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A great idea comes all of a sudden. In the depths of the mind, networks of brain cells perform a sublime symphony, and a twinkle of insight pops into consciousness. Unexpected as they are, these lightbulb moments seem impossible to orchestrate. Recent studies suggest otherwise. By freeing the mind of some of its inhibitions, we might improve creative problem solving.

The human brain constantly filters thoughts and feelings. Only a small fraction of the stimuli impressed on us by our environment ascends to the level of conscious awareness. Prior learning enforces mental shortcuts that determine which sensations are deemed worthy of our attention. Our laboratory is investigating whether we can weaken these biases and boost openness to new ideas by temporarily diminishing the neural activity in specific brain areas.

The inspiration for this approach comes from individuals with brain impairment. People with savant syndrome—those rare individuals who possess uncanny skill in specific, circumscribed domains while struggling in others—appear to show a pattern of left-hemisphere dysfunction with a tendency for right-hemisphere dominance. We theorize this arrangement renders their mental filters less powerful than those in normal, healthy adults.

Genius, rare as it is, must demand a qualitatively different view of the world than what most of us experience. Austrian physician Hans Asperger, whose name is associated with the eponymous condition on the autism spectrum, suggested that “a dash of autism” might set brilliant minds apart. We have been investigating this hypothesis by using weak electric current to modulate brain activity in healthy people in our laboratory. The effects fade in an hour, preserving normal cognition. This method of brain stimulation is safe and portable, suggesting the possibility of a device—a “creativity cap”—that anyone might use to spur creativity on demand.

Limited by Mind-sets

The brain does not passively receive information. It actively interprets what we think of as our raw experience in light of past knowledge. Two people looking at the same cloud formation, for example, may form completely different impressions of the patterns in the vapor: the ultrasound technician may see a diseased gallbladder, whereas the portrait painter may observe a dignified face.

Mind-sets are crucial. They allow us to predict likely outcomes based on incomplete information and to negotiate day-to-day activities efficiently. Without them we would see the world naively, unable to distinguish between important and irrelevant details. This cognitive architecture also leaves us susceptible to errors, however, including illusions, false memories and prejudice. Mind-sets make us less receptive, perhaps even resistant, to novel interpretations. Once a mind-set is formed, we lose conscious access to the stimuli that make up a thought. For example, read this passage:

A bird in the hand is worth two in the the bush

Many readers fail to spot the double “the.” Neurologist Oliver Sacks read the sentence in our lab many times without detecting it. Humans are instinctively conceptual, not literal, thinkers.

We argue that creative insight requires two cognitive styles—one approach is mind-set-driven, and one grants us an unfiltered experience of the world around us. We would like to access perceptual details usually hidden from conscious awareness, potentially unlocking the genius within us all.

A Dash of Autism

A clue for achieving this goal comes from savants, most of whom fall on the autism spectrum. Savant skills sometimes appear in early childhood; other times they emerge after damage to the brain. These abilities tend to call on a less conceptual, more literal way of thinking. For example, when the teacher of a boy with infantile autism asked him to recall the ending of a particular book, he recited the last page verbatim but showed no comprehension of its gist. Although in the extreme this cognitive style is a setback in daily life, it can also confer a range of advantages, including superior drawing abilities and a reduced susceptibility to illusions and false memories.

Stephen Wiltshire, for instance, is a British artist with autism who has been able to produce spectacularly detailed drawings from a young age. He can draw with photographic realism, in minute detail, whereas most adults tend to draw according to their internal schemas, producing crude but meaningful caricatures. In our view, Wiltshire and others like him have privileged access to more raw, less processed information about the world. This literal cognitive style appears to allow a person to work bottom up, from the parts to the whole.

A number of studies suggest that savants have some form of left-hemisphere dysfunction, together with right-hemisphere facilitation. (Typically damage to one hemisphere of the brain incites compensatory activity in the other half.) This characteristic can be observed from early childhood or after an injury, stroke or dementia damages the left hemisphere. Some of these impairments occur in a brain area of particular interest to us, the left anterior temporal lobe. This region is known to be involved in semantic memory, which includes the ability to categorize or combine concepts—in essence, filtering thoughts. Neurologist Bruce Miller of the University of California, San Francisco, for example, has documented multiple cases of dementia in which degeneration in the left anterior temporal lobe is associated with the sudden emergence of savantlike literal skills. Some of his subjects began producing realistic art—meticulous copies of scenes lacking abstract or symbolic features—without training.

Acquired savant skills are not restricted to drawing. T. L. Brink, then at the Palo Alto School of Professional Psychology, described the case of Mr. Z, who as a nine-year-old child suffered a gunshot wound to the left temporal lobe. He lost the ability to read and write but suddenly gained extraordinary mechanical skills; for example, he discovered he could dismantle and reassemble multigear bicycles without instruction. Another case is Orlando Serrell, whom we have studied, who was hit on the left side of his head with a baseball when he was 10. He has exhibited savant skills in calendar calculation—the ability to swiftly discern the day of the week that a given date falls on—and in literal recall of the weather every day since his accident. The abrupt emergence of autisticlike cognitive abilities in acquired savant syndrome points to the possibility that these skills are latent in us all, but beyond conscious access.

