink more, but only if participants had been thirsty already. Dutch psychological scientist Johan Karremans took that research a step further by showing that priming people with a specific brand name of a drink (i.e., Lipton Ice) attracted them to the brand — but again, only if they were already thirsty. Similar results have been obtained in other laboratories, and recently Chris Loersch of the University of Colorado and colleagues extended these results beyond basic needs. They showed that the effects of subliminal priming depend on one's concerns during the evaluation stage. In a study published last year, Loersch's team primed participants with words related to cleanliness (*clear*, *fresh*, and *pure*) or dirtiness (*dirty*, *filthy*, and *foul*). Some of the participants were asked to consider how much they needed a product, say Ajax, while others were simply asked to consider the product's physical appearance. Participants who had considered their need for a product judged it as more desirable when primed with words like *dirty* and *filthy*, but these primes had the opposite effect if subjects simply considered a product's appearance.

Attitudes can be changed in indirect ways, too. Cornell University psychology professor Melissa Ferguson and I examine the effects of national flags on political attitudes. In experiments run in Israel and in the United States, we repeatedly found that subliminal or subtle priming of national flags affects political behavior, voting intentions, and actual voting in general elections. In studies headed by Travis Carter of Colby College before the 2008 US Presidential Election, incidental exposure to the flag increased support for Republican candidate John McCain and self-reports of voting for McCain in the general election. Other studies in the US, Israel, and Italy also document interesting effects of flag priming on attitudes. Yet some of our American results recently failed to replicate, so there's definitely more work to be done before we fully understand the relevant processes.

Another way of changing attitudes is by subtly changing associations. Psychologist Kerry Kawakami's lab at York University, Canada, for example, uses this approach to decrease implicit racial prejudice.

Participants who were instructed to pull a joystick toward themselves when presented with photographs of Black faces, thereby associating Black faces with approach movements, showed lowered prejudice towards Black people on subsequent Implicit Association Tests. In one of these experiments the pictures were presented for 23 milliseconds, a duration so short that subjects did not consciously perceive them. Even then, similar effects were obtained. When approaching subliminal pictures of Black faces, then, one's attitude towards Black people becomes more positive.

Information Integration

Integrating independent pieces of information is considered a hallmark of conscious processing. As it turns out, however, information integration does not require consciousness. To take a few examples, French neuroscientist Stanislas Dehaene's lab showed that the sum and average of a subliminally primed set of numbers (say, 9, 3, 2, 4) significantly influenced participants' ability to subsequently calculate the sum and average of a *target* set of numbers. In a 2011 study, Liad Mudrik of the California Institute of Technology and colleagues exposed participants to pictures depicting people performing actions with a congruent or incongruent object (say, basketball players playing with a basketball vs. with a watermelon). The pictures were presented subliminally, but they were ramped up in intensity until participants could see them. The incongruent pictures became conscious before congruent ones, thereby teaching us that unconscious processes integrated the information from the visual scenes. Mudrik and American neuroscientist Christof Koch recently replicated this finding using another, more implicit, measure.

Recently, studies headed by Asael Sklar and Ariel Goldstein from my lab showed that the reading of short sentences and verbal expressions, as well as doing simple arithmetic, are within the reach of unconscious processes, too. The results of the reading experiments were very similar to Mudrik's: Incoherent sentences (such as "John broke the water"), as well as negative multiple word expressions (such as "babies in the oven") became conscious before coherent sentences and neutral expressions, thus suggesting that the sentences were read unconsciously. As a part of an undergraduate course on replication, the incoherency results were recently replicated by Rebecca Saxe of MIT. Other studies in this set used priming and showed that nonconscious simple arithmetic equations (e.g., 9-3-1) primed their solutions, thereby suggesting that nonconscious processes can solve arithmetic equations.

Lastly, integrating information in the service of decision-making was repeatedly demonstrated by the lab of Ap Dijksterhuis at Radboud University Nijmegen in the Netherlands. In this paradigm, participants were presented with a complex decision — such as choosing an apartment — in which they had to choose between various alternatives. Information about the alternatives was presented at a first stage. Then, some participants were allowed to think about the options for a while before making a decision, while others were kept busy with a difficult cognitive task. The results of these studies showed advantage for the "busy" group — the people who had their conscious thinking disrupted. These results suggest that limiting consciousness may actually improve information integration.

