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## BRAIN POWER

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### Myths about the Brain and Perception

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#### Myth # 1 Most People Use Only 10% of Their Brain Power

Whenever those of us who study the brain venture out of the Ivory Tower to give public lectures or media interviews, one of the questions we're most likely to encounter is, "Is it true that we only use 10% of our brains?" The look of disappointment that usually follows when we respond, "Sorry, I'm afraid not," strongly suggests that the 10% myth is one of those hopeful truisms that refuses to die simply because it would be so darn nice if it were true (Della Sala, 1999; Della Sala & Beyerstein, 2007). Indeed, this myth is widespread, even among psychology students and other well-educated people. In one study, when asked "About what percentage of their potential brain power do you think most people use?," a third of psychology majors answered 10% (Higbee & Clay, 1998, p. 471). Fifty-nine percent of a sample of college-educated people in Brazil similarly believe that people use only 10% of their brains (Herculano-Houzel, 2002). Remarkably, that same survey revealed that even 6% of neuroscientists agreed with this claim!

Surely, none of us would turn down a hefty hike in brain power if we could achieve it. Not surprisingly, marketers who thrive on the public's fond hopes for a self-improvement breakthrough continue to peddle a never-ending stream of dubious schemes and devices premised on the 10% myth. Always on the lookout for a "feel-good" story, the media has played a big role in keeping this optimistic myth alive. A great deal of advertising copy for legitimate products continues to refer to the 10% myth as fact, usually in the hopes of flattering potential customers who see themselves as having risen above their brain's limitations. For example, in his popular book, *How to Be Twice as Smart*, Scott Witt

(1983) wrote that “If you’re like most people, you’re using only ten percent of your brainpower” (p. 4). In 1999, an airline tried to entice potential flyers by informing them that “It’s been said that we use only 10% of our brain capacity. If, however, you’re flying \_\_\_\_\_ (name of company deleted) Airlines, you’re using considerably more” (Chudler, 2006).

Yet an expert panel convened by the U.S. National Research Council concluded that (alas!), in this, as with other miraculous self-improvement claims, there’s no good substitute for hard work when it comes to getting ahead in life (Beyerstein, 1999c; Druckman & Swets, 1988). This unwelcome news has done little to discourage millions who comfort themselves with the belief that the shortcut to their unfulfilled dreams lies in the fact that they just haven’t quite caught up with the secret for tapping their vast, allegedly unused cerebral reservoir (Beyerstein, 1999c). That desired promotion, stellar grade point average, or authorship of the next bestselling novel is within your grasp, say the sellers of cerebral miracle remedies.

Even more questionable are the offerings of New Age entrepreneurs who propose to hone the psychic skills we allegedly all possess with obscure gizmos for the brain. Self-proclaimed psychic Uri Geller (1996) claimed that “In fact, most of us use only about 10 percent of our brains, if that.” Promoters like Geller imply that psychic powers reside in the 90% of the brain that simple folk forced to subsist on the drudge-like 10% haven’t yet learned to use.

Why would a brain researcher doubt that 90% of the average brain lies silent? There are several reasons. First of all, our brain has been shaped by natural selection. Brain tissue is expensive to grow and operate; at a mere 2–3% of our body weight, it consumes over 20% of the oxygen we breathe. It’s implausible that evolution would have permitted the squandering of resources on a scale necessary to build and maintain such a massively underutilized organ. Moreover, if having a bigger brain contributes to the flexibility that promotes survival and reproduction—which are natural selection’s “bottom lines”—it’s hard to believe that any slight increase in processing power wouldn’t be snapped up immediately by existing systems in the brain to enhance the bearer’s chances in the continuous struggle to prosper and procreate.

Doubts about the 10% figure are also fueled by evidence from clinical neurology and neuropsychology, two disciplines that aim to understand and alleviate the effects of brain damage. Losing far less than 90% of the brain to accident or disease almost always has catastrophic consequences. Look, for instance, at the much-publicized controversy

surrounding the nonconscious status and ultimate death of Terri Schiavo, the young Florida woman who lay in a persistent vegetative state for 15 years (Quill, 2005). Oxygen deprivation following a cardiac arrest in 1990 had destroyed about 50% of her cerebrum, the upper part of the brain responsible for conscious awareness. Modern brain science argues that “mind” equals brain function. Therefore, patients like Ms. Schiavo had permanently lost the capacity for thoughts, perceptions, memories, and emotions that are the very essence of being human (Beyerstein, 1987). Although some claimed to see signs of consciousness in Schiavo, most impartial experts found no evidence that any of her higher mental processes had been spared. If 90% of the brain is indeed unnecessary, this shouldn’t have been the case.

Research also reveals that no area of the brain can be destroyed by strokes or head trauma without leaving patients with serious deficits in functioning (Kolb & Wishaw, 2003; Sacks, 1985). Likewise, electrical stimulation of sites in the brain during neurosurgery has failed to uncover any “silent areas,” those in which the person experiences no perception, emotion, or movement after neurosurgeons apply these tiny currents (neurosurgeons can accomplish this feat with conscious patients under local anesthesia because the brain contains no pain receptors).

The last century has witnessed the advent of increasingly sophisticated technologies for snooping on the brain’s traffic (Rosenzweig, Breedlove, & Watson, 2005). With the aid of brain imaging techniques, such as electroencephalograms (EEGs), positron emission tomography (PET) scanners, and functional magnetic resonance imaging (MRI) machines, researchers have succeeded in localizing a vast number of psychological functions to specific brain areas. With nonhuman animals, and occasionally with humans undergoing neurological treatment, researchers can insert recording probes into the brain. Despite this detailed mapping, no quiet areas awaiting new assignments have emerged. In fact, even simple tasks generally require contributions of processing areas spread throughout virtually the whole brain.

Two other firmly established principles of neuroscience create further problems for the 10% myth. Areas of the brain that are unused because of injuries or disease tend to do one of two things. They either wither away, or “degenerate,” as neuroscientists put it, or they’re taken over by nearby areas that are on the lookout for unused territory to colonize for their own purposes. Either way, perfectly good, unused brain tissue is unlikely to remain on the sidelines for long.

