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November/December 2013
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SPECIAL ISSUE

THE 7 DEADLY SINS

TURN TEMPTATIONS INTO A SOURCE OF STRENGTH

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GREED
SLOTH
WRATH
LUST
PRIDE

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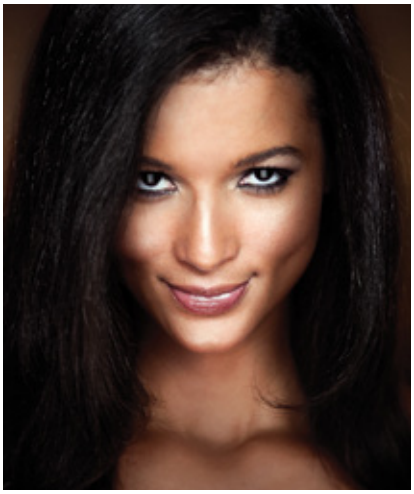

The Science of Sin

Everything good in life is illegal, immoral or fattening—or so the saying goes. A few centuries ago religious authorities sought to codify that sentiment into a handy list, which we know today as the seven deadly sins. In this special issue devoted to them, we explore how desires take shape and influence our thoughts, alongside the scientific insights that can help us meet our goals.

We often think of temptations as the ruin of diets, oaths and ambitions, yet their pull is a natural part of life. They can even be meaningful. As psychologists Jan Crusius and Thomas Mussweiler suggest in "Untangling Envy," beginning on page 34, envy may alert us that we face a disadvantage, thus motivating us to take action.

Pride, too, compels us to try harder so as to feel good about ourselves and to secure high status. In the form of arrogance, pride elevates social standing while alienating others. Yet it can also be a positive force. Psychologist Jessica L. Tracy explores the dynamics of hubris and self-esteem in "Pride and Power," starting on page 64.

Sometimes factors beyond our awareness can cause trouble. The makeup of a meal, for example, can nudge us toward gluttony. To temper the urge to overindulge, think carefully about the flavor profile of your next dinner, selecting spicy foods over bland ones because we reach satiety sooner when tastes are piquant. Turn to page 26 for "Accidental Gluttons," by contributing editor Karen Schrock Simring.

At other times our actions can baffle us, such as when we lash out at the people we love. To quell rage toward a romantic partner, psychologists Eli J. Finkel and Caitlin W. Duffy find that writing about a conflict in the third person can reduce a couple's anger and distress. Starting on page 50, they describe why flare-ups occur and how to handle them in "The Thin Line between Love and Wrath."

These fascinating topics and others lurk in the mind's so-called dark side, and exploring it can leave us both wiser and stronger. Illegality may be fairly cut and dry, but immorality is not—and therein lies the fun.

Sandra Upson
Managing Editor
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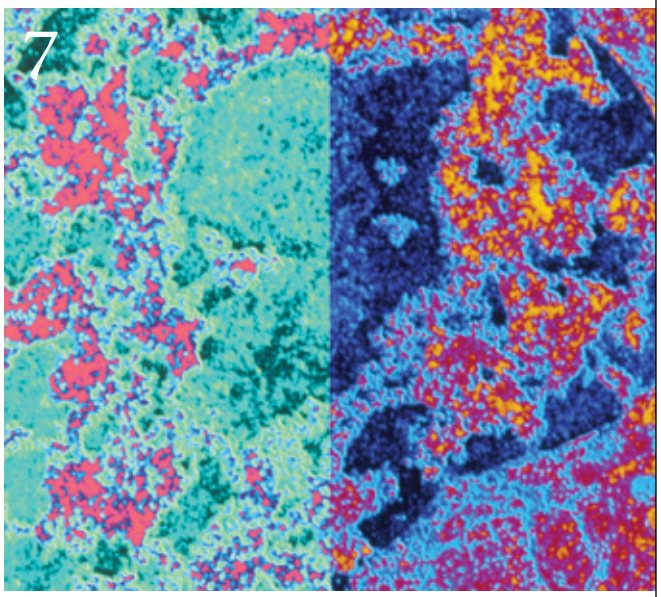
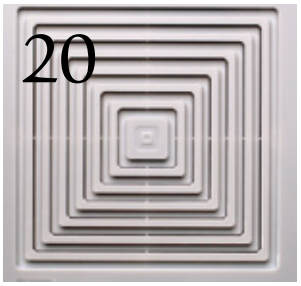
25 SPECIAL ISSUE THE SEVEN DEADLY SINS

FEATURES

DEPARTMENTS





Editors' note: Christof Koch's column Consciousness Redux will return in the next issue of *Scientific American Mind.*

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YEARNING FOR STIMULATION

The research on boredom as described by James Danckert in "Descent of the Doldrums" is interesting in a number of ways, but it also shows that there are limitations to research that concentrates on a single emotion. Instead emotions should be viewed as parts of a more general system of experience. For example, one model called reversal theory posits that boredom can only be fully understood as one of a set of four related emotions: boredom, excitement, relaxation and anxiety.

These four emotions differ on two dimensions: whether high or low arousal is desired and what level of arousal is actually being experienced. Boredom occurs when the desire is for high arousal, but it is low arousal that is actually experienced. In contrast, relaxation is the desire for low arousal when arousal actually is low; excitement is the desire for high arousal in the presence of high arousal; and anxiety is the desire for low arousal in the presence of high arousal.

Whether a given level of arousal is pleasant or unpleasant, therefore, depends on what we might call motivational state. By studying these emotions related to levels of arousal, as well as other sets of emotions and motivational states, reversal theory pursues questions such as what brings about reversals among different motivational states and how people respond to these internal changes.

Danckert reflects on the lack of definition regarding boredom; reversal theory, however, clearly defines boredom in psychological terms and how it relates to arousal and state of mind.

Mitzi Desselles
Louisiana Tech University
Ruston, La.

BORED BAGGAGE SCREENERS

In the article "To See or Not to See," Michael C. Hout and Stephen D. Goldinger suggest that baggage screeners looking for weapons may make errors because they do not expect to find any weapons. It seems more likely to me that the making of errors would be because of agitated boredom, as described in "Descent of the Doldrums," by James Danckert. The finding of a weapon would probably be very extrinsically stimulating to a baggage screener. After screening hundreds (or thousands) of pieces of baggage and not finding any weapons, agitated boredom would undoubtedly arise because of the lack of external stimulation, and mistakes would tend to occur because of the boredom. One way these two effects might be dissociated might be to monitor the occurrence of mistakes over a longer term. If the mistakes are more or less uniform over a given period, then low expectation may be at work. If the mistakes increase over time, then agitated boredom may be at work.

Richard Sieb
Edmonton, Alberta

RECOVERY FROM AUTISM?

As a child psychologist who has diagnosed and worked with many children and adults with autism for many years, I have never encountered a case where a child properly diagnosed with autism has "recovered," as Jennifer Richler describes in "Is It Possible to Recover from Autism?" [Perspectives]. Rather I have observed cases where a person, usually high functioning, has memorized responses that give the impression of social engagement when it is not present.

The problem is rooted in misdiagnosis. I have found the rate of falsely diag-

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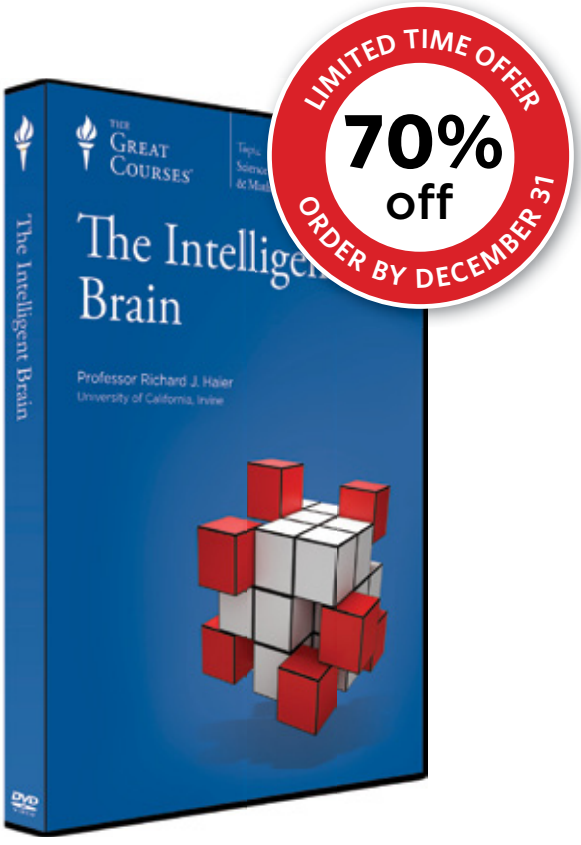

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nosed autism to be upward of 30 to 40 percent—even higher for Asperger's. In some cases, very young children are diagnosed when they respond to the pressure of testing by exhibiting behaviors that are mistakenly attributed to autism, such as hand flapping. Some of these children may be identified as having a different developmental disorder by the time they enter kindergarten, but the inaccurate label of autism remains.


perspectives

Is It Possible to Recover from Autism?

There is huge motivation for gain: children with autism receive very high levels of service. Caregivers have been taught to believe that 40 hours a week of specially designed therapies such as Discrete Trial Training, a one-on-one learning method with instructor feedback at every step, are required to help children recover from, in my opinion, a condition they never had.

Even more telling was the comment I heard made by the editor of the diagnostic guide *DSM-IV,* who expressed regrets on National Public Radio for including the category of Asperger's. He said, to paraphrase, that to get services for children who "looked odd," schools and mental health providers used the diagnosis of Asperger's. Yet that condition, according to this editor, has a "diminishingly small frequency of occurrence."

David Herman
Elkins Park, Pa.

RICHLER REPLIES: *Misdiagnosis is indeed a problem in some purported cases of autism. In both studies I described in the article, however, the diagnosticians were highly trained and experienced. The researchers in the retrospective study used a rigorous review process to minimize the chance of initial misdiagnosis.*

The other study was longitudinal; the same experts who did the initial diagnosis were the ones who followed the participants over time. In both studies, the experienced diagnosticians should have been able to recognize subtle signs of autism, even in someone who had "memorized responses that give the impression of social engagement when it is not present."

Your autism article was fascinating reading. When my son was diagnosed 15 years ago at age three, we were told categorically by the doctor that autism is a lifelong, untreatable condition. Fortunately, we chose not to accept that, and now he is very largely recovered, although with a few remaining issues connected to socialization.

Alongside behavioral training in his early years, we believe that his gluten- and dairy-free diet has a lot to do with his recovery, a possibility not mentioned in your article. We often wonder why trying the diet for six months is not recommended to all parents as a possible if not guaranteed route to recovery. Perhaps it has to do with experts' reluctance to admit that at least some of what discredited physician Andrew Wakefield has said about autism being linked to gut function is right after all!

Paul Hemphill
Newcastle upon Tyne, England

RICHLER REPLIES: *Although there are anecdotal reports of improvement in the symptoms of autism spectrum disorder following the introduction of a gluten-free, casein-free diet, to my knowledge there is no high-quality research (that is, double-blind, randomized controlled trials) that supports these claims. I would imagine most responsible doctors and other professionals are reluctant to recommend any kind of special diet in the absence of such evidence.*

NEURONS CONTROL BLOOD FLOW

Justin Rhodes asserts in the column Ask the Brains that "part of the reason exercise enhances cognition has to do with blood flow.... More blood means more energy and oxygen, which makes our brain perform better." This phrasing implies that the brain performs suboptimally until the heart pumps more vigorously, akin to a car engine awaiting the flooring of the accelerator pedal to deliver more gas.

A different article in the same issue, "A Magic Touch for Stroke Prevention?" by Stephani Sutherland, provides the better conceptualization: "the brain's vasculature might be at the beck and call of the very neurons it serves." I would add that, in fact, the beautiful pictures from functional MRI scans are possible because neurons actively regulate essentially all brain blood flow.

Thus, neurons are not passively awaiting the surge of oxygenated blood associated with the "blood flow increase everywhere in the body" from exercise. Rather neurons activate the muscles engaging in exercise and regulate both systemic circulation and brain microcirculation to ensure that the metabolic needs of their own increased activity are met.

