# The Neuroscience of Leadership

*by David Rock and Jeffrey Schwartz*

## Breakthroughs in brain research explain how to make organizational transformation succeed.

Illustration by Jason Holley

Mike is the CEO of a multinational pharmaceutical company, and he's in trouble. With the patents on several key drugs due to expire soon, his business desperately needs to become more entrepreneurial, particularly in its ability to form internal and external partnerships to reduce time-to-market. Yet his organization has a silo mentality, with highly competitive teams secretly working against one another. How can Mike change the way thousands of people at his company think and behave every day?

Businesses everywhere face this kind of problem: Success isn't possible without changing the day-to-day behavior of people throughout the company. But changing behavior is hard, even for individuals, and even when new habits can mean the difference between life and death. In many studies of patients who have undergone coronary bypass surgery, only one in nine people, on average, adopts healthier day-to-day habits. The others' lives are at significantly greater risk unless they exercise and lose weight, and they clearly see the value of changing their behavior. But they don't follow through. So what about changing the way a whole organization behaves? The consistently poor track record in this area tells us it's a challenging aspiration at best.

During the last two decades, scientists have gained a new, far more accurate view of human nature and behavior change because of the integration of psychology (the study of the human mind and human behavior) and neuroscience (the study of the anatomy and physiology of the brain). Imaging technologies such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), along with brain wave analysis technologies such as quantitative electroencephalography (QEEG), have revealed hitherto unseen neural connections in the living human brain. Advanced computer analysis of these connections has helped researchers develop an increasing body of theoretical work linking the brain (the physical organ) with the mind (the human consciousness that thinks, feels, acts, and perceives).

The implications of this new research are particularly relevant for organizational leaders. It is now clear that human behavior in the workplace doesn't work the way many executives think it does. That in turn helps explain why many leadership efforts and organizational change initiatives fall flat. And it also helps explain the success of companies like Toyota and Springfield Remanufacturing Corporation, whose shop-floor or meeting-room practices resonate deeply with the innate predispositions of the human brain.

Managers who understand the recent breakthroughs in cognitive science can lead and influence mindful change: organizational transformation that takes into account the physiological nature of the brain, and the ways in which it predisposes people to resist some forms of leadership and accept others. This does not imply that management — of change or anything else — is a science. There is a great deal of art and craft in it. But several conclusions about organizational change can be drawn that make the art and craft far more effective. These conclusions would have been considered counterintuitive or downright wrong only a few years ago. For example:

- **Change is pain.** Organizational change is unexpectedly difficult because it provokes sensations of physiological discomfort.
- **Behaviorism doesn't work.** Change efforts based on incentive and threat (the carrot and the stick) rarely succeed in the long run.
- **Humanism is overrated.** In practice, the conventional empathic approach of connection and persuasion doesn't sufficiently engage people.
- **Focus is power.** The act of paying attention creates chemical and physical changes in the brain.
- **Expectation shapes reality.** People's preconceptions have a significant impact on what they perceive.
- **Attention density shapes identity.** Repeated, purposeful, and focused attention can lead to long-lasting personal evolution.

**Change Is Pain**

"Why do people resist change so stubbornly, even when it's in their own interest?" wonder CEOs like Mike. Changing the way others go about their work is harder than he has expected. New advances in neuroscience provide insight into why change can be so difficult, and there are several key findings.

The first has to do with the nature of human memory and its relationship to conscious attention. Working memory — the brain's "holding area," where perceptions and ideas can first be compared to other information — is frequently engaged when people encounter something new. When you see a new product on a supermarket shelf and rationally compare its benefits to a product you already use, it's your working memory that takes in the new information and matches it against the old. This kind of memory activates the prefrontal cortex, an energy-intensive part of the brain.

The basal ganglia, on the other hand, are invoked by routine, familiar activity, like putting an often-purchased product into a supermarket cart without consciously paying attention, and perhaps without later remembering having picked it out. This part of the brain, located near the core, is where neural circuits of long-standing habit are formed and held. It requires much less energy to function than working memory does, in part because it seamlessly links simple behaviors from brain modules that have already been shaped by extensive training and experience.

The basal ganglia can function exceedingly well without conscious thought in any routine activity. In contrast, working memory fatigues easily and can hold only a limited amount of information “on line” at any one time. Therefore, any activity conducted repetitively (to the point of becoming a habit) will tend to get pushed down into the basal ganglia, the habit-center part of the brain. This frees up the processing resources of the prefrontal cortex.