All told, evidence suggests that there’s no cerebral spare tire waiting to be mounted with a little help from the self-improvement industry. So,

if the 10% myth is so poorly supported, how did it get started? Attempts to track down this myth's origins haven't uncovered any smoking guns, but a few tantalizing clues have materialized (Beyerstein, 1999c; Chudler, 2006; Geake, 2008). One stream leads back to pioneering American psychologist William James in the late 19th and early 20th centuries. In one of his writings for the general public, James said he doubted that average persons achieve more than about 10% of their *intellectual potential*. James always talked in terms of underdeveloped potential, never relating it to a specific amount of the brain engaged. A slew of "positive thinking" gurus who followed weren't as careful, though, and "10% of our capacity" gradually morphed into "10% of our brain" (Beyerstein, 1999c). Undoubtedly, the biggest boost for the self-help entrepreneurs came when journalist Lowell Thomas attributed the 10% brain claim to William James. Thomas did so in the 1936 preface to one of the bestselling self-help books of all time, Dale Carnegie's *How to Win Friends and Influence People*. The myth has never lost its steam since.

The popularity of the 10% myth probably also stems partly from authors' misunderstandings of scientific papers by early brain researchers. In calling a huge percentage of the human cerebral hemispheres "silent cortex," early investigators may have fostered the mistaken impression that what scientists now call "association cortex" had no function. As we now know, association cortex is vitally important for our language, abstract thinking, and performance of intricate sensory-motor tasks. In a similar vein, early researchers' admirably modest admissions that they didn't know what 90% of the brain did probably contributed to the myth that it does nothing. Another possible source of confusion may have been laypersons' misunderstanding of the role of glial cells, brain cells that outnumber the brain's neurons (nerve cells) by a factor of about 10. Although neurons are the scene of the action with respect to thinking and other mental activities, glial cells perform essential support functions for the neurons that do the heavy lifting, psychologically speaking. Finally, those who've searched for the origins of the 10% myth frequently came across the claim that Albert Einstein once explained his own brilliance by reference to the myth. Nevertheless, a careful search by the helpful staff at the Albert Einstein archive on our behalf yielded no record of any such statement on his part. More likely than not, the promoters of the 10% myth simply seized on Einstein's prestige to further their own endeavors (Beyerstein, 1999c).

The 10% myth has surely motivated many people to strive for greater creativity and productivity in their lives, which certainly isn't a bad thing.

The comfort, encouragement, and hope that it's generated almost surely help to explain its longevity. But, as Carl Sagan (1995) reminded us (see *Introduction*, p. 11), if something sounds too good to be true, it probably is.

## Myth # 2

### Some People Are Left-Brained, Others Are Right-Brained

The next time somebody tries to sell you a book or device for retraining your allegedly flabby right hemisphere, reach for your wallet. Then clasp it firmly to your chest and run as fast as you can. Like some other myths in this book, the one you're about to encounter has a grain of truth to it. Nevertheless, this grain can be a bit hard to find amidst the mounds of misinformation that bury it.

Are some people left-brained and others right-brained? There's good evidence that the two sides of the brain, called *hemispheres*, differ in their functions (Springer & Deutsch, 1997). For example, different abilities are more affected by injuries to one side of the brain than the other, and brain imaging techniques demonstrate that the hemispheres differ in their activity when people engage in various mental tasks. By far the most dramatic evidence for *laterality of function*—the superiority of one or the other hemisphere for performing certain tasks—comes from patients who've undergone a “split brain” operation. In this rarely performed procedure, surgeons sever the nerve tracts connecting opposite points in the brain's left and right hemispheres in a last-ditch attempt to control severe epilepsy. The large pathway connecting these hemispheres, the main target of the split-brain operation, is the corpus callosum (“colossal body”).

Roger Sperry shared the Nobel Prize in 1981 for his landmark studies of split-brain patients, and a fascinating lot they are (Gazzaniga, 1998). Once they'd recovered from surgery, they appeared deceptively normal in their everyday activities. But once Sperry tested them in the laboratory, it became apparent that the two halves of their brains were working independently. Each side operated without awareness or knowledge of the other.

In Sperry's laboratory tests, patients fixate their eyes at the center of a screen, on which the researcher briefly flashes words or pictures. With the eyes immobilized, information flashed to the left of the fixation point goes to the right hemisphere and the opposite is true of information presented to the right of the fixation point (that's because

the optic pathways on each side of the visual field cross over to the other side). In more ordinary situations, this separation of information doesn't occur because patients constantly move their eyes about their surroundings. As a result, the input normally reaches both hemispheres eventually. When it doesn't, though, some decidedly peculiar things can happen.

The right hemisphere receives input from and controls the movements of the left side of the body, and the left hemisphere does the same for the right. In almost all right-handers, and most lefties as well, the primary areas for language reception and production are in the left hemisphere. Thus, if we restrict new information to the right hemisphere, the left hemisphere—which is more verbal than the right—will be unable to tell us what the input was, and it may be perplexed to see the left hand acting on the segregated knowledge, for reasons it can't fathom.

For example, if the researcher shows the right hemisphere of a split-brain subject a photograph of a naked man, she may giggle. Yet when asked what she's giggling about, the subject (her left hemisphere, that is) won't be able to say. Instead, she may cook up a plausible-sounding reason ("That photo reminds me of my uncle George, who's a really funny guy"). Split-brain subjects may even do something with their right hand, like assemble a group of blocks to fit a pattern, utterly oblivious of the fact that their left hand is following a few seconds behind, undoing all the good work. This much is well established. The dispute concerns the uniqueness of the kinds of tasks handled by the two hemispheres and how they go about it. In this regard, brain researchers have become more cautious in recent years while many pop psychologists have run wild.

Using Sperry's techniques, researchers have confirmed that the left and right hemispheres are relatively better at different mental activities. Note, however, that we wrote *relatively* better. The two halves of the brain differ in how they process tasks rather than what they process (McCrone, 1999). Let's take language, for example. The left hemisphere is better at the specifics of speech, such as grammar and word generation, whereas the right hemisphere is better at the intonation and emphases of speech (what's known as "prosody"). Although the right hemisphere is better at nonlinguistic functions that involve complex visual and spatial processes, the left hemisphere plays some role in these capacities if we give it the chance. The right brain is better at dealing with a general sense of space, whereas corresponding areas in the left brain become active when the person locates objects in specific places. In many cases, it's not

that one hemisphere or the other can't perform a given task; it's just that one of them can perform it faster and better than the other. So it tends to grab the assignment first.