Michael J. Soso
Pittsburgh

ERRATA

Because of an editing error, in Robert Epstein's review of Gary Greenberg's *The Book of Woe* [Reviews and Recommendations, September/October 2013], the publisher of the *Diagnostic and Statistical Manual* is incorrectly printed as the American Psychological Association. The publisher of the *DSM* is the American Psychiatric Association. Also, the review of Melody Moezzi's *Haldol and Hyacinths* in the same issue misstated the author's homeland: it is Iran. We regret the errors.

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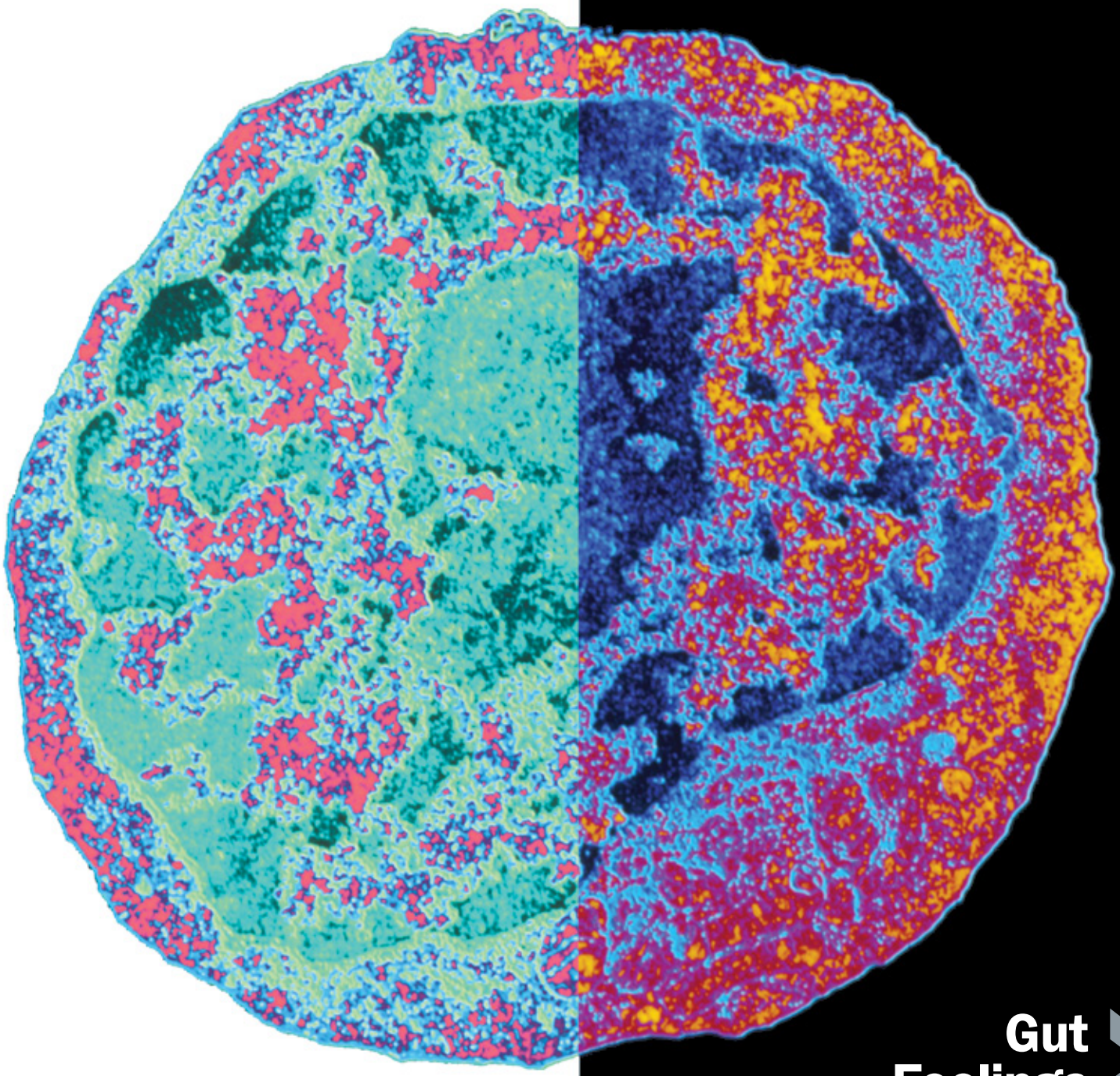
Head Lines

LIFE LESSONS FROM THE LABS



Gut Feelings

NEWS FROM OUR WEB SITE When a wolf leaves its pack, its closest lupine pals are the ones most likely to howl.

From Bowel to Brain Microbes affect our mind

Gut Bacteria May Exacerbate Depression

Microbes that escape the digestive tract may alter mood

The digestive tract and the brain are crucially linked, according to mounting evidence showing that diet and gut bacteria are able to influence our behavior, thoughts and mood. Now researchers have found evidence of bacterial translocation, or "leaky gut," among people with depression.

Normally the digestive system is surrounded by an impermeable wall of cells. Certain behaviors and medical conditions can compromise this wall, allowing toxic substances and bacteria to enter the bloodstream (*see list at right*). In a study published in the May issue of *Acta Psychiatrica Scandinavica*, approximately 35 percent of depressed participants showed signs of leaky gut, based on blood tests.

100 TRILLION
Approximate number of microbes present in the gut

The scientists do not yet know how leaky gut relates to depression, although earlier work offers some hints. Displaced bacteria can activate autoimmune responses and inflammation, which are known to be associated with the onset of depression, lower mood and fatigue. "Leaky gut may maintain increased inflammation in depressed patients," which could exacerbate the symptoms of depression if not treated, says Michael Maes, a research psychiatrist with affiliations in Australia and Thailand and an author of the paper. Currently leaky gut is treated with a combination of glutamine, *N*-acetylcysteine and zinc—believed to have anti-inflammatory or antioxidant properties—when behavioral and dietary modifications fail.

—Tori Rodriguez

CAUSES OF **LEAKY GUT**

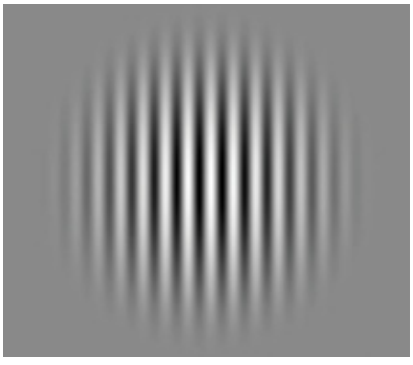
- Regular use of painkillers
- Regular use of antibiotics
- Infections (such as HIV)
- Autoimmune disorders
- Alcohol abuse
- Inflammatory bowel disease
- Gluten hypersensitivity
- Severe food allergies
- Radiation therapy
- Inflammatory disorders
- Psychological stress
- Exhaustion

A Visual Intelligence Test

High IQ may reflect the ability to both think fast and ignore distractions

For more than a century researchers have been trying and failing to link perception and intelligence—for instance, do intelligent people see more detail in a scene? Now scientists at the University of Rochester and at Vanderbilt University have demonstrated that high IQ may be best predicted by combining what we perceive and what we cannot.

In two studies in the journal *Current Biology*, researchers asked 67 people to take IQ tests. They then viewed millisecond-long video clips in which black-and-white stripes (*right*) moved left or right. The split-second films challenged viewers: the stripes moved within a circular frame that could differ in size, varying from the width of a thumb to a fist held at arm's length. After each clip, the viewers guessed whether the bars moved toward the left or right.



IQ predicts the ability to detect which way these lines move in split-second videos.

ALFRED PASIEKA *Science Source (preceding page and this page);* COURTESY OF DUJE TADIN *University of Rochester (intelligence test)*

The investigators discovered that performance on this test was more correlated with IQ than any other sensory-intelligence link ever explored—but the high-IQ participants were not simply scoring better overall. Individuals with high IQ indeed detected movement accurately within the smallest frame—a finding that suggests, perhaps unsurprisingly, that the ability to rapidly process information contributes to intelligence. More intriguing was the fact that subjects who had higher IQ struggled more than other subjects to detect motion in the largest frame.

The authors suggest that the brain may perceive large objects as background and subsequently may try to ignore their movements. "Suppressing information is a really important thing that the brain does," explains University of Rochester neuroscientist Duje Tadin. He explains that the findings underscore how intelligence requires that we think fast but focus selectively, ignoring distractions.

—Daisy Yuhas

M Biologists have grown mini brains, akin to that of a nine-week-old fetus, out of stem cells derived from skin. | A computer

Ulcer Bacteria Linked to Cognitive Decline

One type of harmful bacteria escaping the gut might be *Helicobacter pylori,* the main cause of stomach ulcers. *H. pylori* may contribute to cognitive impairment or Alzheimer's disease, according to a study published in the June issue of *Psychosomatic Medicine*. Compared with uninfected individuals, people who tested positive for *H. pylori* performed worse on cognitive tests, including ones assessing verbal memory. Some laboratory evidence indicates that *H. pylori* cells can escape the gut and sneak into the brain. There the cells aggregate with the amyloid proteins characteristic of Alzheimer's and instigate the buildup of plaque, suggests study co-author May Baydoun, a staff scientist at the National Institute on Aging. The National Institutes of Health estimates that about 20 percent of people younger than 40 and half of adults older than 60 are infected with the bacteria, which can be treated with antibiotics. —*T.R.*

SCIENCE SOURCE (*1, 2, 4*); DENNIS KUNKEL *Corbis* (*3*)

Bugs That Influence the Brain

Preliminary research suggests that these common gut microbes can also affect our thoughts and feelings.

❶ ***Helicobacter pylori:*** Children infected with this ulcer-causing bacterium performed worse on IQ tests, suggesting a possible link between *H. pylori* infection and cognitive development.

❷ ***Lactobacillus helveticus* and *Bifidobacterium longum:*** Healthy human volunteers who consumed a probiotic mix of these bacteria exhibited less anxiety and depression.

❸ **Probiotic bacteria *B. animalis* subsp. *lactis, Streptococcus thermophilus, L. delbrueckii* subsp. *bulgaricus, L. lactis* subsp. *lactis:*** Healthy women who consumed yogurt containing these bugs showed less activity in brain regions that process emotions and physical sensations. Researchers do not yet know whether these effects were beneficial; they also have not discovered the mechanism underlying the observed shift in brain activity.

❹ ***Lactobacilli:*** Healthy students had fewer of these bacteria present in their stool during a high-stress exam time compared with a less stressful period during the semester. The findings suggest a potential link between stress and gut microbes, but the exact relation remains unknown.

Soccer Players Show Signs of Brain Damage

Frequently hitting the ball with the head may impair memory

Football has become notorious for the degeneration it causes in players' brains. Now a preliminary study of soccer players has found that frequently hitting the ball with the head may adversely affect brain structure and cognition.

The study imaged the brains of 37 amateur soccer players, 21 to 44 years old, and found that players who reported "heading the ball" more frequently had microstructural changes in the white matter of their brains similar to those observed in patients with traumatic brain injury. These players also performed poorly on cognitive tests, compared with players who reported heading the ball less. The study, published online in June in *Radiology*, found evidence of a threshold—1,800 headings—above which the effects on memory begin to manifest. Neuroradiologist Michael Lipton of the Albert Einstein College of Medicine of Yeshiva University, who led the study, says the findings may indicate that heading causes mild concussions, even when players do not show symptoms.

The results are noteworthy but far from conclusive, comments Jonathan French, a neuropsychologist in the Sports Medicine Concussion Program at the University of Pittsburgh Medical Center, who was not involved in the study. "The majority of soccer players who are concussed don't have any functional problems in everyday life," he says. The structural changes detected in the study, he points out, are "so microscopic that we don't know what they actually mean" for long-term function.

Lipton agrees more work is needed to determine the significance of the brain changes, but he hopes to call attention to the potential risk because soccer is the most popular sport in the world. —*Ajai Raj*

ADAM PRETTY *Getty Images*

scientist's interest in stylometry, the study of writing style, helped to unveil J. K. Rowling as the true author of a recent crime novel.

A GUIDE TO MASTERING YOUR WORLD

How to Be a Better cook

I've never enjoyed cooking. All the chopping, stirring and waiting—not to mention handling raw meat (the former vegetarian in me can't help but shudder). Somehow I still pull together meals for my family that they seem to enjoy. But when I think about teaching my daughter to cook or about ways to help my husband become more comfortable in the kitchen, I'm at a loss. How do you translate habit and instinct into step-by-step pointers anyone can follow? I asked the experts what makes for success in the kitchen, and here's what they had to say.

