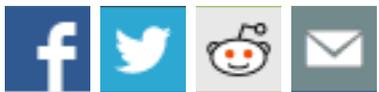


# Laughter and the Brain

Can humor help us better understand the most complex and enigmatic organ in the human body?

Photo by Nosha

**By Richard Restak**



In my neuropsychiatric practice, I often use cartoons and jokes to measure a patient's neurologic and psychiatric well-being. I start off with a standard illustration called "The Cookie Theft." It depicts a boy, precariously balanced on a stool, pilfering cookies from a kitchen cabinet as his sister eggs him on, while their absentminded mother stands drying a plate, oblivious to the water overflowing from the sink onto the floor. Though not really a cartoon—in that nothing terribly funny is taking place—it allows me to begin assessing various things: abstraction ability, empathy, powers of observation and description, as well as sense of humor. I am especially curious to see how patients process the image, whether they perceive only a portion of it or take it in as a whole. Some people notice only the boy, others only the mother.

Next, I show a series of cartoons, starting with examples from a newspaper comics page and working up to more sophisticated drawings from *The New Yorker*. I then ask for an explanation of what's going on in each of them. Over the years, I've learned that you can't fake an understanding of a cartoon; you either get it or you don't.

Finally, I tell a few jokes set out in increasing levels of subtlety and complexity. Patients don't have to find

the jokes funny (humor is too heterogeneous for that), but they should be able to explain why other people might find them funny. Why am I interested in my patients' ability to appreciate humor? Because humor impairment may point to operational problems at various levels of brain functioning.

Charles Darwin referred to humor as “a tickling of the mind.” We speak of being “tickled pink” at a funny joke, and tickling often leads to laughter, so the analogy is apt. At the physiological level, humor reduces levels of stress hormones such as cortisol and is thought to enhance our immune, endocrine, and cardiovascular systems. Laughter also provides a workout for the muscles of the diaphragm, abdomen, and face. A joke can raise our spirits, or ease our tension. If we're able to laugh during a stressful situation, we can put psychological distance between ourselves and the stress. Norman Cousins, editor of *The Saturday Review* for more than 30 years, chronicled in his 1979 bestselling book, *Anatomy of an Illness*, how he attempted to cure himself of a mysterious and rapidly progressive inflammatory illness of the spine by engaging in hours-long laughing sessions while watching Marx Brothers films and reruns of the then-popular *Candid Camera*. Though Cousins's claims could not be scientifically confirmed, even the most skeptical researchers agree that humor provides an antidote to some emotions widely recognized to be associated with illness—for example, the feelings of rage and fear that can precipitate a heart attack.

Though I wouldn't take a position on whether laughter has universally salutary benefits, many laughter associations and workshops around the world—common most notably in India and Sweden—do just that. Their goal is to promote good health via the therapeutic properties of laughter. LaughterWorks, which bills itself as “Australia's leading laughter leaders,” arranges seminars and workshops for various groups, as well as half-hour sessions of “laughing, breathing and gentle exercise, under the guidance of one of our qualified laughers.”

A Swedish friend described a laughter-inducing exercise involving two people sitting across from each other. When one begins to laugh, the other soon starts laughing, too. Not long ago, my friend and I decided to try this ourselves. She sat facing me, and after a few awkward moments (at least on my part) spent staring silently at each other, she began laughing. I wasn't sure how to respond. But a few moments later I found myself laughing, even though nothing funny was said. I must admit that I felt better after our laughter exercise. But why?

In the weeks that followed, as I searched for an explanation, I was invited to participate in a discussion with three popular comedians—Robert Kelly, Dan Naturman, and Kristin Montella—at the Comedy Cellar in Greenwich Village. The four of us sat at the famous Comedy Table, reserved for professional comedians, and spent almost two hours engaging in some high-speed repartee concerning the interaction between comedians and their audiences. The comedians, naturally curious about the presence of a “brain doctor” in their midst, may not have known that the club's owner, Noam Dworman, had read my books and has long maintained a lively interest in neuroscience.

Soon after, I sat on a panel at the Rubin Museum of Art in Manhattan, where I joined *New Yorker* cartoonists Zach Kanin, Paul Noth, and David Sipress to explore the question of why people find cartoons funny. We discussed how humor, whether conveyed by joke or cartoon, has both a subjective component (exhilaration or mirth) and its physical expression (smiling or laughing). One can exist without the other: we may find a risqué joke amusing but withhold a smile if we happen to be in polite company. We may also laugh nervously when we're made to feel uncomfortable. We laugh when we hear others laugh—as I experienced with my Swedish friend (indeed, this phenomenon of contagious laughter is why laugh

tracks are used in situation comedies). Laughter can even be induced chemically, with laughing gas, or via electrical stimulation of certain parts of the brain.