Of course, ordinary people aren't, as left-brain/right-brain aficionados suggest, just split-brain patients who haven't gotten around to having their corpus callosums snipped. In the normal brain, the side that's first off the mark will call for help from across the way. As long as the left-right pathways are intact, the two hemispheres share information extensively. Indeed, brain imaging research shows that the two hemispheres routinely communicate during most tasks (Mercer, 2010). After a split-brain operation, this cooperation isn't possible, so the separated systems limp along as best they can.

Therefore, the ways in which the two sides of brain differ are far more limited than pop psychology's "hemisphericity" entrepreneurs suggest (Aamodt & Wang, 2008; Corballis, 1999, 2007; Della Sala, 1999). On balance, the two hemispheres are much more similar than different in their functions (Geake, 2008). Modern neuroscientists have never agreed with many New Age "hemisphere trainers," who claim that the brain's two halves house totally dissimilar minds that approach the world in radically different ways, with one (the left) side an accountant and the other (the right) side a veritable Zen master. Robert Ornstein was among those to promote the idea of using different ways to tap into our "creative" right brains versus our intellectual left brains in his 1997 book, *The Right Mind: Making Sense of the Hemispheres*. Moreover, scores of educational and business programs de-emphasize getting the "right" answers on tests in favor of harnessing creative ability. Such programs as the *Applied Creative Thinking Workshop* have trained business managers to develop the untapped capacities of their right brains (Hermann, 1996). Furthermore, the enormously successful book, *Drawing on the Right Side of the Brain* (Edwards, 1980), which has sold over 2.5 million copies, encourages readers to unleash their artistic abilities by suppressing their "analytical" left hemispheres. Even cartoonists have jumped on the bandwagon; one shows a student holding an exam emblazoned with a big "F" who tells his professor, "It's not fair to flunk me for being a right-brain thinker."

The urge on the part of pop psychologists to assign all mental abilities to unique left and right compartments probably owes more to politics, social values, and commercial interests than to science. Its detractors have dubbed this extreme view "dichotomania" because of pop psychologists' tendency to dichotomize the two hemispheres' functions (Corballis, 1999). The notion was embraced enthusiastically by New Age proponents of

the 1970s and 1980s, largely because it offered a rationale for world-views that were mystical and intuitive.

Pop psychologists further embellished genuine differences in how the hemispheres process information, proclaiming the allegedly cold and rational left hemisphere “logical,” “linear,” “analytical,” and “masculine.” In contrast, they proclaimed the allegedly warm and fuzzy right hemisphere “holistic,” “intuitive,” “artistic,” “spontaneous,” “creative,” and “feminine” (Basil, 1988; Zimmer, 2009). Arguing that modern society undervalues the right hemisphere’s touchy-feely mode of approaching the world, dichotomizers touted fanciful schemes for boosting this hemisphere’s activity. Their books and seminars promised to free us of the barriers to personal growth imposed by an inflexible school system that favors “left hemisphere thinking.”

Yet an expert panel, assembled by the U.S. National Academy of Sciences, concluded that “. . . we have no direct evidence that differential hemispheric utilization can be trained” (Druckman & Swets, 1988, p. 110). The panel concluded that behavioral training could probably enhance different styles of learning or problem solving, but that such improvements were not due to differences in the two hemispheres’ functioning.

If the behavioral exercises promoted for right hemisphere calisthenics might yield a few benefits, we can’t say the same for the far-fetched “brain tuners” sold for the same purposes (Beyerstein, 1985, 1999a). Numerous devices of this sort allegedly harmonize or synchronize the activity of the two hemispheres. One of the most successful of these schemes was invented by a former public relations executive with no formal training in neuroscience. Like others of its ilk, the device supposedly synchronizes brain waves across the hemispheres by means of feedback signals. Probably because of the placebo effect (see *Introduction*, p. 14), the product found scores of satisfied customers. Yet even if the devices synchronized left–right brain waves, there’s no reason to believe that making the two hemispheres resonate in this fashion would be good for us. In fact, if the brain is working optimally, this is probably exactly what you *wouldn’t* want it to do. Optimal psychological performance usually requires differential activation rather than synchronization of the hemispheres (Beyerstein, 1999a).

The bottom line: Don’t be taken in by the claims of dichotomizers with a seminar to sell or marketers of hemispheric synchronization gizmos that sound too good to be true. Current research on hemispheric differences, even by those responsible for discovering left–right specializations, focuses on showing how the normal brain works in an integrated fashion (Corballis, 2007; Gazzaniga, 1998; McCrone, 1999).

## Myth # 3

### Extrasensory Perception (ESP) Is a Well-Established Scientific Phenomenon

Having trouble with your love life? How about money problems? Call Miss Cleo's Psychic Hotline for Free! The operators of Miss Cleo's Psychic Hot Line charged callers an astonishing \$1 billion before a 2002 settlement with the Federal Trade Commission (FTC) required that they cancel \$500 million in customer bills and pay a \$5 million fine (Miss Cleo's psychic powers apparently failed to warn her of the FTC's impending legal action). Nearly 6 million viewers of late-night television commercials featuring the purported Jamaican soothsayer were moved to speak with her or one of her "trained psychics" by the promise of receiving 3 free minutes of revelations about their future. Callers had no reason to suspect that Miss Cleo had American parents, that she was born in Los Angeles, and that her real name was Youree Dell Harris. Nor did they realize that their calls were being charged at the rate of \$4.99 a minute from the outset, and that the goal of the "psychic" on the other end of the line was to keep them talking as long as possible, thereby running up their phone bills.