#1 Boost your focus. Complex dishes can involve long lists of ingredients and instructions, and even simple ones can get mind-numbingly repetitive—measure, pour, stir, repeat. A skill that will help you deal with both issues is simple concentration. "To me, focus and tenacity are key to being a good cook," says Jason McClure, chef of Sazerac, a restaurant in Seattle. "You can get an initial thrill from cooking a new dish, and it's always perfect and gorgeous that first time"—but boredom and distraction can lead to charred meat and soggy pasta. One well-known way to increase your natural ability to concentrate? Meditation. A 2010 paper in *Psychological Science* found that people who went to an intensive three-month meditation retreat for a week were better able to maintain their concentration during a boring test than a control group; in another study, college kids who meditated for 20 minutes a day saw a difference in cognitive abilities after just four days.

#2 Make like a cooking show and *mise en place*. There's a reason Rachael Ray and Ina Garten look so relaxed while they are cooking on TV—everything has been measured and laid out for them beforehand. "Preparing all of your ingredients in advance so everything is all set up and ready to go, called *mise en place*, is really important," says Jackie Newgent, a New York City nutritionist and author of *1,000 Low-Calorie Recipes* (Houghton Mifflin Harcourt, 2012). This way your garlic will not burn in the pan while you are trying to rinse and slice the chicken. Measuring and chopping everything beforehand also leaves you free to be mindful of more subtle cooking cues such as whether things are cooking faster than expected. "A recipe will say something like 'cook until browned, about 10 minutes,' but some people will cook it for 10 minutes regardless of whether it browned more quickly," Newgent says. "You have to be able to adapt as things go, paying attention to visual or texture cues."

#3 Cook more. If you can force yourself to start cooking at least three times a week, your skills in the kitchen will blossom fast, says Adam Roberts, author of *Secrets of the Best Chefs* (Artisan, 2012), who painstakingly taught himself to cook during law school and eventually made a career of his love affair with the kitchen. The best chefs in the world are what they are because, he points out, they spend most of their time cooking. Cognitive scientists would call this skill refinement—the improvement in performance of a cognitive or motor skill with practice. But Roberts explains it in simpler terms of shaping a new habit: "Cooking is a lot like anything in that the more you make a routine out of it, the easier it becomes. If you cook three nights a week and you get into the rhythm of that, it won't seem like such a big deal when you come home from work tired and you don't feel like making dinner."

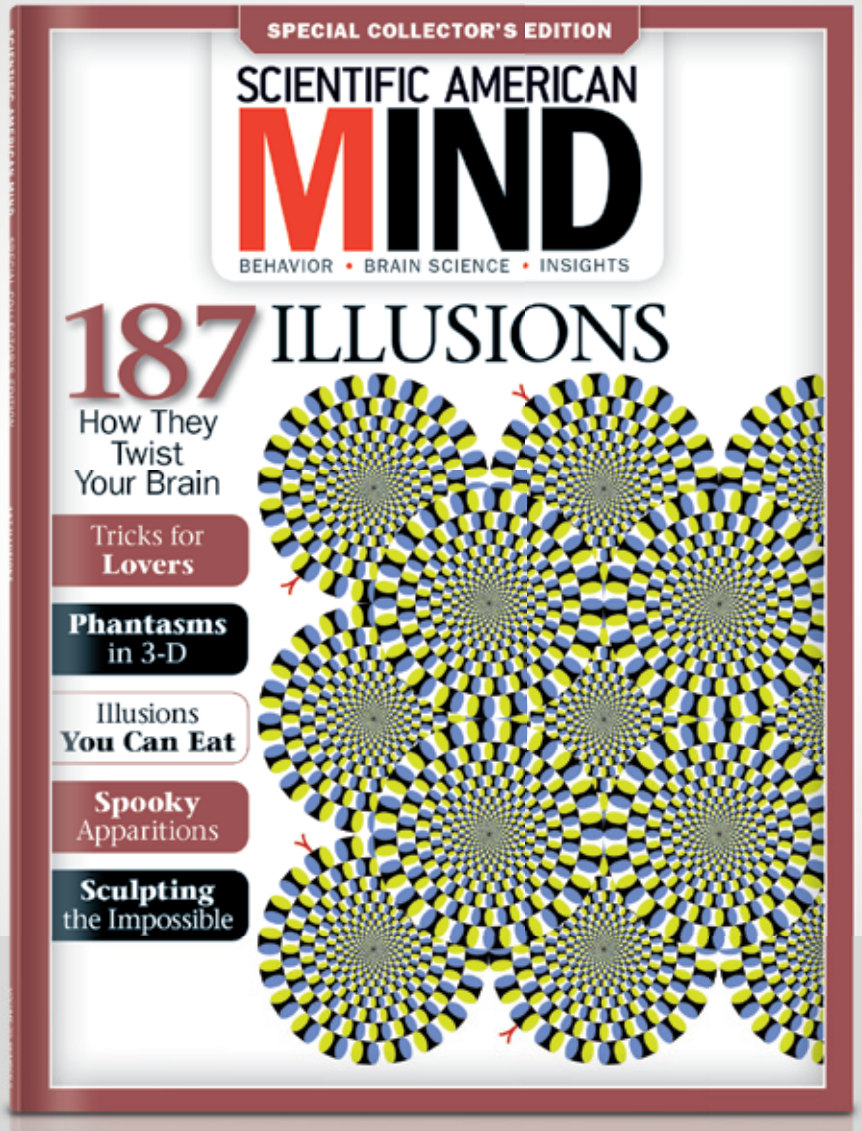
#4 When all else fails, add butter and onions. This admittedly lazy tip comes straight from my amateur kitchen. I can't tell you how many times my husband has marveled at the flavor of some omelet, veggie hash or even reheated pasta that I "magically" (as it seems to him) made appear on the dining room table during the time it took him to drive our daughter home from preschool. This usually happens when I took the time to add some onions that have been sautéed in full-fat, salted butter. A little pat of butter is only 25 calories, but the flavor it adds is enormous. As for onions ... well, as Julia Child herself wrote, "It's hard to imagine a civilization without onions."

—*Sunny Sea Gold*

PAUL PANTAZESCU *iStockphoto (world icon)*; STUART BRADFORD *(kitchen collage)*

M Obsessive-compulsive disorder may have shaped many great figures in American history, who in turn shaped the country.

187 ways to trick your brain



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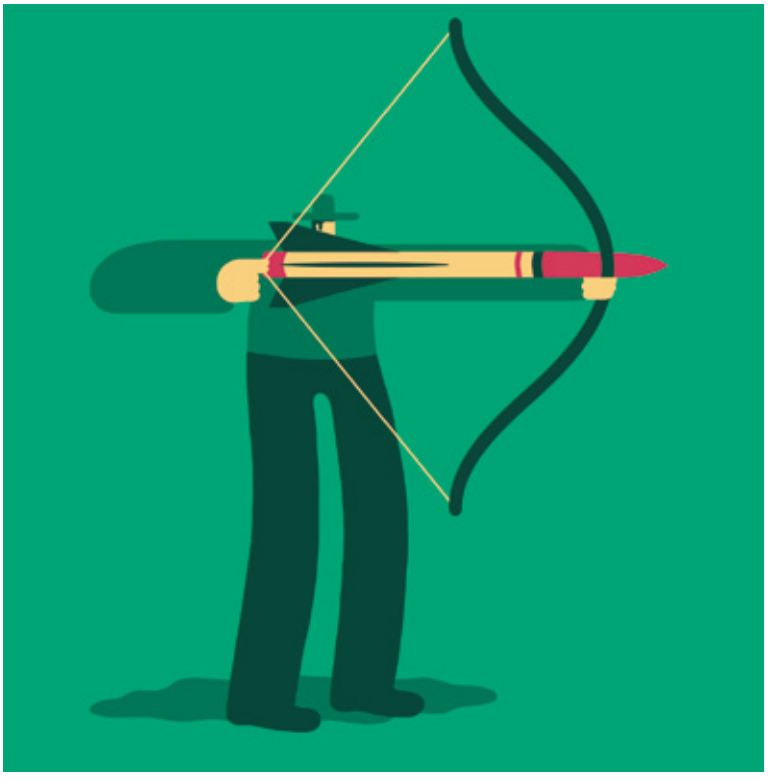
The Act Defines the Victim

Harm done, especially if the act was intentional, changes our perception of the injured party



When a bad deed makes headlines, the first thing we want to know is whether the perpetrator did it "on purpose." Intention matters in our moral judgments, as we intuitively realize and many studies confirm. Now studies suggest that this focus on the cause of an event can distort our understanding of the damage done—and knowing harm has been inflicted can even change the way we view the victims, ascribing them pain and consciousness when none might exist.

In a study published in July in *Psychological Science,* Princeton University psychologists Daniel Ames and Susan Fiske asked 80 study participants to read a vignette about a company CEO who had either accidentally or intentionally made a poor investment that resulted in lower pay for his employees. Those who thought the CEO had intentionally made the mistake estimated the harm done to his employees on a scale of 0 to 100 to be 39 percent larger than those who thought it was accidental.

In a follow-up experiment, 55 subjects read about a man who had either accidentally or intentionally diverted the flow of a river, causing a water shortage. Participants were then briefly shown an itemized list of the damages and were asked to estimate the total. Those who believed the diversion to be accidental estimated the damages accurately (on average, $2,753, as compared with the true total of $2,862), whereas those who thought the diversion had been done on purpose vastly overestimated the damages at $5,120. This psychological bias could have political implications: if governments systematically overestimate the damages done by intentional harms like terrorism, they might "leave fewer resources to combat other kinds of harms," such as global warming, Ames says.

A different group of researchers at Harvard University and the University of Pennsylvania explored how intentional and unintentional acts affect our perception of those injured. In their study, published in June in *Psychological Science,* subjects read stories about a hospital nurse who unplugged the food supply of a patient in a persistent vegetative state named Ann in order to make money. Others read a similar story about a nurse who took good care of Ann. When subsequently asked about Ann's mental capacities, the subjects who had read about her as a victim said she was much more able to feel pain and was more consciously aware than did subjects who read the other story. When participants read a similar pair of stories in which the nurse had either intentionally or unintentionally cut off Ann's food supply, those who thought the act was intentional ascribed more mental faculties to Ann than did the others. In another series of experiments, Ann was described not as a human patient in a persistent vegetative state but as either a robot or a corpse. Again, subjects thought the entities were more mentally aware if they were victimized.

The findings have implications for our understanding of complex moral issues such as abortion. People may consider fetuses to be mentally aware because they think abortion is immoral—not the other way around. "People often have knee-jerk moral intuitions and only come up with explanations for these intuitions after the fact," says co-author Adrian Ward, a psychologist now at the University of Colorado at Boulder. "Many times apparent causal reasoning is simply post hoc justification." —*Melinda Wenner Moyer*

MÁGOZ

M Different brainwide networks of neurons give rise to distinct stages of the creative process. | When a peacock

MÁGOZ (*money exchange*); ISTOCKPHOTO (*smiling robber*); JAMIE CARROLL *iStockphoto* (*brain*)

Dirty Money Appeals More to the Righteous

Feeling high and mighty gives us license to accept dubious dough

It may be satisfying to think back on good deeds. But beware: studies suggest these rosy recollections can prime us for future behaviors that are actually less ethical. When reassured of our rock-solid morality, it seems, we give ourselves more leeway in ethically slippery situations—a phenomenon dubbed "moral licensing." In a recent example, California researchers found that individuals who had just written about a past good deed—such as helping a troubled friend or doing charitable work—worked harder for dough from an ethically iffy source.

Authors of the study, published online in April in *Social Psychological and Personality Science,* asked 140 adults to categorize words in exchange for modest cash rewards, allegedly provided by a store with unethical labor practices. Individuals were not particularly persistent in pursuing raffle prizes from that store, judged by the number of word puzzles they completed to earn raffle entries. The subjects even devalued the purchasing power of the morally tainted currency by underestimating the amount of groceries they could buy with it.

Such concerns went out the window for those reminded of their moral wherewithal: individuals who had recalled a virtuous act completed roughly 40 percent more tasks to earn the supposedly corrupt cash than their less morally reassured counterparts.

