Section 8
Popular Myths About the Brain and Behavior

Introduction

In 1990, President George H. W. Bush issued a presidential proclamation declaring the 1990s “The Decade of the Brain.” The purpose was to make the public more aware of the benefits that can be derived from brain research. Since then, we have continued to make dramatic advances in our understanding of how the brain works. Despite this remarkable progress, some questionable beliefs about the brain continue to be widely accepted by the general public and are discussed in this section. These include: We use only about 10% of our brain’s capacity; some people are predominantly right brained (intuitive and creative) and others left brained (logical and rational); increasing our alpha waves causes a deeper sense of consciousness and relaxation.

Hypnosis has remained a fascinating topic for researchers and non-researchers alike. Here, too, increased knowledge has been accompanied by questionable beliefs. Perhaps the most widespread of these beliefs is that hypnosis is a “trance” or distinct state of consciousness. Many people believe this state is associated with dramatically increased suggestibility during which the hypnotist can induce people to engage in behaviors...
not typical or even possible in the “waking state.” There are even claims that hypnosis can generate dramatic psychological and medical cures.

As they get older, most people experience a decline in memory. They often believe that this decline is inevitable and irreversible. Questions have been raised about this belief and whether there are empirically supported methods to help the aging memory.

In this section, we address the following questions:

- Do we use only a very small percentage of our brain’s capacity?
- Are some people predominantly right brained (intuitive and creative) and others left brained (logical and rational)?
- Does increasing our alpha brain waves cause a deeper sense of consciousness and relaxation?
- Is what is called a “trance state” in hypnosis a distinct state of consciousness?
- In hypnosis, can people be made to engage in behaviors that they never would engage in in the nonhypnotic state?
- Is the memory loss that accompanies aging an irreversible decline?
- Are there no ways to improve memory in the elderly?
Uncovering “Brainscams”

Most of us take our brain for granted. As poet Robert Frost wrote, “The brain is a wonderful organ. It starts working the moment you get up in the morning and does not stop until you get into the office.” Weighing in at a mere 3 pounds and possessing the consistency of a lump of Jell-O, our brain looks surprisingly unimpressive in the flesh. Yet it is capable of soaring intellectual feats.

Although our brain underpins virtually every aspect of our thinking, personality, and identity, it is the focus of a host of misconceptions. Without question, the world’s expert on “neuromythology” – the study of myths regarding brain structure and function – was Simon Fraser University psychology professor Barry L. Beyerstein, who died in 2007 at the age of 60. Barry coined the term “brainscams” in a 1990 article to draw attention to popular efforts to capitalize on the public’s misunderstanding of the brain.

Barry was a friend of one of us (Scott Lilienfeld) and a contributor to both Scientific American and Scientific American Mind. We think it would be apropos to honor Barry’s memory and contribution to neuromythology by dedicating this chapter to him and by examining three widespread brainscams that he helped to expose.
We Use Only 10 Percent of Our Brain’s Capacity

This misconception, about which Barry wrote on multiple occasions (including for an Ask the Experts column in the June 2004 issue of *Scientific American*), is among the most deeply entrenched in all of popular psychology. Its seductive appeal is understandable, as we would love to believe that our brain harbors an enormous reservoir of untapped potential. The 10% myth has contributed to a plethora of self-help books and self-improvement gadgets, including commercially available devices that supposedly enable us to harness our unrealized capacities.

Yet the scientific evidence against this myth is overwhelming. Functional brain-imaging studies have consistently failed to turn up any region of the brain that is perpetually inactive. Moreover, research on brain-damaged individuals reveals that a lesion to almost any brain area will produce at least some psychological deficits.

As Barry had noted, the 10% myth probably stemmed in part from a misinterpretation of the writings of William James, one of the founders of American psychology. In his musings around the turn of the 20th century, James wrote that most of us actualize only a small portion of our intellectual potential, an assertion that may well possess some merit. But several popular authors – including Lowell Thomas, who penned the foreword to Dale Carnegie’s 1936 best-seller, *How to Win Friends and Influence People* – took liberties with James’s writings by proposing that we use only about 10% of our brain. Further contributing to this notion’s cachet were early studies suggesting that a substantial majority of the cerebral cortex is “silent.” Yet because of advances in the measurement of brain activity, we now know that these areas are far from silent; they make up what neuroscientists term the brain’s “association cortex,” which plays a vital function in connecting perceptions, thoughts, and emotions across diverse brain areas.