Some readers skeptical of psychic abilities might assume that callers, who ended up paying an average of \$60 for each call, were simply suckers. Yet this judgment doesn't consider the fact that belief in psychic abilities and extrasensory perception (ESP) is firmly entrenched in modern society. The millions of callers to "Miss Cleo" were but a tiny fraction of the Americans who believe that ESP is a firmly established scientific fact. Coined in 1870 by Sir Richard Burton, the term ESP has come to mean knowledge or perception without the use of any of the senses. According to the most recent Gallup poll on this topic (Moore, 2005), 41% of the 1,002 U.S. adults surveyed believe in ESP, 31% in the existence of "telepathy/communication between minds without using traditional senses," and 26% in "clairvoyance/the power of the mind to know the past and predict the future." Among 92 introductory psychology students, 73% said they believed that the existence of ESP was well documented (Taylor & Kowalski, 2003).

The types of experiences assessed by these surveys are also known as paranormal, or psi-related experiences. Many parapsychologists (psychologists who study the paranormal) also describe *psychokinesis*—the ability to influence physical objects or processes by the power of thought—as a paranormal ability. Nevertheless, psychokinesis is typically excluded from ESP, which includes the three capacities of (1) *telepathy* (mind reading), (2) *clairvoyance* (knowing the existence

of hidden or far-away objects or people), and (3) *precognition* (predicting the future using paranormal means).

Believers in ESP aren't limited to the general public. More than half of natural scientists polled (Wagner & Monnet, 1979) reported that they believed that ESP is an established fact or a likely possibility. Starting in 1972, the U.S. government shelled out \$20 million of taxpayer money to fund a program known as "Stargate" to study the ability of "remote viewers" to acquire militarily useful information from distant, inaccessible places (using clairvoyance), such as a nuclear facility in the then Soviet Union. Government agents gave remote viewers the geographical coordinates (longitude, latitude) of a specific person, place, or document, and these viewers then wrote down, drew, or described whatever they could glean mentally about the target. The government discontinued the Stargate program in 1995, apparently because it yielded no useful military information. Amidst the debate over whether the government was wasting taxpayer money on this project, a blue-ribbon subcommittee of the U.S. National Research Council reviewed the world literature on ESP and concluded that the case for psychic powers was feeble (Alcock, 1990; Druckman & Swets, 1988; Hyman, 1989). Still, the mere fact that such a program was established in the first place highlights the widespread acceptance of ESP among educated people.

If the scientific support for ESP is so weak—and we'll soon provide evidence for this verdict—why do so many people believe in it? From childhood, most of us are bombarded by favorable and unskeptical media accounts of paranormal experiences. Such television shows as the *X-Files*, *Medium*, *Fringe*, and *America's Psychic Challenge* and, before that, *Twilight Zone* and the *Outer Limits*, have portrayed ESP as part of the fabric of everyday life. Movie plots encourage belief in a wide range of paranormal powers, including clairvoyance (such as *Minority Report*, *The Dead Zone*, *Stir of Echoes*, *The Butcher's Wife*, *The Sixth Sense*), telepathy (such as *Scanners*, *Dreamscape*, *The Sender*, and *Ghostbusters*), and psychokinesis (such as *Carrie* and *X-Men*). Many popular self-help books (Hewitt, 1996; Manning, 1999) declare that we all harbor latent psychic talents and tout simple techniques to liberate these powers and achieve ESP success. The Internet features innumerable pitches for courses that promise to develop and enhance our psychic abilities. For example, an advertisement for the *Silva Ultra Mind Seminar* (2005) tells participants that they'll be paired up with other people, taught to harness their ESP following meditation, and given the skills to guess astonishing facts about each other by means of paranormal powers.

Belief in the paranormal is bolstered by strong needs to believe in something greater than ourselves, a reality that lies beyond what the “senses can sense” (Gilovich, 1991). But perhaps even more influential in spreading belief in ESP is the fact that our personal experiences occasionally seem so extraordinary that they defy ordinary explanation. In one study (Greeley, 1987), 67% of 1,500 American adults claimed to have had personal experience with clairvoyance, precognition, or psychokinesis.

The emotional impact of dramatic and unexpected coincidences is certainly one reason why so many people believe in ESP. Say you have a dream about your friend, Jessica, from whom you haven’t heard in years, and Jessica calls the next morning. You might assume the coincidence is so incredible that it must be ESP. Yet people tend to underestimate how often such events could occur by chance alone. If you find yourself in a group of 25 people, what are the odds that at least 2 of them share the same birthday? Most people are shocked to learn that the answer is over 50%. If we increased the size of the group to 35, the odds of at least 2 people sharing the same birthday rises to about 85% (Gilovich, 1991). We tend to underestimate how probable most coincidences are, and we may then attribute false “psychic” significance to these events (Marks & Kammann, 1980).

As we noted in the *Introduction* (p. 11), selective perception and memory lead us to remember events that confirm our beliefs and ignore or forget events that don’t (Presley, 1997). Accordingly, people who believe in ESP may be more likely to remember and attach special significance to occurrences that fall into the category of the paranormal, even though they’re due merely to chance. Because the timing of Jessica’s call grabbed your attention, it stood out in your memory. So if we asked you a few weeks later if you believed in ESP, her call could spring to mind as evidence for ESP.

In light of the seeming reality of ESP experiences, scientists have given them serious consideration since the late 19th century. Joseph Banks Rhine (1933) and his wife Louisa jump-started the scientific study of ESP in the United States. They established a major program of research on ESP at Duke University in the 1930s based on subjects’ trying to guess one of five standard symbols (star, triangle, squiggly line, plus sign, square) on cards—named “Zener cards” after one of Rhine’s colleagues. Yet other scientists couldn’t replicate positive findings from Rhine and his colleagues’ Zener card studies. Nor could they replicate later research involving the ability of people to transmit visual images to a dreaming person (Ullman, Krippner, & Vaughan, 1973). Skeptics dismissed rates of ESP

responding that exceeded chance as due to the unintentional “leakage” of subtle sensory cues, such as seeing the vague imprint of a Zener card symbol through a sealed envelope.

Studies using the *Ganzfeld* technique have received by far the most attention from the scientific community. The mental information detected by ESP, if it indeed exists, is presumably an exceedingly weak signal. So this information is typically obscured by many irrelevant stimuli. According to the logic of the Ganzfeld method, we need to create a uniform sensory field, the Ganzfeld (from the German word meaning “whole field”), to decrease the proportion of noise relative to signal and allow the faint ESP signal to emerge (Lilienfeld, 1999).

