

WHAT MAKES BIG IDEAS STICKY?

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In 1641 René Descartes published his *Meditations on First Philosophy*, in which he presented his theory of mind-body dualism, later known simply as Cartesian dualism. According to Descartes, the mind is animated by an immaterial soul distinct from the realm of the physical and all physical processes. There is the mental and there is the physical, and never the twain shall meet (except perhaps through the pineal gland, or perhaps by God's intervention; otherwise it is difficult to explain the nearly perfect correlation between the mind's desire to open a door and the body's simultaneous performance of the desired act). A few decades later, J. J. Becher published *Physica subterranea* (1667), which similarly focused on an invisible entity. Becher proposed that all flammable materials are flammable because they contain phlogiston, a hypothetical substance without color, odor, taste, or weight; thus fire, too, is animated

by a seemingly immaterial substance. Descartes' and Becher's ideas were widely discussed and believed in their day.

Times have changed, and so have the fortunes of these two theories. Whereas mind-body dualism is one of the most entrenched ideas of the last millennium, informing policy discussions regarding the ethics of cloning, abortion, euthanasia, and the use of animals in laboratory tests, phlogiston is only occasionally mentioned in scientific circles, and then as a cautionary tale of unscientific theorizing. One might naturally assume that the reason Cartesian dualism endures while phlogiston has fallen out of favor is that the former has garnered scientific support while the latter has been refuted by science. One might assume this, but one would be wrong.

In scientific circles, neither theory is reputable, although scientists still regularly report their findings in dualistic language. One of the fundamental tenets of the modern science of the mind is that the mind is a thoroughly biological and therefore material entity. Moreover, philosophy long ago established that mind-body dualism is logically impossible without the incorporation of numerous convoluted assumptions. Nevertheless, people walk around with an ingrained belief in the simple but implausible form of mind-body dualism that Descartes described. Just consider all the mind-brain and mind-body institutes springing up around the world, all claiming to explore the connection between those entities. Such institutes continue to reify dualism by suggesting that mind and body are distinct enough to need connections. Ongoing discussions of how brain states cause mental states and how meditation uses the mind to alter the brain and body similarly bolster the mind-body distinction.

Why is mind-body dualism a sticky idea that endures in the face of scientific and philosophical disbelief? Why, for that matter, does any idea take hold of large groups of people and endure for decades, or centuries? How do ideas become Big Ideas? Psychologists know a great deal about how the source and content of a message lead an individual to reject or be persuaded by an argument. Malcolm Gladwell's 2000 best seller *The Tipping Point* is a compelling popular account of the kinds of people who serve as an idea-distribution chain, ensuring an idea's wide influence. Most such memes, or contagious cultural ideas, typically come and go in a matter of years, months, or even days. Disco and bell-bottoms may have been cool in the seventies, for all the reasons thought to make ideas persuasive, but come the eighties, disco and bell-bottoms were out and new-wave music and tight jeans were in.

But what about the ideas that are truly enduring, like Cartesian dualism? I argue that Big Ideas sometimes match the structure and function of the human brain such that the brain causes us to see the world in ways that make it virtually impossible not to believe them. I call this explanation the *Deacon doctrine*, in honor of Berkeley anthropologist and neuroscientist Terrence Deacon, who inspired the idea.

In *The Symbolic Species: The Co-Evolution of Language and the Brain* (1998), Deacon provides a counterintuitive account of why humans have come to use language in its modern form. The common account of language use, according to Deacon, is that the human brain evolved *in order to* be able to perform all the mental activities necessary to use the kind of language we use. Deacon turned this logic on its head by suggesting that although the human brain did evolve a capacity for symbolic

processing, this was not for the purpose of language per se. Rather, Deacon suggests that it was so that couples could forge a bond of sexual trust that would be respected by the tribe, allowing the men to go off hunting without their mates. It is the next part of Deacon's argument that is critical to the Deacon doctrine. Deacon suggests that language has evolved (and continues to evolve) to fit the structure and function of the human brain, rather than the other way around. He provides extensive evidence that language evolves much more quickly and easily than the brain does, and that as language changes from generation to generation, it almost always changes in ways that make it easier for two-year-old children to learn.

The Deacon doctrine can thus be stated: *one reason Big Ideas are influential and enduring is because they fit with the structure and function of the human brain.* Or, as Deacon puts it, ideas evolve to fit the structure and function of the brain, and as greater fit emerges, the ideas become "stickier." Two effects should be present in cases where the Deacon doctrine applies: first, there should be some form of strong fit between the content of a Big Idea and the structure and function of the brain; second, the Big Idea should have changed over time to better approximate the critical features of brain organization. This essay will consider two Big Ideas for which the Deacon doctrine applies: mind-body dualism and Eastern versus Western culture.

