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This Is Your Brain on Metaphors

By ROBERT SAPOLSKY

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Tags: Neuroscience, Philosophy

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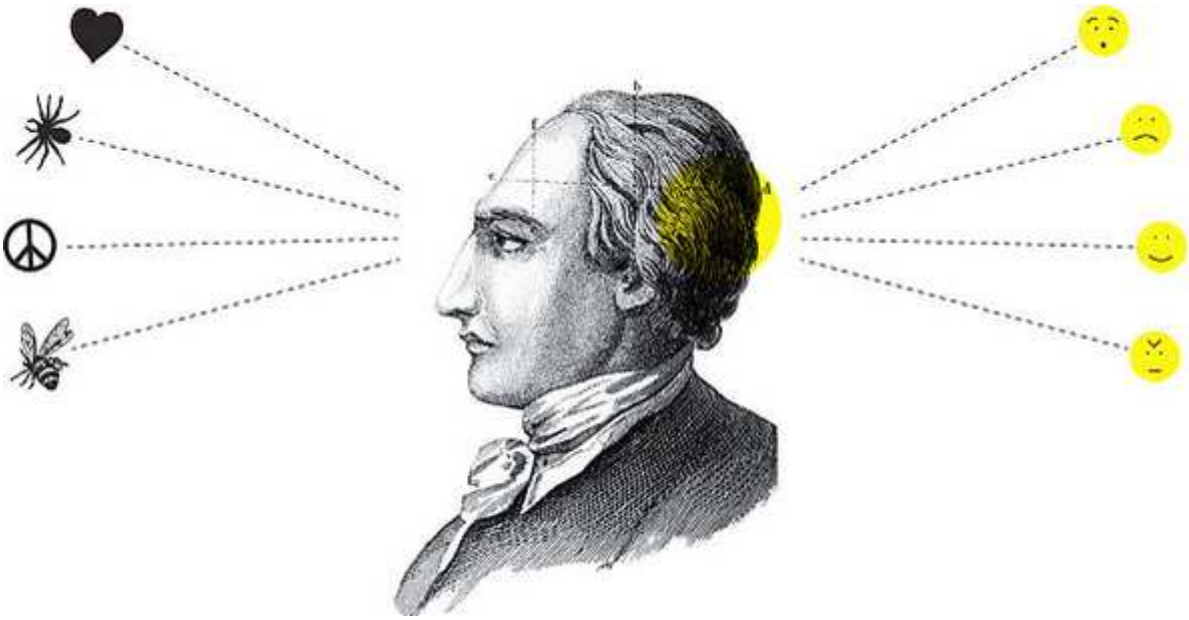
http://opinionator.blogs.nytimes.com/2010/11/14/this-is-your-brain-on-metaphors/

Despite rumors to the contrary, there are many ways in which the human brain isn't all that fancy. Let's compare it to the nervous system of a fruit fly. Both are made up of cells, of course, with neurons playing particularly important roles. Now one might expect that a neuron from a human will differ dramatically from one from a fly. Maybe the human's will have especially ornate ways of communicating with other neurons, making use of unique "neurotransmitter" messengers. Maybe compared to the lowly fly neuron, human neurons are bigger, more complex, in some way can run faster and jump higher.

We study hard to get admitted to a top college to get a good job to get into the nursing home of our choice. Gophers don't do that.

But no. Look at neurons from the two species under a microscope and they look the same. They have the same electrical properties, many of the same neurotransmitters, the same protein channels that allow ions to flow in and out, as well as a remarkably high number of genes in common. Neurons are the same basic building blocks in both species.

So where's the difference? It's numbers — humans have roughly one million neurons for each one in a fly. And out of a human's 100 billion neurons emerge some pretty remarkable things. With enough quantity, you generate quality.



Erin Schell

Neuroscientists understand the structural bases of some of these qualities. Take language, that uniquely human behavior. Underlining it are structures unique to the human brain — regions like "Broca's area," which specializes in language production. Then there's the brain's "extrapyramidal system," which is involved in fine motor control. The complexity of the human version allows us to do something that, say, a polar bear, could never accomplish — sufficiently independent movement of digits to play a trill on the piano, for instance. Particularly striking is the human frontal cortex. While occurring in all mammals, the human version is proportionately bigger and denser in its wiring. And what is the frontal cortex good for? Emotional regulation, gratification postponement, executive decision-making, long-term planning. We study hard in high school to get admitted to a top college to get into grad school to get a good job to get into the nursing home of our choice. Gophers don't do that.

There's another domain of unique human skills, and neuroscientists are learning a bit about how the brain pulls it off.