To establish this uniform sensory field, ESP experimenters cover the eyes of relaxed subjects with ping-pong ball halves, and direct a floodlight containing a red beam toward their eyes. Meanwhile, these researchers pump white noise into subjects’ ears through headphones to minimize extraneous sounds in the room. A person in another room then attempts to mentally transmit pictures to subjects, who later rate the extent to which each of four pictures matches the mental imagery they experienced during the session.

In 1994, Daryl Bem and Charles Honorton published a remarkable article on the Ganzfeld method in one of psychology’s most prestigious journals, *Psychological Bulletin*. To analyze data collected previously by other investigators on this method, they used a statistical technique called *meta-analysis*, which allows researchers to combine the results of many studies and treat them as though they were one large study. Bem and Honorton’s meta-analysis of 11 Ganzfeld studies revealed that participants obtained overall target “hit” rates of approximately 35%, thereby exceeding chance (25%: that’s 1 in 4 targets) performance. Nevertheless, it wasn’t long before Julie Milton and Richard Wiseman (1999) analyzed 30 recent Ganzfeld studies not reviewed by Bem and Honorton, and reported that the size of Ganzfeld effects corresponded to essentially chance performance.

Lance Storm and Suitbert Ertel (2001) responded to Milton and Wiseman (1999) with another meta-analysis of 79 Ganzfeld studies, dating from 1974 to 1996, and contended that their analysis supported the claim that the Ganzfeld procedure detected ESP. In the parting shot in this scientific ping-pong game (appropriate for Ganzfeld research, we might add) of arguments and counterarguments, Milton and Wiseman (2001) countered that the studies that Storm and Ertel included in their analysis suffered from serious methodological shortcomings, and had shown nothing of the kind. It’s clear that the question of whether the

Ganzfeld technique will prove to be the replicable method long sought by parapsychologists is far from conclusively resolved (Lilienfeld, 1999). Still, the fact that psychologists have tried unsuccessfully for over 150 years to demonstrate the existence of ESP is hardly encouraging (Gilovich, 1991).

Many scientists argue that the scientific “bar” necessary to accept the existence of ESP should be set very high. After all, the very existence of ESP would run counter to most established physical laws related to space, time, and matter. A program of well-controlled research that yields consistent support for ESP across independent laboratories will be needed to persuade the scientific community that paranormal abilities are real. Although we shouldn’t dismiss these abilities as impossible or unworthy of further scientific consideration, we recommend holding off on making any major life decisions based on that call to the psychic hot line.

## Myth # 4

### Visual Perceptions Are Accompanied by Tiny Emissions from the Eyes

Before reading on, take a look at the world around you. If you’re inside, fixate on an object, like a chair, pen, or coffee mug; if you’re outside, fixate on a tree, blade of grass, or cloud. Keep staring at it.

Now answer this question: Is anything coming out of your eyes?

This question may strike you as decidedly odd. Yet surveys demonstrate that large proportions of adults believe that our visual perceptions are accompanied by tiny emissions from our eyes (Winer, Cottrell, Gregg, Fournier, & Bica, 2002).

Indeed, when researchers show college students diagrams that depict rays, waves, or particles coming either into the eye or coming out of the eye and ask them to pick the diagram that best describes visual perception, 41–67% select diagrams that show emissions emanating from the eye (Winer, Cottrell, Karefilaki, & Gregg, 1996). Even when researchers have shown college students cartoons of people’s faces staring at an object and asked them to draw arrows to portray their vision, 69% drew arrows that showed visual energies emerging from the eyes (Winer & Cottrell, 1996b). These findings aren’t an artifact of college students not understanding the drawings, because even when researchers ask them—without any drawings—whether or not the eye emits rays or particles that enable it to see objects, many, often 30% or more, say that it does (Winer et al., 1996).

As the great Swiss psychologist Jean Piaget (1929) noted, this belief begins early in life. Piaget even discussed the case of one child who believed that two people's looks can connect and "mix" when they meet each other. Consistent with Piaget's observations, 57% of elementary school children say that something comes out of the eye when people see (Cottrell & Winer, 1994; Winer & Cottrell, 1996a). This belief declines from the third to the eighth grade, but it remains widespread (Winer & Cottrell, 1996a).

This "extramission theory" of vision dates back at least as far as Greek philosopher Plato (427–347 B.C.), who spoke of a "fire" that emanated from the eye during vision, which "coalesces with the daylight . . . and causes the sensation we call seeing" (Gross, 1999). Later, Greek mathematician Euclid (circa 300 B.C.) described "rays proceeding from the eye" during vision. Although the Greek philosopher Aristotle (384–322 B.C.) rejected the extramission theory of vision, it remained popular for many centuries.

Indeed, beliefs about the "evil eye" (*mal ojo*) inflicting psychological harm on others have long been widespread in many countries, especially Mexico and those in the Mediterranean, Central America, and the Arab world (Bohigian, 1998; Gross, 1999; Machovec, 1976; Winer, Rader, & Cottrell, 2003). Both the Old and New testaments of the Bible refer to the evil eye, and ancient Egyptians applied eye shadow to ward off its sinister influence. Throughout the ages, poets wrote of the power of the eye to induce profound psychological effects, perhaps indirectly reflecting people's extramission beliefs (Gross, 1999). For example, Shakespeare penned that "A lover's eye will gaze an eagle blind." Even today, we speak of people giving us a "penetrating glance," a "piercing stare," or a "cutting look" (Winer & Cottrell, 1996a). Because of the representativeness heuristic (see *Introduction*, p. 15), we may overgeneralize from these metaphors to the literal belief that the eye outputs energy. Interestingly, surveys suggest that 93% of college students have experienced the sense that they can "feel the stare of other people" (Cottrell, Winer, & Smith, 1996).

Biologist Rupert Sheldrake (2003) even created a stir in the scientific community by conducting research purporting to show that many people can tell they're being stared at by people they can't see, but a number of researchers have identified serious flaws in his studies, including the fact that Sheldrake's subjects may have subtly influenced people to stare back at them (Marks & Colwell, 2000; Shermer, 2005). More recently, psychiatrist Colin Ross claimed that he can harness beams from his eyes to turn on a tone from a computer. Nevertheless,

preliminary testing by a neurologist revealed that Ross' eyeblinks created a brain wave artifact that was inadvertently triggering the tone (False Memory Syndrome Foundation, 2008).