Finding Our Inner Savant

Intriguingly, recent evidence suggests we need not wound ourselves to access this altered cognitive state. We can quiet neuronal activity in the left hemisphere for brief periods using well-accepted forms of noninvasive brain stimulation. Many studies have shown that such stimulation can temporarily either inhibit or enhance neuronal activity in targeted areas. These techniques are now being explored for numerous applications, including the treatment of depression, eating disorders and speech impairments, among many others.

We started by investigating transcranial magnetic stimulation, a method in which a powerful magnet, positioned over a well-defined part of the brain, interferes with the normal flow of current in nearby neurons. The magnetic field disrupts the firing patterns of established networks of brain cells, whose connections were forged through a lifetime of learning. By targeting specific areas of the brain involved in synthesizing high-level concepts, we hope to reduce the influence of prior knowledge. In published studies so far, we have been able to enhance several skills in ordinary humans, including drawing, proofreading, numerosity estimation (counting the number of items, such as matchsticks, in a group) and verbal memory. The device needed to deliver this kind of stimulation is bulky and expensive, however.

A more promising approach is called transcranial direct-current stimulation (tDCS). This method is a safe, simple way to alter the likelihood that networks of neurons near the surface of the brain will fire. In our setup, a weak electric current passes between two electrodes, a cathode and an anode, placed on the scalp over the left and right anterior temporal lobes, just above the ears. At the cathode, the underlying neurons become less likely to fire, and vice versa for the anode. This dose of current alters the behavior of neurons for about an hour, a temporary window during which recipients can access a different cognitive style.

Boosting Brilliance

In one recent experiment using our apparatus, we asked 60 right-handed participants to solve a series of matchstick arithmetic "insight" problems. An erroneous arithmetic statement, spelled out in Roman numerals using matchsticks, must be corrected by moving one matchstick.

Participants were first given 27 problems that all involved one type of solution, namely changing an "X" to a "V." The goal was to prime the subjects to become fixed in one way of solving problems. Once people have learned to solve a problem, past research has shown, they often struggle to generate solutions using a different approach. As economist John Maynard Keynes put it, "The difficulty lies not in grasping the new ideas, but rather in escaping from the old ones."

The participants then received five minutes of DC stimulation. For one third of the group, we placed the cathode on the left anterior temporal lobe (to decrease the likelihood of neurons firing in that area) and the anode on the right anterior temporal lobe (to boost the chances of neuronal activity there). For another 20 participants, we switched the cathode and the anode. The final third received sham stimulation.

Next the subjects had six minutes to solve another problem. This task required a different kind of solution. As we had expected, many people were stuck. Yet 60 percent of those in the group that received stimulation according to our parameters solved the problem. Only 20 percent of those in the placebo group solved the new problem, and reversing the direction of stimulation did not have a significant effect on performance.

We did a follow-up study to ensure that our results were not a fluke. This time we used a notoriously difficult task—the classic nine-dots problem. The goal is to connect all nine dots with four straight lines, drawn without lifting pen from paper or retracing a line. A century of research has established that in the laboratory, at most 5 percent of participants manage to crack it, and very likely fewer manage to do so. Most people fail to decipher it even with hints and plenty of time. The reason is that the problem activates seemingly relevant prior knowledge that obstructs the solution. We tend to see the dots as a square, with rigid boundaries. Solving the puzzle requires the examinee to do away with false constraints and view the problem in a new light.

Subjects were given three opportunities to solve the nine-dots problem: they tackled it for three minutes before brain stimulation, three minutes during stimulation and three minutes immediately after the current was turned off. None of our participants solved the problem before stimulation or in the sham condition. Yet 14 out of 33 individuals did so as a result of receiving stimulation at the anterior temporal lobes according to our protocol. We calculated that the probability that this fraction of people could solve it by chance is less than one in a billion.

Many questions remain unanswered, of course. The precise effects of tDCS inside the brain are not completely understood, so mechanisms other than the ones we theorize might explain our results. The outcome of DC stimulation also depends on various factors, including which hemisphere is dominant and what the recipient's mental state is. Furthermore, problems are often difficult in multiple ways, and tDCS may only help with overcoming one of the many bottlenecks. In addition to ironing out these issues, we are now testing whether we can induce the ability to formulate new questions—another critical component of genius. Questioning is exemplary of receptiveness to novelty and is often obstructed by our preconceptions.

We want to emphasize that our approach aims not to enhance an existing ability but to reduce the limitations of prior knowledge. This type of cognitive enhancement is qualitatively different from what scientists normally seek to develop. Ultimately our goal is to develop a device that circumvents mental blocks to creativity. Having at our disposal two approaches, the normal way of thinking and the autistic focus on detail, could facilitate the ability to make truly novel connections—the essence of creative genius.