After just a few months of learning to drive a car, people can typically drive “without thinking.” If they then try to drive on the other side of the road, say in another country, the act of driving suddenly becomes much more difficult. The prefrontal cortex must now be used to keep track of the action. Many travelers never want to undergo this experience. Similarly, for those used to an automatic transmission, the first time driving a car with a standard transmission can be a nerve-wracking experience. (Indeed, the basal ganglia area operates like an automatic transmission, shifting among patterns of deeply held thought.)

The same cognitive dynamics come into play when people face other types of stressful experiences, including any strategic or organizational change. Much of what managers do in the workplace — how they sell ideas, run meetings, manage others, and communicate — is so well routinized that the basal ganglia are running the show. Trying to change any hardwired habit requires a lot of effort, in the form of attention. This often leads to a feeling that many people find uncomfortable. So they do what they can to avoid change.

The second reason change is hard relates to basic brain functioning. Human brains have evolved a particularly strong capacity to detect what neuroscientists call “errors”: perceived differences between expectation and actuality. When a child (or an adult, for that matter) is promised a sweet-tasting treat and then discovers it tastes salty or bitter, the brain emits strong signals that use a lot of energy, showing up in imaging technology as dramatic bursts of light. Edmund Rolls first illustrated this at Oxford University in the early 1980s, with a study involving monkeys. Dr. Rolls found that “errors” in the environment produced intense bursts of neural firing, markedly stronger than the firing caused by familiar stimuli.

These error signals are generated by a part of the brain called the orbital frontal cortex. Located above the eyeballs, it is closely connected to the brain’s fear circuitry, which resides in a structure called the amygdala. (The amygdala is the source of the “amygdala hijack,” the sudden and overwhelming fear or anger response described in layman’s terms by Daniel Goleman in his popular book *Emotional Intelligence*.) The amygdala and the orbital frontal cortex are among the oldest parts of the mammal brain, remnants of evolutionary history. When these parts of the brain are activated, they draw metabolic energy away from the prefrontal region, which promotes and supports higher intellectual functions. The prefrontal region is particularly well developed in humans, and doesn’t exist at all below the higher primates. Error detection signals can thus push people to become emotional and to act more impulsively: Animal instincts take over.

People with the syndrome known as obsessive-compulsive disorder (OCD) have error detection circuits that have gone into overdrive. Their orbital frontal cortex sends a constant, incorrect message that something is wrong (“My hands are dirty”). The individual knows, on one level, that the message is incorrect. But the alarm is so compelling, it’s hard to resist trying to fix the situation (“I must wash my hands”), so the person keeps trying to fix it. The more the individual tries to fix it, the more entrenched those neural circuits become in the basal ganglia; any immediate “solution” (washing hands) reinforces the entrenched circuitry, making the problem worse. Even among people without OCD, just trying to change a routine behavior sends out strong messages in the brain that something is not right. These messages grab the individual’s attention, and they can readily overpower rational thought.

It takes a strong will to push past such mental activity — and the same is true on the level of organizational change. Try to change another person’s behavior, even with the best possible justification, and he or she will experience discomfort. The brain sends out powerful messages that something is wrong, and the capacity for higher thought is decreased. Change itself thus amplifies stress and discomfort; and managers (who may not, from their position in the hierarchy, perceive the same events in the same way that subordinates perceive them) tend to underestimate the challenges inherent in implementation.

**Behaviorism Doesn’t Work**

Many existing models for changing people’s behavior are drawn from a field called behaviorism. The field emerged in the 1930s and was led by psychologist B.F. Skinner and advertising executive John B. Watson, building on Ivan Pavlov’s famous concept of the conditioned response: Associate the ringing of a bell with food, and a dog can be made to salivate at the sound. The behaviorists generalized this observation to people, and established an approach to change that has sometimes been caricatured as: “Lay out the M&Ms.” For each person, there is one set of incentives — one combination of candy colors — that makes the best motivator. Present the right incentives, and the desired change will naturally occur. If change doesn’t occur, then the mix of M&M colors must be adjusted.

Yet there is plenty of evidence from both clinical research and workplace observation that change efforts based on typical incentives and threats (the carrot and the stick) rarely succeed in the long run. For example, when people routinely come late to meetings, a manager may reprimand them. This may chasten latecomers in the short run, but it also draws their attention away from work and back to the problems that led to lateness in the first place. Another manager might choose to reward people who show up on time with public recognition or better assignments; for those who are late, this too raises anxiety and reinforces the neural patterns associated with the habitual problem. Yet despite all the evidence that it doesn’t work, the behaviorist model is still the dominant paradigm in many organizations. The carrot and stick are alive and well.