Mind-Body Dualism

Although the scientific consensus is that minds and bodies are made of the same stuff, the science of how the brain makes

sense of minds and bodies in daily life is in its infancy. Indeed, nearly all the evidence on the subject is focused on two other topics—making sense of ourselves and making sense of other people—and only incidentally provides a picture of how the brain generates its own mind-body dualism. About a dozen neuroimaging studies, mostly using functional magnetic resonance imaging (fMRI), have found that two regions on the medial (or middle) surface of the brain, one in the prefrontal cortex (medial PFC) and one in the parietal cortex (medial PAC), tend to be more active during introspection—that is, when one is focused on the self, reflecting on one's state, traits, or preferences.¹ Another line of investigation has examined the brain regions involved in recognizing physical indicators of the self, such as visually recognizing one's own face. Somewhat surprisingly, when people are shown pictures of their faces during neuroimaging studies, the medial PFC and medial PAC, the regions involved in focusing on one's nonphysical attributes, are not activated; instead, regions in the lateral PFC and lateral PAC, on the outer surface of the brain, are activated.² Additionally, the lateral PAC appears to be involved in observing one's own body movements; disturbances in this region may figure in out-of-body experiences and in the sense—as in schizophrenia—that someone else is controlling one's body.³

¹ M. D. Lieberman, "Social Cognitive Neuroscience: A Review of Core Processes," *Annual Review of Psychology* 58(2007): 259–89; W. M. Kelley et al., "Finding the Self? An Event-Related fMRI Study," *Journal of Cognitive Neuroscience* 14(2002): 785–94.

² L. Q. Uddin et al., "Self-Face Recognition Activates a Frontoparietal 'Mirror' Network in the Right Hemisphere: An Event-Related fMRI Study," *NeuroImage* 15(2005): 926–35.

³ O. Blanke et al., "Stimulating Illusory Own-Body Perceptions: The Part of the Brain That Can Induce Out-of-Body Experience Has Been Located,"

A similar distinction can be seen in the brain's processing of other people, depending on whether the test subject is trying to make sense of another person in terms of the mind or the body. When we engage in "mentalizing," we are trying to figure out what's in the mind of another person—that is, his intentions, beliefs, or feelings. The brain region most directly associated with mentalizing is a region of the medial PFC. This mentalizing region is near, though not the same as, the region involved in self-reflection. Thus, mentalizing about another's mind or one's own mind recruits the medial PFC.

What about when we make sense of another person's bodily movements without the intent to understand what's going on in the person's mind? For instance, when we imitate someone's finger-tapping, we need not consider that person's state of mind. In this case, activity is consistently observed in the lateral PFC and lateral PAC. Together, these regions are often referred to as the *mirror-neuron* system, because in other primates, single-cell recordings have shown that whether a primate performs an action (reaching for food, say) or just watches another performing this action, the same neurons in the lateral PFC and lateral PAC respond.⁴ As with self-processing, we see a split between processing others in terms of their mind or their body.

In both self- and other-processing, medial activations dominate when one is trying to make sense of the target's mind, and

Nature 419(2002): 469–70; V. Ganesan et al., "Schneiderian First-Rank Symptoms and Right Parietal Hyperactivation: A Replication Using fMRI," *American Journal of Psychiatry* 162(2005): 1545.

⁴ M. Iacoboni et al., "Cortical Mechanisms of Human Imitation," *Science* 286(1999): 2526–28; G. Rizzolatti and L. Craighero, "The Mirror-Neuron System," *Annual Review of Neuroscience* 27(2004): 169–92.

lateral activations dominate when one focuses on the target's body. The brain regions are in relatively similar locations (that is, the PFC and PAC) on the medial and lateral surfaces of the brain, but they are quite distinct, based on the focus of attention either on minds or on bodies. Additionally, activation in the lateral regions is associated with reduced activity in the medial regions,⁵ suggesting that—at least under some conditions—the activity in the medial and lateral regions may be competitive.