Consider the following from J. Ruth Gendler's wonderful "The Book of Qualities," a collection of "character sketches" of different qualities, emotions and attributes:

> Anxiety is secretive. He does not trust anyone, not even his friends, Worry, Terror, Doubt and Panic … He likes to visit me late at night when I am alone and exhausted. I have never slept with him, but he kissed me on the forehead once, and I had a headache for two years …

Or:

> Compassion speaks with a slight accent. She was a vulnerable child, miserable in school, cold, shy … In ninth grade she was befriended by Courage. Courage lent Compassion bright sweaters, explained the slang, showed her how to play volleyball.

What is Gendler going on about? We know, and feel pleasure triggered by her unlikely juxtapositions. Despair has stopped listening to music. Anger sharpens kitchen knives at the local supermarket. Beauty wears a gold shawl and sells seven kinds of honey at the flea market. Longing studies archeology.

Symbols, metaphors, analogies, parables, synecdoche, figures of speech: we understand them. We understand that a captain wants more than just hands when he orders all of them on deck. We understand that Kafka's "Metamorphosis" isn't really about a cockroach. If we are of a certain theological ilk, we see bread and wine intertwined with body and blood. We grasp that the right piece of cloth can represent a nation and its values, and that setting fire to such a flag is a highly charged act. We can learn that a certain combination of sounds put together by Tchaikovsky represents Napoleon getting his butt kicked just outside Moscow. And that the name "Napoleon," in this case, represents thousands and thousands of soldiers dying cold and hungry, far from home.

And we even understand that June isn't literally busting out all over. It would seem that doing this would be hard enough to cause a brainstorm. So where did this facility with symbolism come from? It strikes me that the human brain has evolved a necessary shortcut for doing so, and with some major implications.

> A single part of the brain processes both physical and psychic pain.

Consider an animal (including a human) that has started eating some rotten, fetid, disgusting food. As a result, neurons in an area of the brain called the insula will activate. Gustatory disgust. Smell the same awful food, and the insula activates as well. Think about what might count as a disgusting food (say, taking a bite out of a struggling cockroach). Same thing.

Now read in the newspaper about a saintly old widow who had her home foreclosed by a sleazy mortgage company, her medical insurance canceled on flimsy grounds, and got a lousy, exploitative offer at the pawn shop where she tried to hock her kidney dialysis machine. You sit there thinking, those bastards, those people are scum, they're worse than maggots, they make me want to puke … and your insula activates. Think about something shameful and rotten that you once did … same thing. Not only does the insula "do" sensory disgust; it does moral disgust as well. Because the two are so viscerally similar. When we evolved the capacity to be disgusted by moral failures, we didn't evolve a new brain region to handle it. Instead, the insula expanded its portfolio.

Or consider pain. Somebody pokes your big left toe with a pin. Spinal reflexes cause you to instantly jerk your foot back just as they would in, say, a frog. Evolutionarily ancient regions activate in the brain as well, telling you about things like the intensity of the pain, or whether it's a sharp localized pain or a diffuse burning one. But then there's a fancier, more recently evolved brain region in the frontal cortex called the anterior cingulate that's involved in the subjective, evaluative response to the pain. A piranha has just bitten you? That's a disaster. The shoes you bought are a size too small? Well, not as much of a disaster.

Now instead, watch your beloved being poked with the pin. And your anterior cingulate will activate, as if it were you in pain. There's a neurotransmitter called Substance P that is involved in the nuts and bolts circuitry of pain perception. Administer a drug that blocks the actions of Substance P to people who are clinically depressed, and they often feel better, feel less of the world's agonies. When humans evolved the ability to be wrenched with feeling the pain of others, where was it going to process it? It got crammed into the anterior cingulate. And thus it "does" both physical and psychic pain.

Another truly interesting domain in which the brain confuses the literal and metaphorical is cleanliness. In a remarkable study, Chen-Bo Zhong of the University of Toronto and Katie Liljenquist of Northwestern University demonstrated how the brain has trouble distinguishing between being a dirty scoundrel and being in need of a bath. Volunteers were asked to recall either a moral or immoral act in their past. Afterward, as a token of appreciation, Zhong and Liljenquist offered the volunteers a choice between the gift of a pencil or of a package of antiseptic wipes. And the folks who had just wallowed in their ethical failures were more likely to go for the wipes. In the next study, volunteers were told to recall an immoral act of theirs. Afterward, subjects either did or did not have the opportunity to clean their hands. Those who were able to wash were less likely to respond to a request for help (that the experimenters had set up) that came shortly afterward. Apparently, Lady Macbeth and Pontius Pilate weren't the only ones to metaphorically absolve their sins by washing their hands.