Some People Are Left-Brained; Others Are Right-Brained

Supposedly, left-brained people are analytical, logical, and verbal, whereas right-brained people are creative, holistic, and spatial. Scores of popular books have seized on this purported dichotomy. In his 1972

Yet as Barry and University of Auckland psychologist Michael Corballis noted, the left-brained-versus-right-brained dichotomy is grossly oversimplified. For one thing, this distinction implies that people who are verbally gifted are not likely to be artistically talented, but research suggests otherwise. Moreover, neuroscience studies suggest that the brain’s two hemispheres work in a highly coordinated fashion.

Like many brain myths, this one contains a kernel of truth. For several decades, beginning in the 1960s, neuroscientist Roger Sperry of the California Institute of Technology, psychologist Michael S. Gazzaniga of the University of California, Santa Barbara, and their colleagues studied patients who underwent surgery to sever the corpus callosum (the large band of neural fibers connecting the two hemispheres) in an effort to halt intractable epilepsy. The research showed that the left and right hemispheres are indeed different. In most of us, the left hemisphere is specialized for most aspects of language, whereas the right hemisphere is specialized for most visuospatial skills. Yet even these differences are only relative; for example, the right hemisphere tends to play a larger role than the left does in interpreting the vocal tone of spoken language. Moreover, because practically all of us have an intact corpus callosum, our hemispheres are continually interacting.

**We Can Achieve a Deeper Sense of Consciousness and Relaxation by Boosting Our Alpha Waves**

Purveyors of “alpha consciousness” have encouraged people to undergo brain-wave biofeedback – in some cases using commercially available devices – to increase their production of alpha waves, brain waves that occur at a frequency of about 8–13 cycles per second. Yet research shows alpha-wave output is largely or entirely unrelated to long-term personality traits and short-term states of contentment.
As Barry observed, the myth of alpha consciousness reflects a confusion between “correlation” and “causation.” It is true that people tend to display a heightened proportion of alpha waves while meditating or relaxing deeply. But this fact does not mean that an increased production of alpha waves causes heightened relaxation. Moreover, research shows that elevated levels of alpha waves are found in some children with attention-deficit hyperactivity disorder, who are anything but relaxed.

These three myths barely scratch the surface of the sprawling field of neuromythology, but they give us a flavor of Barry’s valuable role in combating the public’s misconceptions about brain function. Fortunately, as readers of Scientific American Mind know, the facts about brain function are often far more interesting and surprising than the fictions. By helping laypersons better distinguish brain myths from brain realities, Barry Beyerstein was a pioneer in the ongoing effort to increase the public’s scientific literacy. We miss him.

Further Reading

Is Hypnosis a Distinct Form of Consciousness?

The hypnotist, dangling a swinging pocket watch before the subject’s eyes, slowly intones: “You’re getting sleepy … You’re getting sleepy …” The subject’s head abruptly slumps downward, in a deep, sleeplike trance, oblivious to everything but the hypnotist’s soft voice. Powerless to resist the hypnotist’s influence, the subject obeys every command, including an instruction to act out an upsetting childhood scene. On “awakening” from the trance half an hour later, there is no memory of what happened.

In fact, this familiar description, captured in countless movies, embodies a host of misconceptions. Few, if any, modern hypnotists use the celebrated swinging watch introduced by Scottish eye surgeon James Braid in the mid-19th century. Although most hypnotists attempt to calm subjects during the “induction,” such relaxation is not necessary; people have even been hypnotized while pedaling vigorously on a stationary bicycle. Electroencephalographic (EEG) studies confirm that during hypnosis subjects are not in a sleeplike state but are awake—though sometimes a bit drowsy. Moreover, they can freely resist the hypnotist’s suggestions and are far from mindless automatons. Finally, research by the late psychologist Nicholas Spanos of Carleton University in Ontario...
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shows that a failure to remember what transpired during the hypnosis session, or so-called posthypnotic amnesia, is not an intrinsic element of hypnosis and typically occurs only when subjects are told to expect it to occur.

The Consciousness Question

The iconic scene we described above also raises a deeper question: Is hypnosis a distinct state of consciousness? Most people seem to think so; in a recent unpublished survey, psychologist Joseph Green of Ohio State University at Lima and his colleagues found that 77% of college students agreed that hypnosis is a distinctly altered state of consciousness. This issue is of more than academic importance. If hypnosis differs in kind rather than in degree from ordinary consciousness, it could imply that hypnotized people can take actions that are impossible to perform in the waking state. It could also lend credibility to claims that hypnosis is a unique means of reducing pain or of effecting dramatic psychological and medical cures.