Thus, minds and bodies are represented in the brain in distinct networks, creating a kind of dualism within the brain. Generally speaking, when the brain processes two things in different brain networks, those two things are experienced as being in separate categories. For instance, colors and numbers are experienced as separate categories and are processed in discrete neural networks. (Interestingly, rare individuals called synesthiacs see colors for numbers or conflate other such "qualia"—for example, "seeing" music or "tasting" visual stimuli. The UCSD neuroscientist V. S. Ramachandran has shown that such people tend to process these separate qualia in the same brain area.) Because of this normal separation in the brain, trying to convince people that minds and bodies are really one kind of thing rather than two might be like trying to convince them that colors and numbers are one kind of thing. It doesn't matter what science tells us, it just isn't borne out by our immediate daily experience.

⁵ K. A. McKiernan et al., "A Parametric Manipulation of Factors Affecting Task-Induced Deactivation in Functional Neuroimaging," *Journal of Cognitive Neuroscience* 15(2003): 394-408.

Recall that the second indicator of the Deacon doctrine is that sticky ideas may evolve from less sticky ideas as the ideas transform to better fit the structure and function of the brain. Such idea evolution appears to have occurred with mind-body dualism. Dualism was hardly a new idea when Descartes wrote about it; previous proponents include Pythagoras, Cicero, Saint Augustine, and Thomas Aquinas. The most well-known of these pre-Cartesian dualisms is Plato's; he proposed a theory that contrasted the physical world with the world of universal forms, suggesting that we could appreciate a particular chair as a member of the chair category because we had access to the universal idea of "chair." These universal ideas existed within their own realm, rather than in the mind or the body. While Plato's theory was influential in philosophical circles, it never caught on as a common idea among the masses, and no social policy has ever turned on our feelings about universal forms. Could this be because there are no brain structures devoted to processing universal forms? Are universal forms just one of a countless number of propositional schemes that the all-purpose symbolic machinery of the brain can process but that it need not process—any more than the dorm-room "discovery" that the planets orbiting the sun are analogous to electrons around the atomic nucleus or that the Milky Way is just one molecule in a vast cosmic entity. We can entertain the planet/electron idea, but it isn't sticky, and neither is universal-forms versus physical-world dualism.

A variety of dualisms were proposed to account for many of the same complexities of the world, and yet none really stuck until Descartes' version. This version just happens to correspond to a major division in how the brain processes minds and

bodies. Despite the concerted efforts of scientists and philosophers to discredit mind-body dualism, it remains a core belief and way of processing the world.

Let us turn to the second Big Idea that the Deacon doctrine may explain.

Eastern versus Western Culture

Since the early 1990s, there have been fevered debates in psychology over whether and how a particular culture shapes the minds of those raised in it. The conceptual breakthrough, which has led to hundreds of studies, came in 1991, from Hazel Markus of Stanford and Shinobu Kitayama of Kyoto University, who suggested that Eastern and Western cultures tend to inculcate, respectively, interdependent and independent frames for seeing the world and one's place in it. In essence, East Asians are raised to believe that we are all connected and that the needs of the group outweigh the needs of the individual. In contrast, people from Western Europe and North America are taught to prioritize their own goals, feelings, and achievements. Social rewards and punishments follow accordingly, such that in interdependent (Eastern) cultures "the nail that stands out gets pounded down," whereas in independent (Western) cultures "the squeaky wheel gets the grease." Being raised in one culture or the other is thought to shape one's mind such that the world comes to be seen in interdependent or independent ways, leading individuals to live in accordance with their culture's values.

The values of each culture represent a culture-specific Big Idea that has endured in each culture for more than a millen-

nium. The standard account is that the cultures shape minds and brains. The Deacon doctrine would suggest that the opposite explanation may also hold true. That is, what if East Asians and Western Europeans have brains that differ in just the right ways, such that each culture's Big Idea would be sticky? What if differences in the brains of people in these geographical regions promote cultural narratives that lead each group to value those ways of organizing society that reflect the group's type of brain organization? For instance, if the people of one culture had congenitally poor hearing and the people of another had congenitally poor sight, they would no doubt value music and art differently.

Baldwin Way, a postdoctoral fellow in my lab at UCLA, has recently come across a key genetic difference between individuals of Eastern and Western descent that differentially affects their brains. A subsequent series of conversations led us to begin testing this idea. Way was reviewing research on genes that control the brain's serotonin system. He discovered that individuals of Eastern and Western descent show differentially distributed variations within the regulatory region of the serotonin transporter gene (5-HTTLPR). There are three different forms of the 5-HTTLPR genetic polymorphism, based on the combination of two alleles; these variants (for shorthand) are called short-short, long-short, and long-long. Whereas two-thirds of East Asians have the short-short variant, only one-fifth of Americans and Western Europeans have it. This is an enormous and highly reliable difference, seen in multiple studies.⁶

⁶ See, for example, J. Gelernter et al., "Serotonin Transporter Protein (SLC6A4) Allele and Haplotype Frequencies and Linkage Disequilibria in African- and European-American and Japanese Populations and in Alcohol-Dependent Subjects," *Human Genetics* 101(1997): 243-46.