Recently, scientists have begun conducting research into the neurological processes underpinning mirth and laughter. I would not suggest that neuroscience can “explain” humor or provide the reason why we laugh at certain jokes or cartoons and not at others. Trying to parse humor, in any case, can be a self-defeating exercise. As E. B. White once wrote, “Humor can be dissected, as a frog can, but the thing dies in the process and the innards are discouraging to any but the pure scientific mind.” Still, neuroscience can provide some useful insights into what happens when we find a joke or cartoon funny. Ultimately, it isn’t just humor that we seek to better understand, but rather, that most complex and elusive of organs: the human brain.

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The brain has no humor “center.” Humor is associated with—note that I didn’t say “caused by,” à la White’s frog dissection analogy—brain networks involving the temporal and frontal lobes in the cerebral cortex. Located near the top of the brain, these cortical areas are related to speech, general information, and the appreciation of contradiction and illogicality. Obviously we can’t appreciate a joke told in a language we can’t speak, or a cartoon that relies heavily on cultural norms or information foreign to us. Within these cortical areas the joke or cartoon is parsed.

All humor involves playing with what linguists call scripts (also referred to as frames). Basically, scripts are hypotheses about the world and how it works based on our previous life experiences. Consider what happens when a friend suggests meeting at a restaurant. Instantaneously our brains configure a scenario involving waiters or waitresses, menus, a sequence of eatables set out in order from appetizer to dessert, followed by a bill and the computation of a tip. This process, highly compressed and applicable to almost any kind of restaurant, works largely outside conscious awareness. And because our scripts *are* so generalized and compressed, we tend to make unwarranted assumptions based on them. Humor takes advantage of this tendency. Consider, for example, almost any joke from stand-up comedian Steven Wright, known for his ironic, deadpan delivery:

—I saw a bank that said “24 Hour Banking,” but I didn’t have that much time.

—I bought some batteries, but they weren’t included. So I had to buy them again.

—I washed a sock. Then I put it in the dryer. When I took it out it was gone.

—I went into a store and asked the clerk if there was anything I could put under my coasters. He asked why I wanted to do that. I told him I wanted to make sure my coasters weren’t scratching my table.

In each of these examples, everyday activities are given a different spin by forcing the listener to modify standard scripts about them. Indeed, the process of reacting to and appreciating humor begins with the activation of a script in the brain’s temporal lobes.

It is the brain’s frontal lobes that make sense of the discrepancy between the script and the situation described by the joke or illustrated by the cartoon. This ability is unique to our species. Though apes can engage in play and tease each other by initiating false alarm calls accompanied by laughter, they cannot shift back and forth between multiple mental interpretations of a situation. Only we can do this because—thanks to the larger size of our frontal lobes compared with other species—we are the only creatures that possess a highly evolved working memory, which by creating and storing scripts allows us to appreciate sophisticated and subtle forms of humor. Neuroscientists often compare working memory to mental juggling. To appreciate a cartoon or a joke, you have to keep in mind at least two possible scenarios: your initial assumptions, created and stored over a lifetime in the temporal lobes, along with the alternative

explanations that are worked out with the aid of the frontal lobes.

In the realm of psychology, there are three general theories that explain how humor works. According to the most common explanation for humor—the *tension release theory*—we experience, for a brief period after hearing a joke or looking at a cartoon, a tension that counterbalances what we assume about the situation being described or illustrated against what the comedian or cartoonist intends to convey. The tension is released only when the joke or cartoon is understood.

The second most popular theory of humor, the *incongruity resolution model*, involves the solving of a paradox or incongruity in a playful context. This theory is based on the deep relationship that exists in the human brain between the laughable and the illogical. As a species, we place great value on logic. Even so, we will playfully accept a situation that is highly unlikely or even impossible (a cartoon depicting an attempted kidnapping by Martians) as long as the scenario depicted in the cartoon is coherent and logically consistent with its theme. Incongruity resolution usually takes a little longer than tension release and occurs in two stages. First, expectations about the meaning of a joke or cartoon are jarringly undermined by the punch line of the joke or the caption of the cartoon. This leads to a form of problem solving aimed at reconciling the discrepancy. When we solve the problem, the pieces fall into place and we experience the joy that accompanies insight. Failure to get the point of a joke or cartoon causes the same discomfort we feel when we cannot solve a problem.

Finally, the *superiority theory* emphasizes how mirth and laughter so often involve a focus on someone else's mistakes, misfortune, or stupidity. In Plato's dialogue *Philebus*, Socrates says, "When we laugh at the ridiculous aspects of our friends, the admixture of pleasure in our malice produces a mixture of pleasure and distress. For we agreed some time ago that malice was a form of distress; but laughter is enjoyable, and on these occasions both occur simultaneously." The superiority theory lends itself especially to an explanation of cruel and hostile humor: the situation depicted in the joke or cartoon could never happen to us, hence our amusement. In a word, we feel superior to the person suffering misfortune.