**Humanism Is Overrated**

The next big field to emerge in psychology after behaviorism was the humanist movement of the 1950s and 1960s. Also called the person-centered approach, the field was inspired by such thinkers as Carl Rogers and Abraham Maslow. This school of thought assumed that self-esteem, emotional needs, and values could provide leverage for changing behavior. The prevailing model of humanist psychology involved helping people reach their potential through self-actualization — bringing forth hidden capacities and aspirations. Therapists and trainers left behind the carrot and stick and focused on empathy. They listened to people’s problems, attempted to understand them on their own terms, and allowed a holistic solution to emerge.

In theory, an effective solution might well emerge from the person-centered approach. But there is rarely time to go through this process with employees, and no guarantee that it will produce the desired results. True self-actualization might simply lead someone to quit his or her job. Moreover, in practice, the humanist approach leads to an emphasis on persuasion. The implicit goal is to “get people on board” by establishing trust and rapport, and then to convince them of the value of a change. Performance management training manuals on

administering annual appraisals often counsel managers to “deliver constructive performance feedback.” Translated from the jargon, this means, “Politely tell people what they are doing wrong.” Though colored by humanist intent, this approach is, in its own way, as mechanistic as behaviorism. It assumes that if people receive correct information about what they are doing wrong, and the right incentives are in place, they will automatically change.

But the human brain can behave like a 2-year-old: Tell it what to do and it automatically pushes back. Partly this phenomenon is a function of homeostasis (the natural movement of any organism toward equilibrium and away from change), but it also reflects the fact that brains are pattern-making organs with an innate desire to create novel connections. When people solve a problem themselves, the brain releases a rush of neurotransmitters like adrenaline. This phenomenon provides a scientific basis for some of the practices of leadership coaching. Rather than lecturing and providing solutions, effective coaches ask pertinent questions and support their clients in working out solutions on their own.

The power of changing behavior by asking questions goes back to Socrates, but even the Socratic method can backfire when it is wielded by someone in authority who is trying to convince others of a particular solution or answer. Leslie Brothers, a psychiatrist–neuroscientist and author of *Friday’s Footprint: How Society Shapes the Human Mind*, has demonstrated that the brain’s structure predisposes us to be socially oriented. Newborns experience a form of empathy, and at six months, well before they can speak, infants experience advanced socially oriented emotions like jealousy. When someone tries to politely tell people what they are doing wrong and phrases the criticism as a question (even one as seemingly innocuous as, “What made you think that solution would work?”), subconscious alarm bells ring. People can detect the difference between authentic inquiry and an effort to persuade them.

Neither the behaviorist perspective nor the person-centered approach has been sophisticated enough to provide a reliable method for producing lasting behavior change in intelligent, high-functioning workers, even when it’s in their own interest to change. It’s time we looked elsewhere.

**Focus Is Power**

Some of the biggest leaps in science and industry have emerged from the integration of separate fields. When the study of electricity and of magnetism coalesced to become the science of electromagnetism, the field gave us the electric motor and generator, which in turn sparked the Industrial Revolution. To understand how to better drive organizational change, we turn to another nexus, this time between neuroscience and contemporary physics.

Neurons communicate with each other through a type of electrochemical signaling that is driven by the movement of ions such as sodium, potassium, and calcium. These ions travel through channels within the brain that are, at their narrowest point, only a little more than a single ion wide. This means that the brain is a quantum environment, and is therefore subject to all the surprising laws of quantum mechanics. One of these laws is the Quantum Zeno Effect (QZE). The QZE was described in 1977 by the physicist George Sudarshan at the University of Texas at Austin, and has been experimentally verified many times since.

The QZE is related to the established *observer effect* of quantum physics: The behavior and position of any atom-sized entity, such as an atom, an electron, or an ion, appears to change when that entity is observed. This in turn is linked to the *probabilistic* nature of such entities. The quantum laws that govern the observed behaviors of subatomic particles, and also the observed behaviors of all larger systems built out of them, are expressed in terms of probability waves, which are affected in specific ways by observations made upon the system. In the Quantum Zeno Effect, when any system is observed in a sufficiently rapid, repetitive fashion, the rate at which that system changes is reduced. One classic experiment involved observing beryllium atoms that could decay from a high-energy to a low-energy state. As the number of measurements per unit time increased, the probability of the energy transition fell off: The beryllium atom stayed longer in its excited state, because the scientists, in effect, repeatedly asked, “Have you decayed yet?” In quantum physics, as in the rest of life, a watched pot never boils.