Psychologists still don't understand why so many of us hold extramission beliefs, but they have a few tantalizing leads. First, popular culture, as exemplified by Superman's X-ray vision with its power to attack villains and slice through steel (Yang, 2007), may have contributed to some modern extramission beliefs, although this influence of course can't explain the origins of these beliefs in ancient culture (see Figure 1.1). Second, most of us have experienced "phosphenes," perceptions of light—often consisting of dots or patterns—created by excitation of the retina, the light-sensitive layer at the back of the eye (Neher, 1990). Pressure phosphenes, which we most often see after rubbing our eyes after awakening, are almost certainly the most common. Some writers have conjectured that phosphenes may contribute to the belief that the eye emits tiny particles to detect objects (Gross, 1999). Third, the eyes of many animals that possess good night vision contain a "tapetum lucidum," a reflective layer behind or within the retina. Many of us have seen the gleaming light generated by this layer, sometimes called "eyeshine," in cats or raccoons at night (Ollivier et al., 2004). Some have suggested that this experience may foster the misimpression that the eyes generate emissions (Yang, 2007). Nevertheless, all three speculations, although intriguing, are just that—speculations—and none has been tested systematically. The reasons for extramission beliefs remain poorly understood (Winer et al., 2003).

Can we modify extramission beliefs by education? At first blush, the answer appears to be "no." Remarkably, exposure to lectures on sensation and perception in introductory psychology courses seems to make no difference in the percentage of college students who endorse beliefs in extramission (Gregg, Winer, Cottrell, Hedman, & Fournier, 2001; Winer et al., 2002). Nevertheless, there may be a "ray" of hope, if we can be forgiven for the pun. Research suggests that presenting college students with "refutational" messages, those designed not merely to explain how the eye works but how it *doesn't* work, in this case that the eye doesn't emit rays or particles, leads to short-term reductions in extramission beliefs (Winer et al., 2002). Even here, though, these reductions aren't especially long-lasting—they've largely dissipated by 3 to 5 months—suggesting that a one-shot exposure to a refutational message may not do the trick. Repeated exposure may be needed.

In many respects, research on refutational messages mirrors the approach we're adopted throughout this book: first debunking the fictions



**Figure 1.1** Superman’s “X-ray vision” captures many people’s intuitive beliefs regarding visual emissions. Source: *Superman #37*.

about the mind and brain before unveiling the facts. As Mark Twain reminded us, learning often first requires unlearning.

## Myth # 5

### Subliminal Messages Can Persuade People to Purchase Products

Many of us know that psychologists and advertisers can present sights and sounds so briefly or so faintly that we fail to perceive them. But can those feeble stimuli influence our behavior in powerful ways? There’s a profitable industry that hopes you believe the answer is “yes.”

Some promoters push this kind of ultra-weak or “subliminal” messaging in the realm of advertising, whereas others have become leaders in the burgeoning self-help movement. The Internet, New Age fairs and magazines, supermarket tabloids, late-night TV “infomercials,” and bookstores market subliminal audiotapes and CDs that promise to make the purchaser healthy, wealthy, and wise. Among our personal favorites we include audiotapes that promise to enlarge women’s breasts,

relieve constipation, improve one's sex life, or cure deafness (although the mechanism by which a deaf person could detect subliminal sounds remains truly mysterious). Given the widespread promotion of subliminal persuasion in the popular psychology world, it's hardly surprising that 59% of the psychology undergraduates sampled by Larry Brown (1983), and 83% of those sampled by Annette Taylor and Patricia Kowalski (2003), said they believed it works.

Interestingly, there's evidence that under tightly controlled laboratory conditions, psychologists can demonstrate short-lived and modest subliminal effects. In these experiments, researchers flash *priming* words or pictures on a screen so briefly that observers are unaware of what the flashes contain. In psychological lingo, priming stimuli increase the speed or accuracy with which we'll identify a later stimulus. Experimenters then determine whether the meanings or emotional content of the priming stimuli influences people's responses to the task, like completing a word with missing letters or judging the emotion of a person in a photograph. For instance, Nicholas Epley and his colleagues (Epley, Savitsky, & Kacheliski, 1999) described an experiment in which researchers asked psychology graduate students to generate ideas for research projects. The investigators then exposed the students to extremely brief flashes featuring either the smiling face of a familiar colleague or the scowling face of their faculty supervisor. The students perceived the stimuli as nothing but flashes of light. Next, they rated the quality of the research ideas they'd produced. Without knowing why, subjects exposed to the flash featuring the scowling face of their supervisor rated their own ideas less favorably than those exposed to the smiling colleague's face.

Investigators can similarly influence verbal behaviors, as when a shared theme in a series of subliminally flashed priming words increases the odds that a person will choose a related word from a list of alternatives (Merikle, 1992). For example, if we present a subject with the word stem "gui \_ \_" and ask her to form a complete word, "guide" and "guile" are both options. Research shows that we can boost the probability of subjects choosing "guide" by priming them subliminally with words like "direct," "lead," and "escort," whereas we can boost the probability of their choosing "guile" by priming them subliminally with words like "deceit," "treachery," and "duplicitous."

"Subliminal" means "under the limen." The *limen*, better known as the "sensory threshold," is the narrow range in which a diminishing stimulus goes from being just barely detectable to being just barely undetectable. If the stimulus happens to be a word or phrase, the first

hurdle it must pass is the *simple detection threshold*. That's the point at which people first become dimly aware that the researcher has presented anything, even though they can't identify *what* they saw or heard. The researcher must present the stimulus for a longer interval and at a higher intensity to reach the next stage of awareness, the *recognition threshold*. At that point, people can say precisely what they heard or saw. If a stimulus has so little energy, or is so thoroughly obscured by noise that it can't trigger a physiological response in the eye's or ear's receptors, it can't affect anything the person thinks, feels, or does. Period. Messages that inhabit the gray zone between the detection and recognition thresholds, or that we simply aren't attending to, sometimes influence our emotions or behavior.