This potential to manipulate behavior by exploiting the brain's literal-metaphorical confusions about hygiene and health is also shown in a study by Mark Landau and Daniel Sullivan of the University of Kansas and Jeff Greenberg of the University of Arizona. Subjects either did or didn't read an article about the health risks of airborne bacteria. All then read a history article that used imagery of a nation as a living organism with statements like, "Following the Civil War, the United States underwent a growth spurt." Those who read about scary bacteria before thinking about the U.S. as an organism were then more likely to express negative views about immigration.

Another example of how the brain links the literal and the metaphorical comes from a study by Lawrence Williams of the University of Colorado and John Bargh of Yale. Volunteers would meet one of the experimenters, believing that they would be starting the experiment shortly. In reality, the experiment began when the experimenter, seemingly struggling with an armful of folders, asks the volunteer to briefly hold their coffee. As the key experimental manipulation, the coffee was either hot or iced. Subjects then read a description of some

individual, and those who had held the warmer cup tended to rate the individual as having a warmer personality, with no change in ratings of other attributes.

Another brilliant study by Bargh and colleagues concerned haptic sensations (I had to look the word up — haptic: related to the sense of touch). Volunteers were asked to evaluate the resumes of supposed job applicants where, as the critical variable, the resume was attached to a clipboard of one of two different weights. Subjects who evaluated the candidate while holding the heavier clipboard tended to judge candidates to be more serious, with the weight of the clipboard having no effect on how congenial the applicant was judged. After all, we say things like "weighty matter" or "gravity of a situation."

What are we to make of the brain processing literal and metaphorical versions of a concept in the same brain region? Or that our neural circuitry doesn't cleanly differentiate between the real and the symbolic? What are the consequences of the fact that evolution is a tinkerer and not an inventor, and has duct-taped metaphors and symbols to whichever pre-existing brain areas provided the closest fit?

Jonathan Haidt, of the University of Virginia, has shown how viscera and emotion often drive our decision making, with conscious cognition mopping up afterward, trying to come up with rationalizations for that gut decision. The viscera that can influence moral decision making and the brain's confusion about the literalness of symbols can have enormous consequences. Part of the emotional contagion of the genocide of Tutsis in Rwanda arose from the fact that when militant Hutu propagandists called for the eradication of the Tutsi, they iconically referred to them as "cockroaches." Get someone to the point where his insula activates at the mention of an entire people, and he's primed to join the bloodletting.
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But if the brain confusing reality and literalness with metaphor and symbol can have adverse consequences, the opposite can occur as well. At one juncture just before the birth of a free South Africa, Nelson Mandela entered secret negotiations with an Afrikaans general with death squad blood all over his hands, a man critical to the peace process because he led a large, well-armed Afrikaans resistance group. They met in Mandela's house, the general anticipating tense negotiations across a conference table. Instead, Mandela led him to the warm, homey living room, sat beside him on a comfy couch, and spoke to him in Afrikaans. And the resistance melted away.

This neural confusion about the literal versus the metaphorical gives symbols enormous power, including the power to make peace. The political scientist and game theorist Robert Axelrod of the University of Michigan has emphasized this point in thinking about conflict resolution. For example, in a world of sheer rationality where the brain didn't confuse reality with symbols, bringing peace to Israel and Palestine would revolve around things like water rights, placement of borders, and the extent of militarization allowed to Palestinian police. Instead, argues Axelrod, "mutual symbolic concessions" of no material benefit will ultimately make all the difference. He quotes a Hamas leader who says that for the process of peace to go forward, Israel must apologize for the forced Palestinians exile in 1948. And he quotes a senior Israeli official saying that for progress to be made, Palestinians need to first acknowledge Israel's right to exist and to get their anti-Semitic garbage out of their textbooks.

Hope for true peace in the Middle East didn't come with the news of a trade agreement being signed. It was when President Hosni Mubarak of Egypt and King Hussein of Jordan attended the funeral of the murdered Israeli prime minister Yitzhak Rabin. That same hope came to the Northern Irish, not when ex-Unionist demagogues and ex-I.R.A. gunmen served in a government together, but when those officials publicly commiserated about each other's

family misfortunes, or exchanged anniversary gifts. And famously, for South Africans, it came not with successful negotiations about land reapportionment, but when black South Africa embraced rugby and Afrikaans rugby jocks sang the A.N.C. national anthem.

Nelson Mandela was wrong when he advised, “Don’t talk to their minds; talk to their hearts.” He meant talk to their insulas and cingulate cortices and all those other confused brain regions, because that confusion could help make for a better world.

(Robert Sapolsky’s essay is the subject of this week’s forum discussion among the humanists and scientists at On the Human, a project of the National Humanities Center.)
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