In practice, most humor incorporates aspects of all three of those theories. But understanding the humor of a joke or cartoon is only half the process. If successful, jokes evoke mirth and laughter, emotional responses that involve a subcortical network (that is, beneath the cortex) devoted to mediating reward or pleasure. Whenever we're doing something we love, this subcortical network is activated and "lights up" in a functional magnetic resonance imaging (fMRI) brain scan, which measures brain activity by noting changes in blood flow. A similar response occurs when we look at a funny cartoon. We know this based on some highly original research by Dean Mobbs, now at Columbia University. Mobbs showed his subjects a series of funny and unfunny cartoons. In each instance the humorous element in the funny cartoon was subtracted to produce a cartoon that wasn't funny. Mobbs then compared his subjects' responses to the two versions. Though many of the cortical areas responsible for understanding the cartoon were activated in both of its versions, only the funny cartoons engaged the network of humor-specific subcortical structures that compose the pleasure and reward network.

Humor makes heavy demands on the brain. After entering via the visual track (cartoons) or the auditory track (jokes), humorous material triggers a precise repertoire of responses: the order, timing, and emphasis must be just right; irrelevant or distracting elements must be discounted or ignored. In one study from 1969, conducted by neurologists Shirley Ferguson and Mark Rayport and neuropsychologist Melvin L. Schwartz, patients with temporal lobe epilepsy were shown a series of cartoons. The patients

didn't find them at all funny. The experimenters instead noted an "inappropriate focus on irrelevant detail," "integration difficulty," and "egocentricity."

The frontal lobes also play a huge role in the improvisation associated with the creation of jokes or cartoons. We know this based on a recent study performed at the National Institutes of Health involving rap artists. The research—which involved fMRI—shows that rappers use different parts of their frontal lobes when improvising their lyrics than when they are performing rhymes that have already been written down. When they started to freestyle, the fMRI displayed a switch in frontal activity from the dorsolateral frontal areas, responsible for self-monitoring and self-criticism, to the medial frontal area, associated with spontaneous creative efforts. Similarly, the successful stand-up comedian has to "let go" and resist

the temptation to self-criticize and self-monitor, which can lead to mistakes in delivery, timing, or presentation.

Indeed, when a comedian bombs on stage, it can take a personal toll on his or her mental health. In an interview with fellow comedian David Steinberg on Showtime's *Inside Comedy*, Steven Wright described comedic performance as "very dangerous, like walking a tightrope, or like running across a lake of ice where the ice is breaking behind you and it is going to take an hour to get to the other side." Steve Martin told Steinberg of the comedian's need to steel himself against the pain aroused when no one laughs at a joke or, worse yet, when you get booed off the stage. "Stand-up comedy is the ego's last stand," according to Martin. This proved true for the late Jonathan Winters, who suffered a serious nervous breakdown during a performance in San Francisco in 1959. After spending time in a psychiatric hospital, Winters returned to stand-up only to suffer another nervous collapse two years later, after which he quit nightclub performances altogether and turned his attention to making records.

Physical injuries to some areas of the brain—namely, the right hemisphere, which plays a special role in the integration of perceptions, enabling us to see the "whole picture"—can damage the ability to process and appreciate humor. Injury to the frontal lobe (within the right hemisphere) prevents a person from shifting back and forth between an initial assumption (based on scripts) and the alternative explanation suggested by a joke or cartoon. A patient with an impaired frontal lobe is, instead, overly literal, unable to make the frame shifts necessary for the creation or appreciation of humor.

In addition, damage to the frontal lobes creates in some patients a predilection for a peculiar form of gallows humor known as *Witzelsucht*. (In German, *witzeln* means "to wisecrack," and *Sucht* means "addiction.") A patient of Canadian neuropsychologist Donald Stuss with bilateral frontal lobe injury was asked to look at a drawing of a casket with three faces beneath it—one smiling, one neutral, one tearful—and decide which of the facial expressions was most appropriate, given the situation. Without hesitation he selected the smiling face. "Why did you pick the smiling face?" he was asked. He laughed and responded, "Because it's not me in the coffin." *Witzelsucht* often also takes the form of bizarre puns, one-liners, and slapstick comments that morbidly refer to some aspect of the patient's illness. It is further distinguished by an inability to appreciate complex or subtly embedded jokes or cartoons, such as [this one](#) from *The New Yorker*.