Despite the ubiquitous Hollywood depiction of hypnosis as a trance, investigators have had an extremely difficult time pinpointing any specific “markers” – indicators – of hypnosis that distinguish it from other states. The legendary American psychiatrist Milton Erickson claimed that hypnosis is marked by several unique features, including posthypnotic amnesia and “literalism” – a tendency to take questions literally, such as responding “Yes” to the question “Can you tell me what time it is?” We have already seen that posthypnotic amnesia is not an inherent accompaniment of hypnosis, so Erickson was wrong on that score. Moreover, research by Green, Binghamton University psychologist Steven Jay Lynn, and their colleagues shows that most highly hypnotizable subjects do not display literalism while hypnotized; moreover, participants asked to simulate hypnosis demonstrate even higher rates of literalism than highly hypnotizable subjects do.

Other experts, such as the late University of Pennsylvania psychiatrist Martin Orne, have argued that only hypnotized participants experience “trance logic” – the ability to entertain two mutually inconsistent ideas at the same time. For example, a hypnotist might suggest to a subject that he is deaf and then ask him, “Can you hear me now?” He may respond,
“No,” thereby manifesting trance logic. Nevertheless, research by the late Theodore X. Barber, then at the Medfield Foundation, and his colleagues showed that participants asked to simulate hypnosis displayed trance logic just as often as hypnotized people did, suggesting that trance logic is largely a function of people's expectations rather than an intrinsic component of the hypnotic state itself.

Brain Changes

Still other investigators have sought to uncover distinct physiological markers of hypnosis. Under hypnosis, EEGs, especially those of highly suggestible participants, sometimes display a shift toward heightened activity in the theta band (four to seven cycles per second). In addition, hypnotized participants frequently exhibit increased activity in their brain's anterior cingulate cortex (ACC).

Yet neither finding is surprising. Theta activity is typically associated with states of quiet concentration, which frequently accompany hypnosis. The ACC is linked to the perception of contradictions, which many hypnotized participants experience as they imagine things – such as childhood experiences in the present – that seem to conflict with reality. Further, psychologists have reported similar brain changes among awake subjects. For example, the ACC becomes activated during the famous Stroop task, which requires subjects to name the colors of ink (such as “green”) in which competing color words (such as “blue”) are printed. Thus, these brain changes are not unique to hypnosis.

Fueling the perception of hypnosis as a distinct trancelike state is the widespread assumption that it leads to marked increases in suggestibility, even complete compliance to the therapist's suggestions. Nowhere is this zombielike stereotype portrayed more vividly than in stage hypnosis shows, in which people are seemingly induced to bark like dogs, sing karaoke, and engage in other comical behaviors in full view of hundreds of amused audience members.

Yet research shows that hypnosis exerts only a minor impact on suggestibility. On standardized scales of hypnotic suggestibility, which ask participants to comply with a dozen suggestions (that one's arm is raising on its own power, for example), the increase in suggestibility following a hypnotic induction is typically on the order of 10% or less.
Moreover, research demonstrates that a formal hypnotic induction is not needed to produce many of the seemingly spectacular effects of hypnosis, such as reduction of extreme pain or various physical feats, popular in stage hypnosis acts, such as suspending a participant horizontally between the backs of two chairs. One can generate most, if not all, of these effects merely by providing highly suggestible people with sufficient incentives to perform them. Stage hypnotists are well aware of this little secret. Before beginning their shtick, they prescreen audience members for high suggestibility by providing those people with a string of suggestions. They then handpick their participants from among the minority who comply.

We agree with Lynn and psychologist Irving Kirsch of the University of Hull in England, who wrote in 1995 that “having failed to find reliable markers of trance after 50 years of careful research, most researchers have concluded that this hypothesis [that hypnosis is a unique state of consciousness] has outlived its usefulness.” Increasingly, evidence is suggesting that the effects of hypnosis result largely from people’s expectations about what hypnosis entails rather than from the hypnotic state itself. Still, it is always possible that future studies could overturn or at least qualify this conclusion. In particular, research on potential physiological markers of hypnosis may elucidate how hypnosis differs from other states of consciousness. Although hypnosis poses fascinating mysteries that will keep scientists busy for decades, it seems clear that it has far more in common with everyday wakefulness than with the watch-induced trance of Hollywood crime thrillers.

Further Reading

When Mick Jagger first sang “What a drag it is getting old,” he was 23 years old. Now in his 70s, he is still a veritable Jumpin’ Jack Flash on stage. Jagger seems to have found the secret to staying physically fit in his advancing years, but getting old can be a drag on the psyche. Many older adults fear memory loss and worry they are headed down the road to dementia, such as Alzheimer’s disease. Every time they forget their keys, leave a door unlocked or fail to remember a name, they are reminded of this nagging concern. In most cases, however, such annoying incidents are part of normal age-related memory loss, not a sign of impending dementia.