The subliminal self-help industry hopes you'll swallow the claim that your brain understands and acts on the complex meanings of phrases that are presented at vanishingly weak levels or overshadowed by stronger stimuli. Moreover, they claim that these sneaky subliminal stimuli are especially effective because they worm their way into your unconscious, where they can pull your strings like a hidden puppeteer. Should you be worried? Read on.

Modern psychology accepts that much of our mental processing goes on outside of our immediate awareness—that our brains work on many tasks at once without monitoring them consciously (Kihlstrom, 1987; Lynn & Rhue, 1994). Nevertheless, this is a far cry from the kind of non-conscious processing envisioned by pop psychology proponents of subliminal effects. Subliminal entrepreneurs are holdovers from the heyday of strict Freudian views of the unconscious, which most scientific psychologists have long abandoned (Bowers, 1987). Like Freud, subliminal enthusiasts see the unconscious as the seat of primitive and largely sexual urges that operate outside of our awareness to compel our choices.

Writer Vance Packard popularized this view of the unconscious in his 1957 smash bestseller, *The Hidden Persuaders*. Packard accepted uncritically the story of marketing consultant James Vicary, who supposedly conducted a successful demonstration of subliminal advertising at a Fort Lee, New Jersey movie theatre. Vicary claimed that during a movie, he repeated exposed cinema patrons to messages flashed on the screen for a mere 1/3,000 of a second, urging them to buy popcorn and Coca-Cola. He proclaimed that although movie-goers were unaware of these commands, sales of popcorn and Coca-Cola skyrocketed during the six-week duration of his "experiment." Vicary's findings achieved widespread popular acceptance, although he never submitted them to the scrutiny

of a scientific journal, nor has anyone been able to replicate them. After much criticism, Vicary finally admitted in 1962 that he'd made up the whole story in an effort to revive his failing consulting business (Moore, 1992; Pratkanis, 1992).

Vicary's confession failed to discourage even more far-fetched accusations that the advertisers were subliminally manipulating the unsuspecting public. In a series of books with such titillating titles as *Subliminal Seduction* (1973), former psychology professor Wilson Brian Key claimed that advertisers were conspiring to influence consumer choices by embedding blurred sexual images into magazine and TV renderings of ice cubes, plates of food, models' hair-dos, and even Ritz crackers. Key gravely warned that even a single exposure to these camouflaged images could affect consumer choices weeks later. Although Key presented no real evidence to back up his claims, public alarm led the U.S. Federal Communications Commission (FCC) to look into his allegations. Although the FCC couldn't find any evidence that subliminal advertising worked, they declared it "contrary to the public interest" and warned licensed broadcasters to steer clear of it. Moreover, in an attempt to soothe public jitters, several advertising trade associations imposed voluntary restrictions, asking their members to refrain from attempts to punch below the liminal belt.

Although Vicary was an admitted fraud and Key never put his strange ideas to a proper test, some still believed that subliminal persuasion claims were worth examining. So in 1958, the Canadian Broadcasting Corporation (CBC) performed an unprecedented nationwide test. During a popular Sunday night TV program, it informed viewers that the network was about to conduct a test of subliminal persuasion. The CBC then flashed subliminally the message "phone now" on the screen 352 times throughout the show. Telephone company records indicated that phone usage didn't increase, nor did local television stations report a big upsurge in calls. Nevertheless, a few viewers, who may have known about Vicary's alleged results, called in to say they felt hungrier and thirstier following the program. The results of more carefully controlled tests of the ability of subliminal messages to influence consumer choices or voter attitudes were also overwhelmingly negative (Eich & Hyman, 1991; Logie & Della Sala, 1999; Moore, 1992; Pratkanis, 1992). To this day, there's no good evidence that subliminal messages can affect purchasers' decisions or voters' choices, let alone yield perfect memories or larger breasts.

Perhaps most bizarre of all were claims that heavy metal rock bands, such as Judas Priest, were inserting *backward* recordings of Satanic

messages in their music. Alarmists claimed these messages encouraged suicidal behavior, although what conceivable purpose entertainers might have in killing off potential album buyers remains unclear. Some even asserted that it was all a plot to subvert the morality of youthful music fans. Many would maintain that youth generally manage this feat quite well without any special subliminal help, but no matter.

John Vokey and J. Don Read (1985) put the idea of subliminal backward messages to a controlled test. In one particularly amusing demonstration, they found that participants with prudish leanings, given subtle suggestions as to what they were about to hear, were likely to perceive nonexistent pornographic material in reverse-played Biblical passages. These results suggest that people who claim to hear Satanic messages embedded in commercial sound tracks are allowing their overheated imaginations to read the lewd material into meaningless sound patterns. It's all in the ear of the beholder.

Tests of self-help subliminal products have been equally discouraging. Anthony Greenwald and his colleagues (Greenwald, Spangenberg, Pratkanis, & Eskenazi, 1991) conducted a double-blind test of commercially marketed subliminal audiotapes that purport to enhance memory or self-esteem. They told half of the participants they were getting the memory boosting tapes, the other half they were getting the self-esteem boosting tapes. Within each of these groups, half got the tapes they were expecting and half got the tapes with the other message. Participants reported that they improved in ways consistent with whichever kind of tape they *believed* they received. Those who received the self-esteem tapes, believing they were the memory boosters, were just as happy with their apparent memory improvement as those who got the real McCoy, and vice versa. This curious finding led Greenwald and his colleagues to refer to this phenomenon as an *illusory placebo effect*: People didn't improve, but they thought they had.

Despite convincing debunking of the concept by the scientific community, subliminal advertisements still pop up occasionally. During the 2000 U.S. presidential election, sharp-eyed Democrats spotted, in a Republican TV attack ad aimed at candidate Al Gore, an extremely brief flash of the word "RATS" superimposed on Gore's face (Berke, 2000). The ad's creator claimed that the fact that the last four letters of the intended word "BUREACRATS" just happened to become detached from this longer word was entirely accidental (see Figure 1.2). Nevertheless, advertising production experts said that given the advanced technology used to prepare the ad, an unintentional insertion of this kind was unlikely.



**Figure 1.2** Was the inclusion of the word (“RATS”), which appeared subliminally in this 2000 Republican campaign advertisement against Democratic candidate Al Gore, intentional?

Source: Reuters/Corbis.