— Andrea Anderson

Happy People Steal More

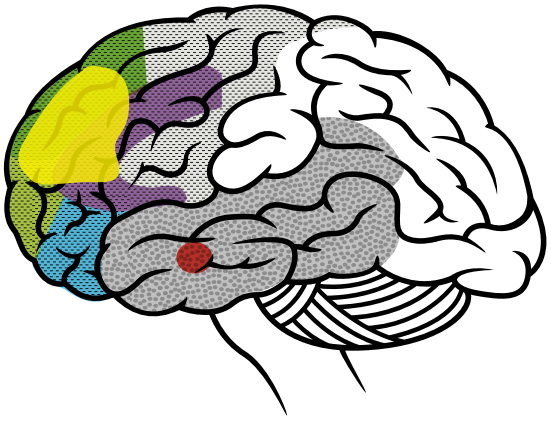
Who stole the office stapler? A study in April's *Psychological Science* argues it's more likely to have been your happiest colleague than your grumpiest. Observing that happier people are more mentally flexible, psychologists at Cornell University wondered whether they might be more morally flexible as well. To find out, the team showed 90 undergraduates either a cheerful video of a cartoon duck showering or a neutral screensaver. In addition, half of each group sat in front of mirrors to promote self-awareness. Finally, participants worked on 20 puzzles, earning 50 cents for each correct solution, with a sneaky bonus: because they scored themselves, they could get away with taking more than they'd earned. The happier, less self-aware group—those who'd watched the cartoon without a mirror—stole $1.17 on average, more than twice what any other group took. Further analysis suggested that these participants were also less morally engaged, which may explain their thievery. *—Nathan Collins*

Of Trolleys and Trade-offs

A trolley is hurtling down a track, and if nobody intervenes it will hit and kill five people. Psychologists use variations on this hypothetical situation to gauge people's gut reactions about morality. Here are three scenarios:

1. The driver could switch the train to another track, on which one man stands. Should the driver reroute the trolley?
2. Now suppose the trolley is driverless and you are a bystander. Should you hit a switch to divert the trolley so it hits the lone man?
3. You are standing above the tracks on a bridge. You could stop the trolley and save the five people by pushing a large man to his death in front of the trolley. Would you push him?

Most people say that the driver should reroute the train and that they would reroute the train with the switch but that they would not push the man to his death. This typical decision is associated with increased activity in the medial prefrontal cortex (*green*), which indicates a strong negative emotional reaction, as well as activity in the amygdala (*red*), which is involved in processing emotions and stressful events.



Some people do decide to push the man. This decision is associated with the following:

- **Increased activity in the dorsolateral prefrontal cortex** (*yellow*), a center for cognitive control and reasoning.
- **Frontotemporal dementia**. Patients with such damage to the frontal lobe (*gray dashes*) and temporal lobe (*gray dots*) show blunted emotions.
- **Ventromedial prefrontal lesions**. People with this condition have less activity in the ventromedial prefrontal cortex (*blue*) and respond less emotionally overall.
- **High-functioning autism or Asperger's syndrome.** Patients with these conditions often have impairments in emotional processing and social awareness.
- **Positive emotion induction**. Healthy individuals shown a funny movie clip first are more likely to say they would push the man.
- **Prejudice**. College-age study participants were more likely to say "yes" to pushing the man if he was described as an outsider (for instance, homeless, disabled, drug addicted or elderly) and if the five people to be saved were part of an in-crowd (American and young).

Can't decide? People who feel deeply divided on a moral issue show increased activity in the anterior cingulate cortex (*purple*), which is associated with internal conflict.

—Victoria Stern

unfurls his tail, peahens look longest at the male's legs and the base of his tail, hardly glancing at the majestic fan of feathers.

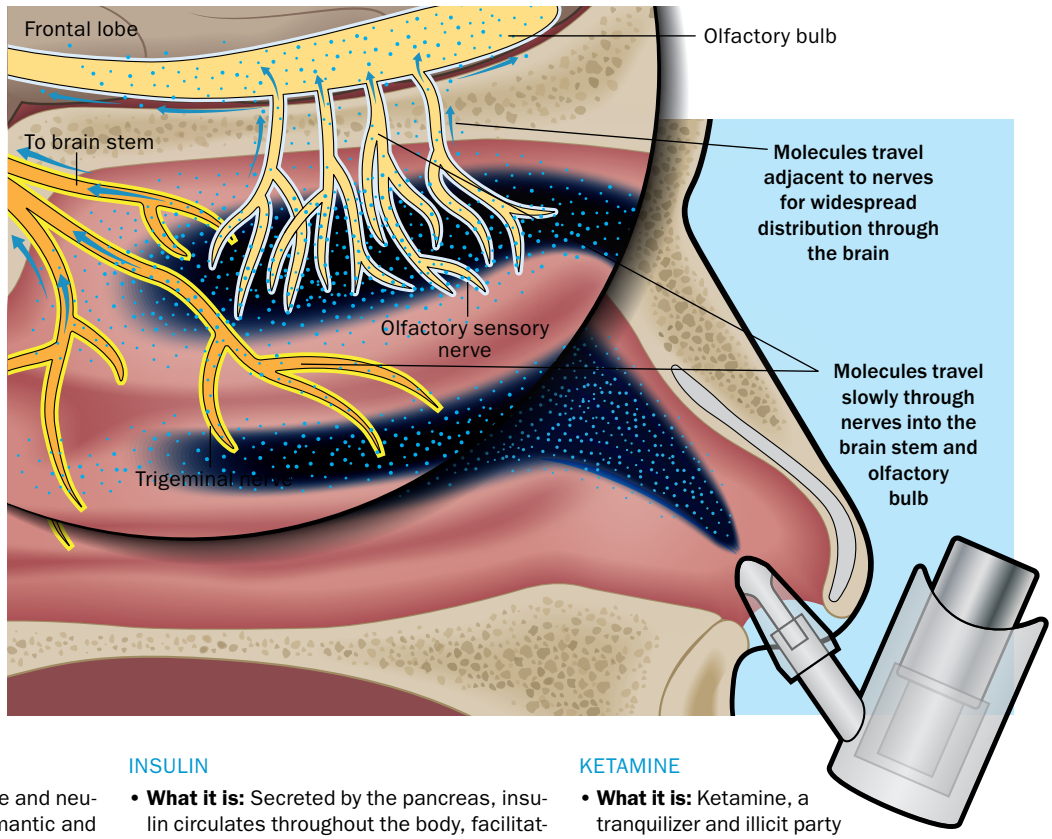
(PHARMA WATCH)

A SNIFF OF THERAPY

Nasal sprays may open the door for new medications

Snorting chemicals has a bad rap. But as a method of drug delivery, it may be on the verge of a renaissance. Unlike medications taken orally, intravenously or otherwise, those sniffed up the nose gain direct access to the brain. Recent findings that intranasal administration is indeed safe and effective—and a revamped delivery system more elegant than a rolled-up twenty—have inspired a new appreciation of the sniff. Below we list a few of the drugs that researchers are experimenting with, including molecules of new shapes and sizes as well as novel uses of medications developed decades ago. —*Caitlin Shure*

The secret to the nose's potential lies in the nerve fibers embedded in its tissue. The nasal cavity houses the endings of nerves that connect to the brain stem and olfactory bulb. Chemicals traveling through or alongside these fibers can bypass the intimidating blood brain barrier. Consisting of tight cellular junctions, this barrier prevents most molecules in the bloodstream from reaching the brain. The barrier keeps pathogens out; however, it also limits the types of medications used to treat brain disorders. Intranasal delivery thus opens the door to entire new classes of therapeutic molecules—or even therapeutic cells.



OXYTOCIN

- **What it is:** Oxytocin is a hormone and neuromodulator associated with romantic and familial bonding and trust.
- **Intranasal effects:** Early research suggests oxytocin therapy may reduce social deficits in individuals with autism spectrum disorder, social phobia and schizophrenia. For instance, in a study of 13 individuals with autism, intranasal oxytocin treatment was associated with increased sociability during a game of catch. Animal studies indicate that intranasal oxytocin may also ease symptoms of alcohol withdrawal in moderately dependent users and reduce food intake and enhance metabolism in the context of obesity.
- **Status:** Efficacy studies have yielded inconsistent results. Researchers are currently investigating whether the genotypes of patients can explain the variability in how they respond to treatment.

INSULIN

- **What it is:** Secreted by the pancreas, insulin circulates throughout the body, facilitating the absorption of glucose (cellular energy) from the blood. Like cells in other parts of the body, neurons use the glucose that insulin provides as fuel.
- **Intranasal effects:** Researchers are aggressively pursuing this medication to manage Alzheimer's disease and mild cognitive impairment. In a study of 33 patients with Alzheimer's, intranasal insulin therapy led to improvements of verbal memory. Theoretically, insulin could also treat a number of neurological and psychiatric disorders, such as schizophrenia, bipolar disorder and post-traumatic stress disorder.
- **Status:** The first large-scale multicenter studies will commence this year. Pending results from these trials, intranasal insulin could be available to Alzheimer's patients as early as 2017.

KETAMINE

- **What it is:** Ketamine, a tranquilizer and illicit party drug, interacts with the brain's glutamate pathway, which mediates learning, memory and mood [see "A Trip Out of Depression," by Simone Grimm and Milan Scheidegger; SCIENTIFIC AMERICAN MIND, May/June 2013].
- **Intranasal effects:** Research on intravenous ketamine suggests the drug may offer hope for patients not responding to conventional antidepressants. In a study of 26 individuals with treatment-resistant depression, a single dose of ketamine appeared to significantly reduce suicidal thoughts. Investigators are hopeful that intranasal delivery will provide equal—if not better—outcomes.
- **Status:** Johnson & Johnson is currently testing the safety and efficacy of intranasal esketamine, a lab-created chemical twin, and hopes to bring the drug to market by 2017.

JIM KOPP (*illustration*); ISTOCKPHOTO (*pills icon*)

M People sleep more poorly during a full moon—even when slumbering in a windowless room. | Are whistle-blowers ethical? In

Stem Cells

Many diseases of the central nervous system involve the death of neurons—so, theoretically, the replacement of dead cells should improve symptoms of degenerative disorders such as Parkinson's, Huntington's, amyotrophic lateral sclerosis (ALS) and Alzheimer's, as well as stroke and brain tumors. Stem cell therapy may do just that even though evidence of its effectiveness is mixed.

In any cell transplant procedure, the host organ—in this case, the brain—may reject its new additions. Further, it is unclear whether grafted cells can truly integrate into complex neural circuitry. Finally, current procedures require invasive surgical implantation, which can be expensive and risky. The surgery can cause neural inflammation, and the implanted cells may quickly die.

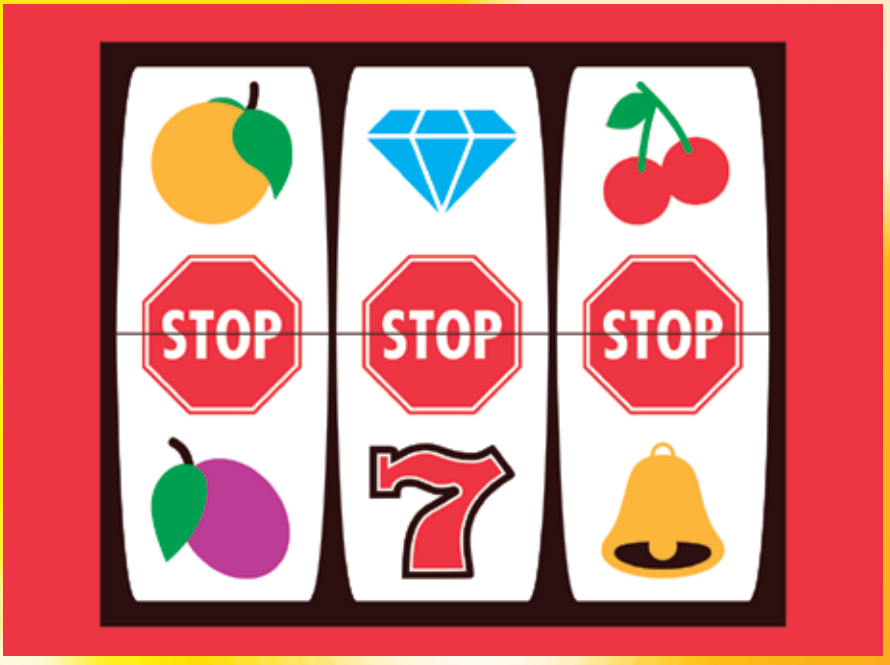
Intranasal administration may address at least some of these issues. Most important, it eliminates the need for surgery. Further, some research suggests that stem cells delivered intranasally are "smart"—they do not spread through the brain indiscriminately but instead target damaged cells.