Goal Pursuit

Goals are mental devices that we set up in the present in order to get to our preferred futures, which is partly why they are considered to be closely associated with consciousness. The idea that goals can

unconsciously shape our futures has gained much empirical support in recent decades. Researchers have shown that subtle exposure to words, or other objects that are associated with one's goals, can set these goals in motion without leaving detectable traces in consciousness. In some of these studies, the goals are primed subliminally, while in others priming is done via conscious materials. To take just one example, Yale University psychologist John Bargh and his colleagues have shown that incidental exposure to words related to cooperation just before engaging in a task increases your cooperation level. In similar fashions one can activate the goals of achievement, sexual interactions, and solving puzzles, among others. Most recently, Gary P. Latham of the University of Toronto, Canada, used achievement-related visual cues, such as a photograph of a runner winning a race, to increase employees' productivity.

Since humans usually pursue multiple goals that often push us in different directions, Tali Kleiman and I examined whether goals can be in active conflict outside of awareness. In one set of studies we used the cooperation priming method used by Bargh, and put participants in a hypothetical social dilemma involving limited resources (e.g., they were told they were one of two fishermen fishing in a small lake.) In this situation, people naturally tend to be a little selfish. We reasoned that cooperation priming would increase conflict, as participants would be swayed into weighing their own needs against shared needs. Indirect markers (such as decision times and physiological arousal) indicated that participants in the priming condition were more conflicted than those in the control. Crucially, however, multiple measures suggested that the participants in the conflict condition did not *consciously experience* more conflict than those in the control condition.

Executive Functions

Can you really resist an Oreo without telling yourself, time and again, *I should not eat this Oreo*? How about a cigarette, a drink, an extramarital love affair? Anyone who has ever tried to get rid of a bad habit — or who has seen Walter Mischel's classic videos of small children trying to resist cookies — knows the answer. Yet ample evidence from various laboratories shows that working memory and executive functions — the mental processes that allow for self-control — do not require consciousness.

To demonstrate unconscious inhibition — one of the main executive functions — cognitive neuroscientist Simon van Gaal at the University of Amsterdam, the Netherlands, gave participants a go/no-go task. The subjects had to rapidly respond to a visual target on most trials, but to withhold responses if a no-go stimulus (such as a gray circle) had been presented before the target (say, a black annulus). Critically, on some trials this no-go stimulus was conscious, while on others it was subliminal. The results showed that the subliminal priming of a no-go stimulus works. Inhibition can be activated subliminally.

Psychological scientist Hakwan Lau of Columbia University has obtained similar results in experiments that require task switching — an executive task in itself. Participants engaged in two tasks, and in each trial a cue indicated which task they had to perform. The results showed that even subliminal cues can bring about task switching.

Our own work on implicit working memory, as well as the work of David Soto from Imperial College London, United Kingdom, suggests that other high-level control functions can occur nonconsciously.

And So?

So, where does all this leave us? The cognitive sciences have taught us that functions traditionally and intuitively associated with consciousness do not really *depend* on consciousness. These include thought, motivation, decisions, reading, math, and mental control — to name just a few. The framework we recently proposed, YIC, suggests that these include all of the fundamental, basic-level cognitive functions.

I do not expect you to be easily persuaded by the central claim of YIC, of course. You have a lifetime of experiencing conscious events (such as thoughts and motivations) and *not* experiencing unconscious ones, a combination that intuitively suggests a crucial role for consciousness in many processes. Yet there is a science-based alternative. YIC is rendered plausible simply by how little we can consciously do at any given point in time, and it is backed by a lot of research, only the tip of which was mentioned here. It has the advantage of not involving a magical leap in our scientific explanation of the human psyche: Consciousness does not have tricks that Mother Nature did not provide to unconscious processes. While YIC proposes that our conscious and unconscious minds have the same tool kit, it does not suggest that they use the tools under the same circumstances, or that the consequences of using these tools are identical. In order to understand humans, and in order to create powerful interventions, we have to understand the different ways in which these tool kits operate in conscious and unconscious processing, and how these two modes work together. œ

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