Perhaps the final word should go to a spokesperson for the industry that lives or dies by its ability to persuade people to buy things they may—or may not—need. Bob Garfield (1994), a columnist for *Advertising Age* magazine, summed up many people’s views on the matter: “Subliminal advertising does not exist except in the public consciousness, at least not in consumer advertising. Nobody bothers with it because it’s hard enough to impress people by hitting them upside the head with [blatant] images.”

## Chapter 1: Other Myths to Explore

### Fiction

*We need a full brain to function effectively.*

*Modern humans have larger brains than Neanderthals.*

*Areas of activation on brain scans mean that brain regions are becoming more active.*

### Fact

Some people who’ve had one brain hemisphere surgically removed in childhood due to illness can function reasonably well in adulthood.

Neanderthals’ brains were probably slightly larger than ours.

Areas of activation on brain scans sometimes mean that some brain regions are inhibiting other regions.

## **Fiction**

*“Alpha consciousness” is associated with states of relaxation.*

*Adult humans don’t grow new neurons.*

*As adults, we lose about 100,000 neurons each day.*

*Blind people have especially well-developed senses of hearing and touch.*

*Blind people can detect obstacles at a distance by sensing heat and pressure on their foreheads.*

*A coma is a state of deep sleep.*

*We can “awaken” people from comas by playing their favorite songs.*

*Biofeedback is a uniquely effective means of reducing tension.*

*Humans have an invisible “body energy” that can cause psychological problems when blocked.*

*Alcohol kills brain cells.*

*Alcohol’s primary effect is stimulating the brain.*

*Alcohol enhances sexual arousal.*

*One can always detect alcohol on the breath.*

## **Fact**

There’s no evidence that boosting the brain’s alpha waves increases relaxation; moreover, some people who aren’t relaxed, such as children with attention-deficit/hyperactivity disorder, have high levels of alpha waves.

Relatively recent research points to the growth of new neurons in parts of the adult brain, especially the hippocampus.

We do lose neurons each day, but the actual number is probably only about one tenth of that.

There’s little evidence that the blind have superior abilities in other senses, including hearing, touch, or smell.

There’s no evidence for this claim.

People in comas are not asleep.

There’s no scientific evidence that people can be brought out of comas by presenting them with their favorite songs or other familiar stimuli.

Most studies indicate that biofeedback is no more effective than relaxation for reducing anxiety.

There’s no scientific evidence for invisible energy fields in or around the human body.

Alcohol appears not to kill brain cells themselves, although it can damage neuronal “dendrites,” which are portals that bring messages into neurons.

Alcohol is primarily a depressant, and is typically a stimulant only at low doses.

Alcohol tends to inhibit sexual arousal and performance, especially at high doses.

One can’t always detect alcohol on the breath.

## Fiction

*Alcohol promotes sleep.*

*Alcohol warms the body.*

*It's easier to get drunk at high altitudes, such as while flying in an airplane.*

*Impaired judgment after drinking occurs only after obvious signs of intoxication.*

*Drinking coffee is a good way to sober up after heavy drinking.*

*A cold shower or exercise is a good way to sober up after heavy drinking.*

*Switching among different types of alcohol is more likely to lead to drunkenness than sticking to one type of alcohol.*

*One can't become an alcoholic by drinking beer only.*

*There's good evidence that people who smoke marijuana for many years end up apathetic.*

*Most people with brain injury look and act disabled.*

*Following a head injury, the best prescription is rest.*

*A head injury can't produce brain damage unless the person is knocked unconscious.*

*Prefrontal lobotomies (more popularly called "lobotomies") turn people into human "vegetables."*

## Fact

Although alcohol typically results in falling asleep more quickly, it usually suppresses deep sleep, often producing awakenings later in the night.

Although drinking alcohol in cold temperatures can make us feel warmer, it actually results in a loss of body heat and therefore cools the body.

Studies show that higher altitudes don't result in greater intoxication.

Impaired judgment can occur well before drunkenness is apparent.

Drinking coffee won't help with a hangover; it just turns us into a "wide awake drunk."

Same as above.

The total amount, not the type, of alcohol predicts the risk of intoxication.

Not true.

The evidence for "amotivational syndrome" is mixed, largely in part because heavy marijuana smokers frequently use other drugs.

Most people with brain injury appear normal and act normally aside from subtle deficits on neuropsychological tests.

Following a head injury, the best prescription is a gradual return to activity.

Brain damage that's detectable on neurological and neuropsychological tests can occur even with no loss of consciousness.

Most people who've received lobotomies are far from "vegetables," although they are typically apathetic.

## Fiction

*Humans have five senses.*

*Most color-blind people see the world in black and white.*

*Dogs see the world in black and white.*

*Reading in dim light can ruin our eyesight.*

*The human tongue's tastes can be described as a "map" of four tastes.*

*Consuming ice cream of other cold substances too quickly causes pain in our brains.*

*Magnets, like those embedded in shoe insoles, can reduce pain.*

*Eating lots of turkey can make us tired.*

## Fact

Humans have several senses in addition to sight, hearing, smell, taste, and touch, including body position, temperature, and pain.

Almost all color-blind people can see at least some colors; "monochromats," who see the world in black and white, comprise only about 0.005% of the population.

Dogs have red–green color blindness, but can perceive a number of colors, including blue and yellow.

Research offers no support for this claim.

Although some textbooks present a human "taste map," this map is grossly oversimplified, because receptors for the four tastes are spread throughout most of the tongue.

"Brain freeze" is caused by a constriction of blood vessels in the roof of the mouth, followed by an expansion of these vessels, triggering pain.

Controlled studies reveal that such magnets are useless for pain reduction.

There's no evidence that turkey is any more sleep-inducing than other foods; but because we often eat turkey on major holidays when we eat a lot and drink alcohol—both of which contribute to fatigue—we may mistakenly perceive a causal association.

## Sources and Suggested Readings

To explore these and other myths about the brain and perception, see Aamodt and Wang (2008); Bausell (2007); Beyerstein (1990); Della Sala (1999, 2007); El-Hai (2005); Herculano-Houzel (2002); Hines (2003); Juan (2006); Lilienfeld and Arkowitz (2008); Vreeman and Carroll (2007).