In a 2005 paper published in the *Philosophical Transactions of the Royal Society* (U.K.), physicist Henry Stapp and one of the authors of this article, Jeffrey Schwartz, linked the QZE with what happens when close attention is paid to a mental experience. Applied to neuroscience, the QZE states that the mental act of focusing attention stabilizes the associated brain circuits. Concentrating attention on your mental experience, whether a thought, an insight, a picture in your mind’s eye, or a fear, maintains the brain state arising in association with that experience. Over time, paying enough attention to any specific brain connection keeps the relevant circuitry open and dynamically alive. These circuits can then eventually become not just chemical links but stable, physical changes in the brain’s structure.

Cognitive scientists have known for 20 years that the brain is capable of significant internal change in response to environmental changes, a dramatic finding when it was first made. We now also know that the brain changes as a function of where an individual puts his or her attention. The power is in the focus.

Attention continually reshapes the patterns of the brain. Among the implications: People who practice a specialty every day literally think differently, through different sets of connections, than do people who don’t practice the specialty. In business, professionals in different functions — finance, operations, legal, research and development, marketing, design, and human resources — have physiological differences that prevent them from seeing the world the same way.

**Expectation Shapes Reality**

Cognitive scientists are finding that people’s *mental maps*, their theories, expectations, and attitudes, play a more central role in human perception than was previously understood. This can be well demonstrated by the placebo effect. Tell people they have been administered a pain-reducing agent and they experience a marked and systematic reduction in pain, despite the fact that they have received a completely inert substance, a sugar pill. One study in 2005 by Robert C. Coghill and others found that “expectations for decreased pain produce a reduction in perceived pain (28.4%) that rivals the effects of a clearly analgesic dose of morphine.” Donald Price of the University of Florida has shown that the mental *expectation* of pain relief accounts for the change in pain perception. The brain’s deepest pain centers show systematic changes consistent with changes in *experienced* pain.

Dr. Price and Dr. Schwartz are currently working to demonstrate that the Quantum Zeno Effect explains these findings. The mental expectation of pain relief causes the person to repeatedly focus his or her attention on the experience of pain relief, so that the brain's pain-relief circuits are activated, causing a decrease in the sensation of pain. People experience what they expect to experience.

The fact that our expectations, whether conscious or buried in our deeper brain centers, can play such a large role in perception has significant implications. Two individuals working on the same customer service telephone line could hold different mental maps of the same customers. The first, seeing customers only as troubled children, would hear only complaints that needed to be allayed; the second, seeing them as busy but intelligent professionals, would hear valuable suggestions for improving a product or service.

How, then, would you go about facilitating change? The impact of mental maps suggests that one way to start is by cultivating moments of insight. Large-scale behavior change requires a large-scale change in mental maps. This in turn requires some kind of event or experience that allows people to provoke themselves, in effect, to change their attitudes and expectations more quickly and dramatically than they normally would.

Mark Jung-Beeman of Northwestern University's Institute for Neuroscience and others have recently used fMRI and EEG technologies to study moments of insight. One study found sudden bursts of high-frequency 40 Hz oscillations (gamma waves) in the brain appearing just prior to moments of insight. This oscillation is conducive to creating links across many parts of the brain. The same study found the right anterior superior temporal gyrus being activated. This part of the brain is involved in perceiving and processing music, spatial and structural relations (such as those in a building or painting), and other complex aspects of the environment. The findings suggest that at a moment of insight, a complex set of new connections is being created. These connections have the potential to enhance our mental resources and overcome the brain's resistance to change. But to achieve this result, given the brain's limited working memory, we need to make a deliberate effort to hardwire an insight by paying it repeated attention.

That is why employees need to "own" any kind of change initiative for it to be successful. The help-desk clerk who sees customers as children won't change the way he or she listens without a moment of insight in which his or her mental maps shift to seeing customers as experts. Leaders wanting to change the way people think or behave should learn to recognize, encourage, and deepen their team's insights.

**Attention Density Shapes Identity**

For insights to be useful, they need to be generated from within, not given to individuals as conclusions. This is true for several reasons. First, people will experience the adrenaline-like rush of insight only if they go through the process of making connections themselves. The moment of insight is well known to be a positive and energizing experience. This rush of energy may be central to facilitating change: It helps fight against the internal (and external) forces trying to keep change from occurring, including the fear response of the amygdala.