Although it is difficult to predict when medical practice will adopt stem cell therapy for the brain, animal studies have produced some promising results. In a rat model of Parkinson's, for example, treatment with intranasal stem cells appeared to improve motor function and slow the neurological deterioration associated with the disease.

—*C.S.*

MÁGOZ (*slot machine*); SCOTT DUNLAP *iStockphoto* (*sun icon*)

ON THE HORIZON



GAMBLING MACHINES THAT *PREVENT* ADDICTION

Forget the simple nickel slots of yesteryear. Today's digital slot machines and poker screens in casinos and at online gambling sites are capable of amassing a wealth of behavioral data on individual players, and they are on the verge of altering game play on the fly. As the software becomes increasingly capable of "thinking" like the gamblers themselves, experts in the gambling research community are working to create machines that will identify and assist problem gamblers, rather than simply pushing players deeper into a financial hole.

Researchers at the University of Brescia and other institutions in Italy found that online gamblers who closed their accounts because of money troubles showed the widest variance in the size of their bets over time. Plotted on a graph, their wagers alternate between slowly increasing and suddenly dropping to almost zero, creating a "sawtooth" pattern. The pattern predicts unsustainable gambling, according to a paper published online in February in *International Gambling Studies*. Before the advent of digital gambling, information on such risk factors was difficult to obtain.

Using such discoveries as the sawtooth betting pattern, researchers are partnering with casinos and online gaming sites to prevent people from losing too much or developing an addiction. For example, Howard Shaffer, a psychiatrist at Harvard Medical School and director of the division on addiction at the Cambridge Health Alliance, and his co-workers have been conducting research with an online gambling site called bwin.party Digital Entertainment. Using the site's data on betting frequency and patterns of play for more than 40,000 registered players, Shaffer and his colleagues are fashioning algorithms that can intervene when people show a risk of becoming problem gamblers. "The machine, for example, will provide messages to the player or slow down or shut down entirely" when it detects an unsustainable pattern, Shaffer says.

But why would a gambling operation want to interrupt their revenue stream by discouraging problem gamblers? For one, problem gamblers make up a very small and stable portion of the gambling public. Less than 1 percent of the entire population is addicted to gambling—a rate that has held steady for 40 years—even though surveys of American adults show that 72 percent have gambled at least once in the prior year. In addition, catering to self-aware gamblers interested in limiting their losses could be a growth industry, writes Nicola Adami on behalf of the Italian research group. Shaffer agrees, adding that gambling providers could burnish their reputations by protecting customers from abusive play.

Ultimately, Shaffer believes, "the very machine that people are blaming will end up being a preventive device."

—*Dirk Hanson*

one study, baseball fans viewed a player-turned-whistle-blower as more ethical if he was on a rival team—but not the home team.

Harness the Power of Language

Use words wisely to meet your goals

Hidden Metaphors Get under Our Skin

Our surroundings can trigger figurative thinking and influence behavior

Look around. Do you see four walls or an expansive vista? The answer could influence your ability to think creatively. A growing body of research suggests that our sensory experiences can trigger metaphorical thinking, influencing our insights and behavior without us even realizing it. New research reveals ways we might be able to harness these subconscious forces.

Consider, for example, the metaphorical idea that the heart is warm and emotional and the head is cool and rational. In a study in August in the *Journal of Personality and Social Psychology*, researchers led their subjects to believe they were investigating how people answer questions when using their nondominant hand. To ensure they did not use their dominant hand, the participants were instructed to place their dominant index finger either on their temple or on the left side of their chest. Participants who pointed at their head answered test questions more accurately, and those who pointed at their heart were more likely to let emotions sway their decisions in a moral dilemma. The finding adds to a rapidly growing list of metaphor effects: past studies have found that seeing forward motion can propel us to "move forward" in a metaphorical sense and that feeling smooth textures makes a difficult social interaction feel easier (or go more "smoothly").

In all these studies, the influence of the embodied metaphors evaded conscious awareness—the study subjects did not notice the connection between their sensations and their subsequent decisions or feelings. Yet researchers think we might be able to wield this effect by altering our surroundings and habits, such as choosing office art that evokes forward motion. "If you're actively touching an object with the expectation that it will change your view of a situation, it might not work right away," explains Joshua Ackerman, a psychologist at the Massachusetts Institute of Technology and a co-author of the smoothness study. "But if you make such behavior a habit, you will gradually stop thinking about the connection, and it will then have a stronger effect."

In a similar vein, freeing yourself from perceived constraints may indeed facilitate "thinking outside the box." In a series of experiments published in May 2012 in *Psychological Science*, scientists tested participants' creative thinking while they literally sat inside or outside a cardboard box. Other participants either walked freely or along the path of a rectangle. Subjects who were outside the box in either sense scored higher on standard measures of creative thinking. Study co-author Angela Leung, associate professor of psychology at Singapore Management University, says you might be able to encourage your own creativity by eliminating constraints to movement, such as by roving around a room or wandering through a park. The key is variety and spontaneity: "If you want to be more creative, run freely outside and do it randomly for the day. Get away from your typical route, time of day, music or even your pace," Leung says.

In any situation, consider your surroundings, sensory perceptions and actions—they might be influencing your thought process via the subtle metaphors embedded in daily life.

—Tori Rodriguez

LIFE-OR-DEATH LANGUAGE

When physicians rephrased "**do not resuscitate**" as "**allow natural death**," family members opted for the latter

27.5%

more often.

CLAYTON HANSEN Getty Images

M Even a simple ritual before an activity heightens our enjoyment of the subsequent experience. | Dolphins have

Figurative Speech Sways Decisions

Choose the right phrasing to convince people to take action

When pondering a decision or trying to convince others, think carefully about your metaphors. The implicit information may subtly influence decision making.

A study published in January in *PLOS ONE* examined how reading different metaphors—"crime is a virus" and "crime is a beast"—affected participants' reasoning when choosing solutions to a city's crime problem. Those who read the beast metaphor were more likely to opt for a direct approach emphasizing enforcement, whereas the virus metaphor elicited a preference for a systemic, reform-focused solution. A follow-up survey indicated that many participants did not remember the metaphor they read, and none thought a metaphor could have influenced their reasoning.

"People don't consciously ponder the ways in which crime is like a virus or beast," says one of the study's authors, Paul Thibodeau, who is now a psychology professor at Oberlin College. "Instead metaphors subtly structure the way they understand the issue being described."

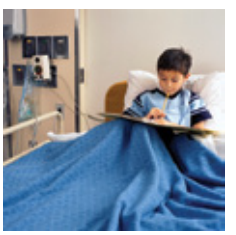
Previous brain-imaging research has shown that interpreting metaphors requires a variety of areas on both sides of the brain, compared with literal language, which is processed in known language areas in the left hemisphere.

Scientists do not yet know how exactly this pattern affects reasoning, but they suspect that the brain triggers related concepts when processing a metaphor's meaning. Thibodeau recommends giving more thought to the metaphors you use and hear, especially when the stakes are high. "Ask in what ways does this metaphor seem apt and in what ways does this metaphor mislead," he says. Our decisions may become sounder as a result. ***—T.R.***

Gestures can generate creativity: people who enacted the metaphor "on the one hand; on the other hand" came up with more novel ideas.

Write to Heal

Expressive writing may lead to faster recovery from injury



Expressive writing is known to help assuage psychological trauma and improve mood. Now studies suggest that such writing, characterized by descriptions of one's deepest thoughts and feelings, also benefits physical health.

Researchers in New Zealand investigated whether expressive writing could help older adults heal faster after a medically necessary biopsy. In the study, 49 healthy adults aged 64 to 97 years wrote about either upsetting events or daily activities for 20 minutes, three days in a row. After a time lag of two weeks, to make sure any initial negative feelings stirred up by recalling upsetting events had passed, all the subjects had a biopsy on the arm, and photographs over the next 21 days tracked its healing. On the 11th day, 76 percent of the group that did expressive writing had fully healed as compared with 42 percent of the control group.

"We think writing about distressing events helped participants make sense of the events and reduce distress," says Elizabeth Broadbent, professor of medicine at the University of Auckland in New Zealand and co-author of the study, published in July in *Psychosomatic Medicine*. Long-term emotional upset can increase the body's levels of stress hormones such as cortisol, which impedes the immune system. A paper in September in the *British Journal of Health Psychology* indeed found that writing about an emotional topic lowered participants' cortisol levels.

The writing in Broadbent's study may have also sped recovery by improving sleep. Participants who slept more in the week before the biopsy healed faster, perhaps because sleep ramps up many bodily processes involved in healing. *—T.R.*

Therapy in **Third Person**

A change of perspective can offer solace

If a past ordeal continues to trouble you, try writing about it as if it happened to somebody else: "She crashed the car," rather than "I crashed the car." In a study that appeared in February in *Stress and Health*, doing so led to greater health gains for participants who struggled with trauma-related intrusive thinking, as measured by the number of days their normal activities were restricted by any kind of illness.

"Third-person expressive writing might provide a constructive opportunity to make sense of what happened but from a safe distance that feels less immediate and threatening," says Matthew Andersson, a graduate student in social psychology at the University of Iowa and a co-author on the study. ***—T.R.***

ISTOCKPHOTO (*green bacteria*); SCOTT TALENT *Getty Images* (*green monster*); ISTOCKPHOTO (*hand*); DAVID LEAHY *Corbis* (*boy in hospital*)

signature whistles that may serve as names. They appear to recognize these whistles even after decades of separation.

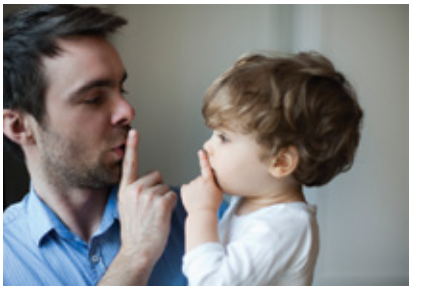
Nonverbal Cues Could Boost Kids' Vocabulary

Meaningful gestures and glances may help children learn more words, independent of how much parents talk to them

Children with a large vocabulary experience more success at school and in the workplace. How much parents talk to their children plays a major role, but new research shows that it is not just the quantity but also the quality of parental input that matters. Helpful gestures and meaningful glances may allow kids to grasp concepts more easily than they otherwise would.

In a study published in June in the *Proceedings of the National Academy of Sciences USA*, Erica Cartmill of the University of Chicago and her collaborators videotaped parents in their homes as they read books and played games with their 14- or 18-month-old children. The researchers created hundreds of 40-second muted video clips of these interactions. Another set of study participants watched the videos and used clues from the scenes to guess which nouns the parents were saying at various points in the sequences. The researchers used the accuracy of these guesses to rate how well a parent used nonverbal cues, such as gesturing toward and looking at objects, to clarify a word's meaning.

Cartmill and her team found that the quality of parents' nonverbal signaling predicted the size of their children's vocabulary three years later. Surprisingly, socioeconomic status did not play a role in the quality of the parents' nonverbal signaling. This result suggests that the well-known differences in children's vocabulary size across income levels are likely the result of how much parents talk to their children, which is known to differ by income, rather than how much nonverbal help they offer during those interactions.

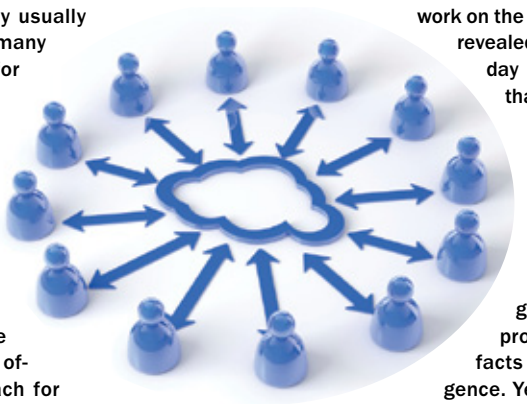


—Janelle Weaver

Online Data Trove Exposes Our Cognitive Quirks

A brain-training company's huge data set reveals nuances of learning and intelligence

When scientists study how we think, they usually design their experiments to control as many variables as possible. Though essential for careful science, these expensive measures restrict research in many ways: most psychology studies are conducted on small groups of Western undergraduates over short periods. Most scientists agree we could learn more from longer studies of larger, more diverse populations, but until recently acquiring such data proved nearly impossible. Now the vast data sets of an online brain-training company, Lumos Labs, are offering insights that have been out of reach for traditional laboratories.