Although lots of older adults think such a decline is inevitable, there is good news for many of them. Researchers have developed an array of helpful methods and activities that exercise our minds and bodies that can help keep the older mind in relatively good condition. In this chapter, we examine the most promising ways to shore up memory in the normal aging brain.
Memory Divided

Memory is not a single entity. The term encompasses several types of remembering, not all of which decline with age. For instance, older people still retain their vocabulary, along with general knowledge about the world (semantic memory). They can also perform certain routine tasks, such as making an omelet or typing on a computer (procedural memory), about as well as they could when they were younger. People do become worse, however, at recalling recent events in their lives (episodic memory) or where they first learned a piece of information (source memory), managing the temporary storage of short-term information (working memory), and remembering to do things in the future (prospective memory).

Prospective memory, in particular, is an important target for memory strategies because forgetting upcoming tasks or appointments can cause considerable frustration or embarrassment. In 2002 psychologist Narinder Kapur of Southampton General Hospital in England and his colleagues reviewed studies on the effectiveness of various common techniques to bolster prospective memory. They found that external aids such as making lists or programming reminders into a cellphone could be helpful in reducing memory problems such as failing to pay bills or attend meetings.

Another successful strategy involves associating information to be recalled with an image, sentence, phrase, or word. The more personally relevant the association is, the more likely it is to be remembered, an approach known as self-referential processing. For example, if we need to return a book to the library, we might imagine ourselves doing just that. Made-up acronyms also can be a big help. In this strategy, a person forms a new word from the initial letters of what he or she wants to remember. To remember to buy a birthday gift for his wife, for example, a man might construct the acronym “BIG” for “Birthday Gift.”

In 2008 psychologists Betty L. Glisky of the University of Arizona and Martha L. Glisky of the Evergreen Hospital Medical Center described other useful methods for improving memory that involve visual or semantic elaboration. In one of these, a person conjures up images related to something he or she wants to retain. To remember the name “Peggy,” you might imagine a pirate with a wooden (peg) leg. Such a tactic could be helpful as long as you do not end up calling her “Pegleggy.”
A semantic approach entails tacking on words to what you wish to recall. For example, in a music appreciation class that one of us (Hal Arkowitz) took in elementary school, the teacher asked the class to associate the main musical theme of the classical piece, the *Peer Gynt Suite*, with the following rather silly sentence: “Morning is dawning and Peer Gynt is yawning and music is written by Grieg.” The tie-in with the phrase was designed to help the kids remember the name of the composer.

Although Glisky and Glisky found support for these visual and semantic techniques, among others, they cautioned that memory improvements in the laboratory do not necessarily translate to enhancements in daily life, because these benefits depend on people practicing and using the tactics regularly. This gap in efficacy may be widest for strategies that take considerable time and effort to learn. Also, improvements in one area of memory often do not generalize to others.

Studies have found some support for the validity of the saying “Use it or lose it.” The more we use our memory – for example, reading, doing crossword puzzles, and playing board games – the better it may be, probably because such activities involve considerable use of memory. Of course, those with better memories may also be more likely to exercise their minds in the first place, accounting for some (but probably not all) of the association between good memory and amount of cognitive stimulation.

**Fit Body, Fit Mind**

If Jagger is as physically fit as he looks, his mind may be following suit. Some studies have found that higher levels of aerobic exercise are associated with better memory in older adults. Although many of these studies do not prove that aerobic exercise causes the memory improvements, some do suggest a causal connection. When psychologist Stanley Colcombe of the University of Illinois at Urbana-Champaign and his colleagues reviewed 18 controlled studies addressing this association in 2003, they found evidence that aerobic exercise did indeed lead to enhancements in memory.

Sustained aerobic activity may not be the only way to keep your mind agile and your memory sharp. In a study published in 2011 neurologist
Ruth Ruscheweyh of the University of Münster in Germany and her colleagues assessed total physical activity in 62 older adults over 6 months. Their questionnaire included both formal exercise and daily routines such as walking to work, climbing stairs, and gardening. The researchers linked reported increases in overall activity, no matter its type, with improvements in episodic memory at the end of 6 months. The greater the rise in activity levels, the bigger the memory boost. Thus, keeping physically active through regular workouts along with everyday errands and tasks may be the best recipe for reinvigorating your powers of recollection. (For more on the connection between physical and mental fitness in old age, see “Fit Body, Fit Mind?” by Christopher Hertzog, Arthur F. Kramer, Robert S. Wilson, and Ulman Lindenberger, *Scientific American Mind*, July/August 2009.)

The research suggests that many memory techniques as well as a physically and mentally energetic lifestyle can improve memory in older adults. We still have a long way to go before we have highly effective methods, but given the vigor of this field, we can expect great progress in the near future.

**Further Reading**