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Given how much we seem to value humor in our daily lives, one would expect that we would be telling and listening to jokes all the time. Yet how many jokes have you been told today? How long has it been since somebody came up to you and asked, "Have the heard the one about ...?" How often have you recently encountered someone who went out of his or her way to make you laugh? (Spouses and close intimates excepted here.) Perhaps in response to the stresses of the early 21st century, we have become a serious (i.e., comparatively humorless) society. In a culture that is increasingly polarized politically, it's hard now to make a joke, either privately or publicly, without running the risk that someone will find some aspect of it offensive. Because of this, I suspect, dinner party jokes have become almost as uncommon as April Fools' Day pranks.

Within the workplace, for instance, humor typically started at the top. If the boss or supervisor said something funny, everybody was supposed to laugh; if someone further down the chain did so, the results were less predictable: the workers usually looked toward the boss to decide how to respond. Not surprisingly, in the more egalitarian environment of the modern office such a hierarchical arrangement is considered patronizing or condescending. As a result, the choice is between an office environment in

which anybody can make a joke (probably not a wise policy) or one in which jokes are restricted to persons in authority (also not a good thing). Is it any surprise that jokes have largely fallen out of favor in the workplace?

Instead, we've formalized humor and licensed it to professionals such as comedians and cartoonists, who fill the ancient role of medieval court jesters, receiving special dispensation to make jokes about serious topics to the king without fear of retaliation. At the yearly White House Correspondents Dinner, for example, a comedian is chosen to act as a surrogate who may say in humorous form, in the presence of the president, what many others would like to say but can't. Stephen Colbert's barbed jokes at the 2006 dinner incensed George W. Bush so much, according to an aide, that the president seemed "ready to blow."

But do any of these considerations portend an end to humor? Given that the impulse to find and express amusement has existed since the formation of the earliest social groups, probably not. Indeed, some neuroscientists believe that humor may have evolved with another cognitive ability we share with the higher primates: the rapid and intuitive assessment of social situations. And humor has much to do with that most fundamental of human behaviors—falling in love.

According to Gil Greengross and Geoffrey Miller of the University of New Mexico, humor "may be one of the most important traits for humans seeking mates." Since jokes and cartoons strike different degrees of mirth in different people, humor helps us identify others with dispositions and propensities similar to our own. (On occasion, of course, we encounter people who find *nothing* funny, but who wants to spend a life with them?) Humor appreciation, however, differs between the sexes, according to psychologist Eric R. Bressler, who notes that, in general, women tend to favor men who make them laugh, while men favor women who laugh at their jokes. Indeed, how much a woman laughs at a man's jokes can determine how attractive *each* partner finds the other. Presumably, when a woman laughs a man's jokes, the man becomes more interested. Bressler found that men's laughter, in contrast, did not predict interest in future interaction on the part of either the woman or the man. Nor are the expressions of humor the same. As Nichole Force notes in a 2011 article published in *Psych Central*, men tend to like slapstick more than women do, and their jokes are more aggressive and mean-spirited. Women—again, generally speaking—favor a gentler brand of humor: funny stories or self-deprecating jokes.

These gender differences have practical implications for long-term relationships. Force cites the work of psychologists Catherine Cohan and Thomas Bradbury, who analyzed the marriages of 60 couples over an 18-month period and found that when men used humor to cope with stressful events, such as job loss or death, it led to a greater incidence of divorce and separation than when women used humor in similar situations. Cohan and Bradbury suggest that the nature of the humor that men favor can lead to a deterioration in a couple's bond during times of turmoil. Male humor may play a role in establishing romantic relationships, Force writes, but female humor seems more effective in maintaining them.

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Humor is constantly evolving—comics' tastes change, as does what society considers funny. Our parents and grandparents would have found this sort of joke amusing: *Knock knock. Who's there? Madame. Madame who? Madame foot's caught in the door!* We no doubt find it juvenile and embarrassing. "Humor" based on racial and ethnic stereotypes or physical or mental disabilities is no longer acceptable, which is all to the good. However humor evolves in the future, neuroscience will attempt to explain its mechanics. It's a subject that raises perplexing questions: Are smiling and laughing based on the same or different circuits within the brain? Do the stages of humor response, whether to cartoons or jokes, involve

distinct brain regions? Though much may be known about the brain structures involved in humor, what exactly is the sequence of their activation? New studies are coming out all the time; dissecting humor, it turns out, isn't quite the gruesome affair that E. B. White imagined. And why should it be? Our brains, after all, are hardwired for laughter. The enduring mystery is understanding how.

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**Nichole Force's online article "How and Why Humor Differs Between the Sexes" (*Psych Central*, 2011) should have been cited in the print version of the SCHOLAR. This online version has been edited to reflect her work. —The Editors**



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