Lumos runs Lumosity.com, a popular brain-training Web site. More than 40 million participants of many ages and nationalities train on the site, some for many years, by taking psychology tests from home. The activities involve, among other things, rapidly solving arithmetic problems or typing words of various lengths when given a word stem. Some participants also volunteer health and lifestyle information.

In a recent paper in *Frontiers of Human Neuroscience,* scientists at Lumos, the University of Michigan and Duke University analyzed the information gathered from these psychology tests—the largest ever data set on human cognition. In one study, the team looked at data from upward of 100,000 diverse participants and determined that higher levels of daily alcohol consumption are associated with ever steeper declines in performance. Unlike earlier work on the cognitive costs of drinking, the new study revealed that each additional drink beyond two a day causes a greater drop in performance than the one before.

In another analysis, the scientists compared more than 22,000 participants of different ages to see how much they improved on tests of memory and reasoning over long periods. They confirmed previous findings that intuition and reasoning, or fluid intelligence, declines faster with age and improves less with training than memory for facts and skills, known as crystallized intelligence. Yet they also found that the ability to improve on tasks worsens with age regardless of how good you are at the outset—old dogma claims that improvement is easier if you start at a low level.

The scientists are careful to point out that the conclusions reached on this type of data must come with some caveats. Participants train from home instead of in a lab, leaving open to question many variables researchers cannot see or control for, such as dishonesty about age or behavior. In addition, the subjects still may not be representative of the general population—perhaps people who choose to use Lumosity differ in some fundamental way from those who do not. Nevertheless, the Internet offers a unique, cost-effective way of studying human cognition on a huge scale. Big data has already become central to genomics research, explains Lumos data scientist Daniel Sternberg. Cognition "is orders of magnitude more complicated." *—Abdul-Kareem Ahmed*

GETTY IMAGES

M Pigeons, like humans, can behave irrationally. For full stories: ScientificAmerican.com/Mind/nov2013/stories

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Dark and Bright Corners of the Mind

The brain's resources are limited. By focusing on angles, curves and line endings, your visual neurons can cut corners

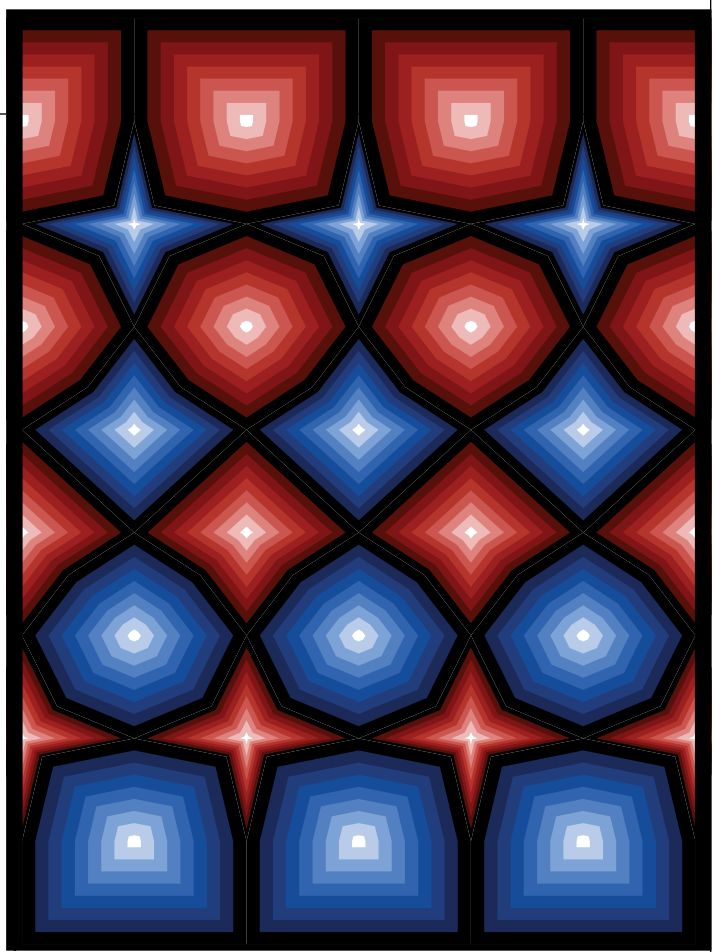
BY SUSANA MARTINEZ-CONDE AND STEPHEN L. MACKNIK

Amazement awaits us at every corner.
—James Broughton,
American poet and filmmaker (1913–1999)

TO PEOPLE, THE WORLD looks richly complete in all details, like a film. The information transmitted by the retina to the brain is constrained by physical limitations, however, such as the relatively small number of nerve fibers in the optic nerve. One way our visual system overcomes these limitations—thus presenting us with the perception of a fully realized world—is by disregarding redundant features in objects and scenes, thereby extracting, emphasizing and processing only the unique components that are critical to describing an object. Next time you visit the Guggenheim Museum in New York City and see a white canvas hanging on the wall, realize that what you perceive—a rectangular field of white—and what your eyes send to your brain—information about where the canvas's edges meet the wall behind the painting—are not equivalent.

As American vision scientist Fred Attneave proposed in the 1950s, just as edges inform the viewer more than uniform fields of color, "points of maximum curvature," or discontinuities in edges, such as curves, angles and corners, are less redundant and thus contain more information than the edges themselves. British neuroscientist Horace Barlow proposed in the 1960s that the brain throws out some information, but little of what is important about the visual world is lost. This idea, known as the redundancy-reducing hypothesis, may explain why neurons at the early stages of visual processing respond more intensively to the edges of objects than to interiors. Redundancy reduction applies to other visual features as well, such as the edges of edges: curves and corners. The following featured illusions result from our brain's preoccupation with any line that is deflected. M

SUSANA MARTINEZ-CONDE and STEPHEN L. MACKNIK are laboratory directors at the Barrow Neurological Institute in Phoenix. They serve on *Scientific American Mind*'s board of advisers and are authors of *Sleights of Mind: What the Neuroscience of Magic Reveals about Our Everyday Deceptions,* with Sandra Blakeslee, now in paperback (http://sleightsofmind.com). Their forthcoming book, *Champions of Illusion,* will be published by Scientific American/Farrar, Straus and Giroux.



COURTESY OF JORGE OTERO-MILLAN *Barrow Neurological Institute*

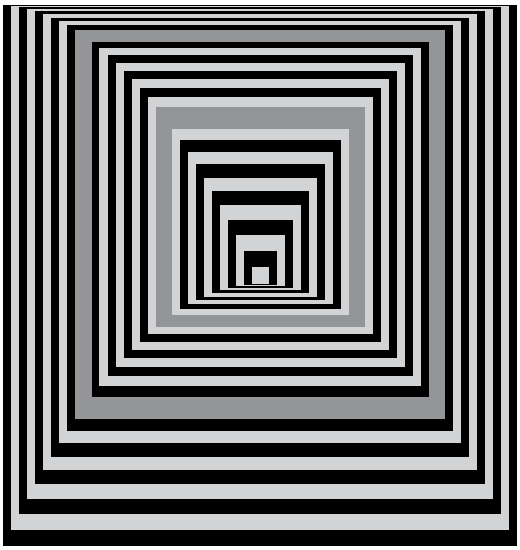
SHINING STARS

If points of high curvature are less redundant than points of low curvature, it follows that sharp corners are less redundant than shallow corners—and therefore should stand out as more salient to our visual system. The Nested Squares illusion, by Victor Vasarely, a Hungarian-French artist and founder of the op-art (short for "optical art") movement, shows illusory folds along the diagonals of concentric squares of increasing or decreasing luminance. The enhanced contrast at the corners of the squares is not physically real; it is a mind construct. The accompanying image, by neuroscientist and engineer Jorge Otero-Millan, a postdoctoral fellow in the Martinez-Conde laboratory at the Barrow Neurological Institute, shows that the strength of the illusion varies with the angle of the corner, with sharp corners generating more salient illusory folds than shallow corners. The two of us (Martinez-Conde and Macknik), along with our colleague Xoana Troncoso (at the time a Ph.D. student in the Martinez-Conde lab), first reported this effect in 2005. Notice that even though each individual polygon has the same exact physical luminance in every point, the corners seem perceptually brighter than the straight edges.

For an interactive demonstration of this illusion, visit http://smc.neuralcorrelate.com/illusions-and-demos/alternating-brightness-star

LINE THEM UP

Corner alignment in concentric polygons, as in Vasarely's Nested Squares and related illusions, affects not only apparent brightness but also depth perception. Vision neuroscientists Robert Shapley of New York University and Marianne Maertens of Technical University of Berlin studied the three-dimensional component of the illusory folds in such illusions, including those by the Native American basketry artists of the Pima (Akimel O'odham) tribe. Consistent with our findings on illusory brightness, Shapley and Maertens found that the extent of perceived depth depended on the steepness of the corner angle, with sharper corners producing stronger depth perception. In Otero-Millan's recreation of Vasarely's art (*top right*), subtle illusory folds, accompanied by the perception of depth, run across the aligned corners of the concentric squares. Some everyday objects, such as a flush fan grille (*middle right*), generate a comparable perception of 3-D. A Pima basket tray (*bottom right*) similarly induces the perception of wedges that recede or protrude in depth.

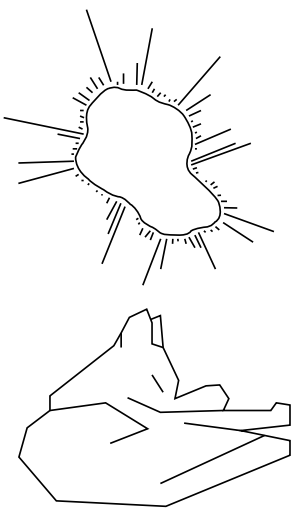


WHAT AM I LOOKING AT?

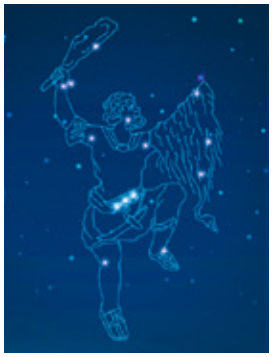
Neuroscientist Irving Biederman of the University of Southern California found that corners and curves are critical to the recognition of everyday objects. The column at the left in this grid shows line drawings of five objects. In the center column, only the high-curvature sections of their contours are visible, and object identification remains unproblematic. In the right column, only the straight edges and shallow curves appear, making the objects very difficult to recognize, although there is as much of the contour present as in the center column.

ANTIREDUNDANT

Attneave showed this blob (*near right, top*) to experiment participants and asked them to choose the 10 points that would be most useful to reconstruct its shape. The lengths of the radiating lines indicate how often subjects chose each point: participants expressed a clear preference for sharp curves and corners versus shallow curves and straight edges. The results suggested that visual neurons rely heavily on curves and other line discontinuities for processing an object's shape. To further support this idea, Attneave took the 38 points of maximum curvature from the picture of a sleeping cat. Then he played connect-the-dots, joining nearby points with straight lines, as in the children's game. The shape of the animal remained easily recognizable (*near right, bottom*).



COURTESY OF JORGE OTERO-MILLAN (*right top*); COURTESY OF BROAN-NUTONE LLC (*right middle*); COURTESY OF SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY (*right bottom*); SCIENTIFIC AMERICAN MIND, SOURCE: "RECOGNITION-BY-COMPONENTS: A THEORY OF HUMAN IMAGE UNDERSTANDING," BY IRVING BIEDERMAN, IN *PSYCHOLOGICAL REVIEW*, VOL. 94, NO. 2; APRIL 1987 (*What Am I Looking At?*); SCIENTIFIC AMERICAN MIND, SOURCE: "SOME INFORMATIONAL ASPECTS OF VISUAL PERCEPTION," BY FRED ATTNEAVE, IN *PSYCHOLOGICAL REVIEW*, VOL. 61, NO. 3; MAY 1954 (*Antiredundant*)



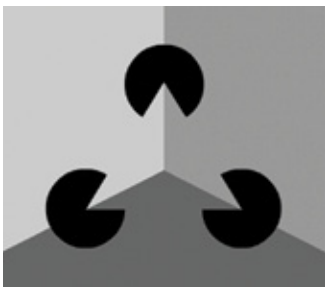
MOVING JOINTS

Our brain's attraction to corners and angles is not limited to static objects and scenes but extends to objects in action. Pioneer Swedish psychologist Gunnar Johansson showed that observers can perceive a full body in motion from just a few shifting dots. Placing these dots on key joints, such as the wrists, elbows or knees, made the perception of biological motion stronger than when the dots were located midway between joints. In biological-motion research, scientists first record the activity of an actual walker (*above left*) and then show just the moving light dots (called point-light displays) to experiment participants. In Latin constellations, stars are similarly found at the joints of fantastic creatures and mythical heroes such as Orion (*above right*). The implied motion in the outline is reminiscent of that in stationary point-light displays.