Second, neural networks are influenced moment to moment by genes, experiences, and varying patterns of attention. Although all people have some broad functions in common, in truth everyone has a unique brain architecture. Human brains are so complex and individual that there is little point in trying to work out how another person ought to reorganize his or her thinking. It is far more effective and efficient to help others come to their own insights. Accomplishing this feat requires self-observation. Adam Smith, in his 1759 masterpiece *The Theory of Moral Sentiments*, referred to this as being "the spectators of our own behaviour."

The term attention density is increasingly used to define the amount of attention paid to a particular mental experience over a specific time. The greater the concentration on a specific idea or mental experience, the higher the attention density. In quantum physics terms, attention density brings the QZE into play and causes new brain circuitry to be stabilized and thus developed. With enough attention density, individual thoughts and acts of the mind can become an intrinsic part of an individual's identity: who one is, how one perceives the world, and how one's brain works. The neuroscientist's term for this is *self-directed neuroplasticity*.

You've probably had the experience of going to a training program and getting excited about new ways of thinking, only to realize later that you can't remember what the new ways of thinking were. Were the ideas no good in the first place? Or did you just not pay enough attention? A 1997 study of 31 public-sector managers by Baruch College researchers Gerald Olivero, K. Denise Bane, and Richard E. Kopelman found that a training program alone increased productivity 28 percent, but the addition of follow-up coaching to the training increased productivity 88 percent.

Further research is needed to help us better understand how much attention is required to facilitate long-term change and in what kind of format the requisite training can be delivered to foster better performance. For chronically late people, habits like carrying two timepieces — one fast and the other accurate — or routinely trying to arrive 20 minutes early to meetings may be effective precisely because they focus conscious attention on the improved result. With an *attention model*, learning becomes possible through many media, not just in a classroom. Also, given the small capacity of working memory, many small bites of learning, digested over time, may be more efficient than large blocks of time spent in workshops. The key is getting people to pay sufficient attention to new ideas, something the "e-learning" industry has struggled with.

Martin Seligman, founder of the positive psychology movement and former president of the American Psychological Association, recently studied 47 severely depressed individuals. The study involved two unusual components. First, participants focused their attention on things that were proven to increase happiness — specifically, an exercise called the three blessings, in which people wrote down three things that had gone well that day — instead of on the source or nature of their unhappiness, which is where many mental health interventions focus. Second, communities were allowed to form, which encouraged people to pay attention to the happiness-inducing exercises. Depression in 94 percent of the participants dropped significantly, from clinically severe to clinically mild-to-moderate symptoms. The impact was similar to the effects of medication and cognitive therapy combined. Perhaps any behavior change brought about by leaders, managers, therapists, trainers, or coaches is primarily a function of their ability to induce others to focus their attention on specific ideas, closely enough, often enough, and for a long enough time.

**Mindful Change in Practice**

How, then, can leaders effectively change their own or other people's behavior?

Start by leaving problem behaviors in the past; focus on identifying and creating new behaviors. Over time, these may shape the dominant pathways in the brain. This is achieved through a solution-focused questioning approach that facilitates self-insight, rather than through advice-giving.

Let's go back to Mike, our pharmaceutical CEO. One of Mike's direct reports, Rob, has hired only three of his targeted six new team members this year. If Mike asks Rob why he didn't reach the goal, he will focus Rob's attention on the nonperformance. As a result of this attention, Rob might make new cognitive connections (also known as reasons) as to why he didn't find the new people. For example, "All the really good people are taken by other companies," or "I don't have time to do the kind of recruiting we need." Although these reasons that people were not hired might be true, they do little to support or foster any change.

A more useful place to focus Rob's attention is on the new circuits he needs to create to achieve his objectives in the future. Mike could ask Rob, "What do you need to do to resolve challenges like this?" Mike's questioning might provoke Rob to have an insight that he needs to remind himself of his annual objectives more regularly, to keep his eyes on the prize. If Mike regularly asked Rob about his progress, it would remind Rob to give this new thought more attention.

As Peter F. Drucker said, "We now accept the fact that learning is a lifelong process of keeping abreast of change. And the most pressing task is to teach people how to learn." In the knowledge economy, where people are being paid to think, and with constant change, there is more pressure than ever to improve how we learn. Perhaps these findings about the brain can start to pull back the curtain on a new world of productivity improvement: in our ability to bring about positive, lasting change in ourselves, in our families, in our workplaces, and in society itself. s+b

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