The serotonin system, and this gene in particular, is related to socioemotional sensitivity. For instance, in one study, children with the short-short variant were shown to be at higher risk for depression, but only if they lacked social support; whereas the risk for depression in those with the long-short and long-long gene variants remained unaffected by social support.⁷ Another study found that short-short individuals from nonsupportive families had the greatest depressive symptomology and short-short individuals from supportive families had the least depressive symptomology—with individuals possessing the long-short and long-long gene variants falling in the middle, regardless of whether their family background was supportive or not.⁸ These results suggest that the well-being of those with the short-short variant of the 5-HTTLPR gene is more dependent on the quality of the social environment and that these individuals are likely to be more sensitive to the social environment in general.

In light of the Deacon doctrine, the prevalence of short-short 5-HTTLPR polymorphism in individuals of East Asian descent suggests that they may possess the kind of neurochemistry that would predispose them toward interdependence, establishing this as a cultural value, or enduring Big Idea, in this region of the world. If your well-being tends to be dependent on

⁷J. Kaufman et al., "Social Supports and Serotonin Transporter Gene Moderate Depression in Maltreated Children," *Proceedings of the National Academy of Sciences* 101(2004): 17316–21.

⁸S. E. Taylor et al., "Early Family Environment, Current Adversity, the Serotonin Transporter Promoter Polymorphism, and Depressive Symptomatology," *Biological Psychiatry* 60, no. 7(2006): 671–76.

how you are treated by others, then you would certainly prefer a culture that encourages others to make your well-being a priority. In contrast, the relative absence of this gene type in the West would lead to a neurochemistry predisposing people to create a culture that values independence and individual achievement.

Recall that mind-body dualism predates Descartes yet hasn't evolved further since his formulation of it, despite numerous critiques. In the case of Eastern and Western cultural differences, over time there has been, analogous to the evolution of an idea, a territorial migration of the two cultural ideas—both of which seem to have originated in central Asia—with one moving nearly exclusively eastward and the other almost exclusively westward.

Eastern and Western cultures can each reasonably be described as the combination of a religion with a particular brand of civics. Eastern culture solidified in the form of neo-Confucianism, which combined the Buddhist beliefs that we are all connected and that selfish attachments are unhealthy with Confucian civics, which characterizes society in terms of the relational obligations among its members. Western culture emerged out of the combination of Judeo-Christian theology, which posits a single god who holds individuals responsible for their own eternal salvation, and Greek civics, which emphasized personal agency and free will.

Buddhism spread from India toward East Asian countries, with more lasting effects the farther east it traveled; there is no longer a major Buddhist presence in India, where less than half the population has the short-short variant of the 5-HTTLPR

gene. In contrast, Christianity spread from the Middle East westward toward Europe and then on to North America, with more lasting effects the farther west it traveled. In both cases, the Big Ideas started out as relatively small ideas that had to travel thousands of miles to find the hospitable regions where they could flourish and become Big Ideas. Interestingly, there were contacts between leaders and representatives of Eastern and Western religions in the time of Alexander the Great, during the Roman Empire, and again in the medieval era. Although the religions were adopted with relative ease when headed in their natural direction—for example, Buddhism to the East—virtually no cross-fertilization of these religions has occurred until lately, when the global economy of the twentieth century eclipsed existing constraints. These cultural Big Ideas appear to have migrated until they found the populations with the right neurochemistry to make them sticky.

We like to think of our beliefs as stemming from some combination of logical analysis and peer influence. The Deacon doctrine suggests another route: the human brain is predisposed to find some ideas appealing because of the structural fit between itself and the idea in question. In the case of Cartesian dualism, we've seen that the brain represents minds and bodies in discrete neural circuits, presumably giving rise to the immediate experience of, and consequent belief in, minds and bodies as discrete categories despite evidence to the contrary. In the case of Eastern and Western cultures, we've seen that regional genetic variation has given rise to distinct brain chemistries that render the two populations differentially sensitive to social feedback and thus differentially receptive to cultural beliefs

and values that do or do not prioritize social interdependence. In both cases, the Deacon doctrine uses neuroscience to provide counterintuitive explanations of some of our most deeply held beliefs. When enough brains are predisposed to find the same idea compelling, it is likely to stick around for quite some time.

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