The lab Web site of Nikolaus Troje of Queen's University in Ontario features several interactive demonstrations of biological motion at www.biomotionlab.ca/?page_id=11

CORNERING THE FASHION MARKET

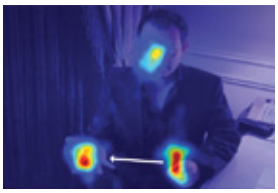
Fashion designers take advantage of the way our visual neurons are drawn to corners, curves and angles. The strategic placement of corners and bulky embellishments in these dresses by Balmain (*below left*) and Mary Katrantzou (*below right*) alters our perception of body shape, creating a slimming effect. Our visual system draws imaginary lines between the sharp corners at the shoulders, lower ribs and hips, exaggerating our perception of the models' hourglass figures.



ILLUSORY PYRAMID

This illusion, by vision scientists Pietro Guardini and Luciano Gamberini, both then at the University of Padua in Italy, won second prize in the 2007 Best Illusion of the Year Contest. The illusory pyramid is a novel variant of the classic Kanizsa triangle, in which the phantom shape of a triangle arises from the placement of three Pac-Man shapes at an imagined triangle's corners. Guardini and Gamberini's illusion adds a background, formed by three patches with different levels of gray, to the three Pac-Men. As the angle formed by the intersection of the three gray segments varies, the illusory triangle becomes a pyramid and then reverts to the original triangle shape.

See an interactive demonstration at http://illusionoftheyear.com/2007/the-illusory-contoured-tilting-pyramid-2



CURVE OF DECEIT

Theatrical pickpocket and sleight-of-hand artist Apollo Robbins (aka "the Gentleman Thief") noticed that he could steal audiences' belongings very effectively when he used curved hand motions to draw spectators' attention away from their possessions. To find out why, some years ago we teamed up with Robbins, Otero-Millan and computational neuroscientist Michael McCamy, a postdoc in Martinez-Conde's lab, to test the effectiveness of curved versus straight hand motions in a classic trick known as the French drop.

(SPOILER ALERT: The next sentence reveals a magic secret, so move further down if you would rather not know.)

In the French drop, the magician holds a coin in one hand and pretends to take it away with the other hand to make it "disappear." In reality, the coin never leaves the original hand. We measured the eye movements of observers as they watched Robbins perform using either a curved or a straight hand motion. When he used a straight motion, people switched their gaze back and forth between the two hands. When he used a curved motion, however, they focused their gaze on the final hand only, as if they had forgotten the original location (and current hiding place) of the coin. Color overlays in the images above represent eye positions, with warm colors indicating increased ocular targeting.

(Further Reading)

- **Recognition-by-Components: A Theory of Human Image Understanding.** Irving Biederman in *Psychological Review,* Vol. 94, pages 115–147; 1987.
- **Novel Visual Illusions Related to Vasarely's "Nested Squares" Show That Corner Salience Varies with Corner Angle.** X. G. Troncoso, S. L. Macknik and S. Martinez-Conde in *Perception,* Vol. 34, No. 4, pages 409–420; 2005.
- **Angle Alignment Evokes Perceived Depth and Illusory Surfaces.** R. Shapley and M. Maertens in *Perception,* Vol. 37, No. 10, pages 1471–1487; 2008.
- **Stronger Misdirection in Curved Than in Straight Motion.** J. Otero-Millan, S. L. Macknik, A. Robbins, M. McCamy and S. Martinez-Conde in *Frontiers in Human Neuroscience,* Vol. 5, No. 133. Published online November 21, 2011.
- **The Illusionists: The Science Behind the Fall Looks That Alter Your Shape.** Esther Adams in *Vogue Daily.* Published online November 30, 2012. Available at **www.vogue.com/vogue-daily/article/the-illusionists-the-science-behind-the-fall-looks-that-flatteringly-alter-your-shape/#1**

COURTESY OF NIKOLAUS TROJE *Queen's University (Moving Joints, left)*; GETTY IMAGES *(Moving Joints, right)*; CORBIS *(Balmain dress)*; REDUX PICTURES *(Katrantzou dress)*; COURTESY OF JORGE OTERO-MILLAN *(Curve of Deceit)*; COURTESY OF LUCIANO GAMBERINI AND PIETRO GUARDINI *University of Padua (Illusory Pyramid)*

That's Disgusting

Morality and disgust are culturally relative

BY JESSE BERING

SÉBASTIEN THIBAULT

DISGUST, in its most familiar form, is our response to something vile in the world—spoiled food, a dirty floor or rats cavorting in the subway. It is a contamination-avoidance mechanism that evolved to help us make biologically adaptive decisions in the heat of the moment. Yet disgust has also come to have powerful symbolic elements. When left unchecked, these symbolic qualities can have devastating impacts on our mental states.

Consider, for example, the often dramatized, heartbreaking image of a woman crouched in the corner of a shower and frantically trying to scrub her body clean after being raped. Empirical evidence supports the characterization. Seventy percent of female victims of sexual assault report a strong impulse to wash afterward, and a quarter of these continue to wash excessively up to three months later.

For women, simply imagining an unwanted advance can turn on this moral-cleansing effect. Psychiatrist Nichole Fairbrother of the University of British Columbia Hospital and her colleagues looked more closely at the phenomenon of mental pollution in a study published in 2005. Two groups of female participants were told to close their eyes and picture being kissed. The members of one group were instructed to imagine being aggressively cornered and kissed against their will. The members of the other group were asked to envision themselves in a consensual embrace. Only those women in the coercive condition chose to wash up after the study. In many cases, it seems as though a person's sense of self has become contaminated.

When symbolic disgust gets into one's core identity, the psychological sanitation process is never an easy one. Residual grime clouds the subjective filter through which a person perceives herself. If left untreated, these effects can permanently darken and sully her entire sense of being.

The Immoral Self

Disgust in its more typical forms generates feelings of hatred and loathing of others. Those emotions lead to a behavioral avoidance of the object of one's social distaste. In fact, the measurable physical distance placed between oneself and the hated target, such as in an elevator, can show this effect empirically. No matter how our worldview tilts, we usually do not stand too close to people whom we believe harbor opinions that are morally repellent to us. Nor do we seek to place ourselves in the immediate vicinity of those who have engaged in social behaviors we strongly believe are offensive and wrong.

Avoiding such a morally aversive person gets far more complicated, however, when the primary source of your symbolic disgust is you. After all, there are only three ways to escape the self—depressive

sleep, drugs and suicide. Needless to say, none of these options is healthy.

Once a person feels tainted in this way by an act judged to be especially unacceptable by his or her own society, either as the victim of the act or as the offender who feels genuine shame and remorse, these rankling feelings of symbolic disgust can quickly metastasize into malignant self-hatred. Sexually abused children, for example, are far more likely than their peers to develop an exhaustive suite of psychopathologies later in life. Suicide rates skyrocket, and correlations have been found with everything from chronic depression to self-harm (such as cutting), substance abuse, eating disorders, paranoia, hostility and psychoticism.

The most common way of managing the damage is to channel the harmful, caustic emotions elsewhere. Usually this method involves directing the symbolic disgust outward—away from the self—and toward those perceived to be responsible for sullying the self. A 2002 study led by psychologist George Bonanno of Columbia University, for instance, showed that the coping strategies of adults who had been sexually abused as children could be reliably gauged by observing their facial displays during a therapy session.

The researchers looked at two expressions of happiness, referred to as Duchenne and non-Duchenne smiles. Named after a 19th-century neurologist, the Duchenne smile conveys genuine pleasure and engages both the mouth and the eyes, whereas a non-Duchenne smile is linked with concealment and social politeness. Bonanno and his colleagues found that those who, as kids, had not disclosed their sexual abuse to others (for example, it was discovered by another adult and only then reported) and who blamed themselves displayed far more non-Duchenne smiles than did those survivors who blamed their abusers. This latter group was more clearly identifiable by their facial expressions of disgust—a palpable moral loathing—whenever speaking about those who had harmed them.

Disgusting to Whom?

Although such powerful symbolic disgust responses are all too real in the damage they can do to a person's well-being, you may be surprised to learn that their precise parameters have no basis in a moral reality. Human beings have evolved to combat pathogens through adaptive responses that require absolutely no enculturation. We do not have to learn how to vomit, for instance, after wolfing down a burger infected with *E. coli*. The symbolic disgust response, in contrast, emerges from prevailing cultural forces. What might have made a Japanese person commit ritual suicide in the 18th century because he could not stand to live with himself and his social offense would for most of us today be quickly forgotten as a trifling incident. Given their sheer emotional intensity, it is easy to mistake feelings of symbolic disgust for an immovable moral reality that exists outside our own subjective head. But no such reality exists.

> Anthropologists have long known how to make Western moral compasses **spin out of control** by describing exotic cultures.

Anthropologists have long known just how easy it is to make Western moral compasses spin out of control by describing other so-called exotic cultural traditions, especially those involving sex. Consider one elaborate ritual in Papua New Guinea, described by anthropologist Gilbert Herdt, now at San Francisco State University. In the tribe he called the Sambia, boys close to their eighth or ninth birthday are banished to a bachelor's hut filled with older males whom they must fellate. The Sambia believe that the ritual transforms their youths into mighty soldiers. In our society, this ritual would be unspeakable, causing irreparable harm and condemning these boys to lifelong issues with their sexuality. In contrast, Sambia adults and older teenagers who participate are seen as altruistic. The Sambia perceive harm in denying boys participation in the ritual because doing so would permanently brand these children as weaklings who would be judged unworthy of defending the community as adult warriors.

The notion of abnormal sexuality is as much a matter of straying from our culture's script as it is one of violating the laws of reproductive biology. This is not to excuse or downplay the violence done to victims of abuse but to note that the concept of perversion or going against what is right is a phantom of the moralizing human mind.

Oddly enough, a healthy dose of moral nihilism is the antidote for so many of the social ills connected to human sexuality. To adopt the most clear-sighted stance on these increasingly slippery subjects, we must remember to take deviance within its given context, and harm must be understood as harm experienced by the parties involved, not by us as "disgusted" onlookers.

Morality is not out there in the world; it is a way of seeing, and it is constantly evolving. The emotional atmosphere of our own culture has undergone radical social climate changes. To assume we are now finally glimpsing a clear moral reality that previous generations did not would be stupendously foolish of us. **M**

JESSE BERING is a psychologist and frequent contributor to Slate.com and *Scientific American*. His previous books include *The Belief Instinct* and *Why Is the Penis Shaped Like That?*

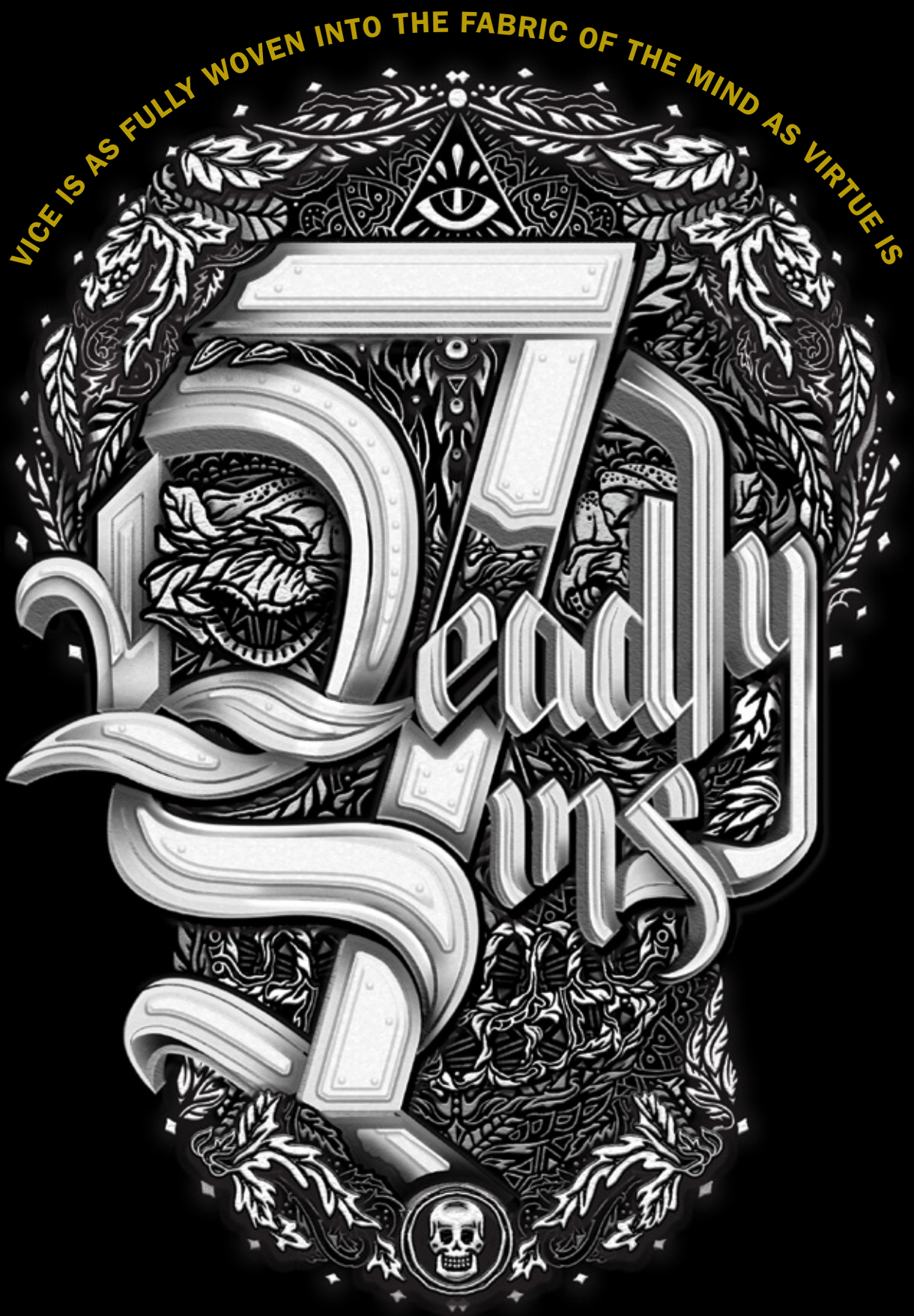


ILLUSTRATION BY **I LOVE DUST**

HOW THE MODERN FOODSCAPE GOT US ADDICTED TO EATING

ACCIDENTAL GLUTTONS

BY **KAREN SCHROCK SIMRING** | ILLUSTRATIONS BY **BRETT RYDER**

I am a glutton.

Most Americans are, it seems: more than two thirds of the population is overweight or obese, and that proportion continues to rise, even as public awareness of the importance of healthy eating is at an all-time high. I know what a healthy diet looks like, and I certainly don't enjoy being fat, so why is eating less such a difficult process? It turns out that every decision we make about eating is influenced by mental and physiological forces that are often outside of our awareness and control.

The path to gluttony looks something like the following. We start with the occasional experience of eating too much—say five handfuls of chips instead of two or a huge helping of dessert, before realizing we are uncomfortably full. The way a particular food looks, tastes and feels in our mouth can trick our brain into eating well past necessity from an energy standpoint, and modern foods (think: processed, packaged goods) are especially effective at this beguilement. "The brain response to high-sugar, high-fat foods is much stronger than to foods found in nature," says clinical psychologist Ashley Gearhardt, an addiction researcher at the University of Michigan. "In the food industry, they amp up that stuff to a point where our brain is really going to react."

New research is revealing that those occasional bouts of overeating and eating for pleasure, rather than out of hunger, can push us further down the path to gluttony, priming our brain to want that hedonistic experience more and more. Humans who overeat may develop the same patterns of neural activity in areas of the brain associated with rewarding experiences as drug addicts do, and many rodent studies have found that eating high-sugar or high-fat diets prompt cycles of craving and withdrawal along with brain changes akin to those that accompany drug addiction. For many people, these brain changes lead to addictionlike behaviors with certain foods—for instance, consistently consuming more than they intended to or feeling regret and shame after many meals.

Although the concept of food addiction is still controversial, many scientists now believe that considerably more than half the population struggles with its symptoms, in large part because of the ubiquity of high-sugar, high-fat foods. "We may not all be equally at risk or equally vulnerable, but the fact that we're all in this environment makes us all vulnerable to some degree," says neuroscientist Brian A. Baldo of the University of Wisconsin–Madison.

The good news is that knowing how our surroundings push us toward gluttony, we can push back, psyching ourselves into eating less and feeling better. "We're battling an environment that is completely cueing us to eat all the time," Gearhardt says. "The goal is to eat more foods that are minimally processed. Keep that bowl of fruits and vegetables on the counter, the pack of almonds in your purse." In other words, be a glutton for nourishment.

FAST FACTS

Fighting Food Addictions

1» Eating for pleasure, rather than out of hunger, can prime our brain to want that hedonistic experience more and more.

2» Humans who tend to overeat may develop the same patterns of neural activity in reward areas as drug addicts do; data suggest that eating high-sugar or high-fat diets can lead to cycles of craving and withdrawal.

3» Although the concept of food addiction is controversial, lessons from recent research can put us on a fitter path. Regulating the amount of food choice we give ourselves, for example, and avoiding situations where we are conditioned to eat can help us consume less and feel better.

Oops, I Ate the Whole Bag

Eating is at once a great pleasure and a dire necessity. Early studies in the mid-20th century largely focused on the necessity component: scientists successfully teased out how our body regulates our appetite in response to changing energy demands. For instance, when a casual runner starts training for a marathon, she needs to consume more calories daily to power her muscles over those longer distances, so her appetite increases. This internal regulation is the product of a complex system of hormones and neurotransmitters that make us feel hungry when we need more energy and sated when we have enough in the tank. Past attempts to develop drugs for weight control focused on these appetite mechanisms, but many researchers now feel that was a mistake.

"We don't want people to not eat; we want them to not eat just for pleasure," explains neuroscientist Nicole M. Avena, a pioneer of food addiction research who runs laboratories at the University of Florida and Princeton University. By shifting the focus to the hedonistic aspect of eating, scientists in the past two decades have uncovered many additional psychological and neural mechanisms that contribute to overeating—not only in one sitting, when a food's taste and texture influence our desire to keep eating, but also in the long term, when addictionlike behaviors can set in.

When I bite into, say, a potato chip, the sensory experience is immediate and intense: crunchy, salty, rich. My desire for those chips depends more on these sensory qualities than my need for sustenance; I will stop eating them when I am tired of putting crunchy, salty things in my mouth. Scientists call that halting point "sensory-specific satiety," and research has shown that it has nothing to do with metabolic satiety, which is the feeling of "fullness" that signals the body has consumed enough energy. We have all heard the advice to eat slowly, so your body has a chance to sense when it is full—but that takes at least 20 min-

utes, which is far longer than we typically spend on a snack or a light meal. "Sensory-specific satiety theoretically happens a lot sooner," in minutes or even a few bites, explains nutritional scientist Agnes Tey of the University of Otago in New Zealand.

According to research in the 1990s, sensory-specific satiety is processed in the orbitofrontal cortex, a region of the brain just behind the brow involved in sensory integration, reward processing and decision making. Neurons in that region respond strongly when we first taste a food, and the response gets weaker with each subsequent bite. When a different food is introduced, neuron activity jumps back to the high initial levels, instigating a response that can spur us to eat more even if we are full, as long as the next bite has a radically different sensory profile than what we had previously eaten. In other words, there is always room for dessert. This work suggests that you can reduce your intake by limiting your choices. "Try to avoid having a variety of foods in one meal; avoid the smorgasbord," Tey says.

Over time, on the other hand, you may need some variety to get around another fattening phenomenon. In the first long-term study of sensory-specific satiety published in 2012, Tey, along with nutrition scientist Rachel Brown and their Otago colleagues, asked 118 study participants to eat either chocolate, hazelnuts or potato chips every day for 12 weeks. Afterward the participants were slower to reach sensory-specific satiety when eating their assigned snack food. The familiar banality of the food, the authors speculate, seems to prevent it from becoming unpalatable. As a result, people robotically consume it. So although it may be wise to stick to one or two foods at every meal, do not eat the same foods day in and day out, or you may gradually eat more, perhaps without knowing it.

Studies on sensory-specific satiety also reveal that the flavor profile of the food you eat makes a dramatic difference in how much of it you want in one sitting. People reach this type of satiety much more quickly when they eat foods that have complex, intense or unfamiliar flavors, as opposed to mild or one-note taste profiles. So if your goal is to eat less without really thinking about it, choose spicy and rich over bland and light: a fiery curry instead of your go-to chicken soup, extra-dark rather than milk chocolate, Granny Smith apples—or better yet, a fruit you have not tried before—over Red Delicious. The more exciting the flavor, the quicker you will feel satisfied.

THE WAY A PARTICULAR FOOD LOOKS, TASTES AND FEELS IN OUR MOUTH CAN TRICK OUR BRAIN INTO EATING WELL PAST NECESSITY FROM AN ENERGY STANDPOINT.

When Indulgence Triggers Compulsion

The occasional episode of overeating, in theory, should not be problematic for our body to handle. We should simply feel full longer, as our body waits for the energy it just consumed to get used up before prompting us to eat again. Unfortunately, our survival-focused brain has other ideas. Bingeing was probably useful in our evolutionary past, when food was scarce and our ancestors needed to eat as much as possible after they came across a berry patch or brought down a fresh kill on the hunt. Yet our food environment is quite different today. "Now that you can open the refrigerator or go to 7-Eleven, this response is absolutely unnecessary," explains addiction expert Nora Volkow, director of the National Institute on Drug Abuse. "But your brain is still operating in a way that is producing a rewarding response."

Being surrounded by a large variety of extremely delicious food plays a key role in triggering this rewarding brain response in some people. Studies on the rodent equivalent of a nearby 7-Eleven—unlimited access to a variety of high-sugar, high-fat foods—find that this food environment makes rats start eating compulsively. For example, in May 2010 neuroscientists Paul M. Johnson and Paul J. Kenny of the Scripps Research Institute in Florida reported that rats that could eat whenever they wanted from a buffet of highly palatable foods

ANOTHER RISK FACTOR FOR OVERINDULGING IS HAVING OVERINDULGED. THAT IS, ONCE A PERSON HAS BINGED, THE BEHAVIOR CAN TRIGGER MORE OF THE SAME.

ate more and more over time, became obese, and showed a disruption of the reward function in their brain compared with control rats fed normal amounts. The obese rats had fewer receptors for the neurotransmitter dopamine, which signals pleasure, in the striatum, a brain area activated by rewarding stimuli. Fewer receptors suggest a lowered sensitivity to a substance such as food, an effect that may motivate an animal to consume more to get the same "high." Similar decreases in dopamine receptors are seen in overweight people, as well as rodents and humans addicted to cocaine and heroin.

Another risk factor for overindulging is, well, having overindulged. That is, once a person has binged, the behavior can trigger more of the same. In a study published in 2011 researcher Kimberly D. Oswald and her colleagues at the University of Alabama at Birmingham compared rats bred to be prone to binge eating with those bred to be resistant. As expected, the binge eaters ate uncontrollably when given access to unlimited food, even crossing a metal plate that gave them a foot shock to get to that food. The binge-resistant rats refused to cross the plate—until the researchers began feeding them a cyclic diet of massive amounts of food followed by very little food. These rats then began overeating when given the chance and even endured the shock to get to the food. Being willing to endure pain to get to a desired substance is a hallmark of addiction.

If humans are like rats, then dieters who break a strict diet with a binge may be putting themselves at risk for addiction. The cycle of caloric restraint followed by overindulgence could make the brain even more sensitive to food cues, according to Gearhardt. "The psychology of this binge-restrict pattern might really set people up to have an addictive response," she says.

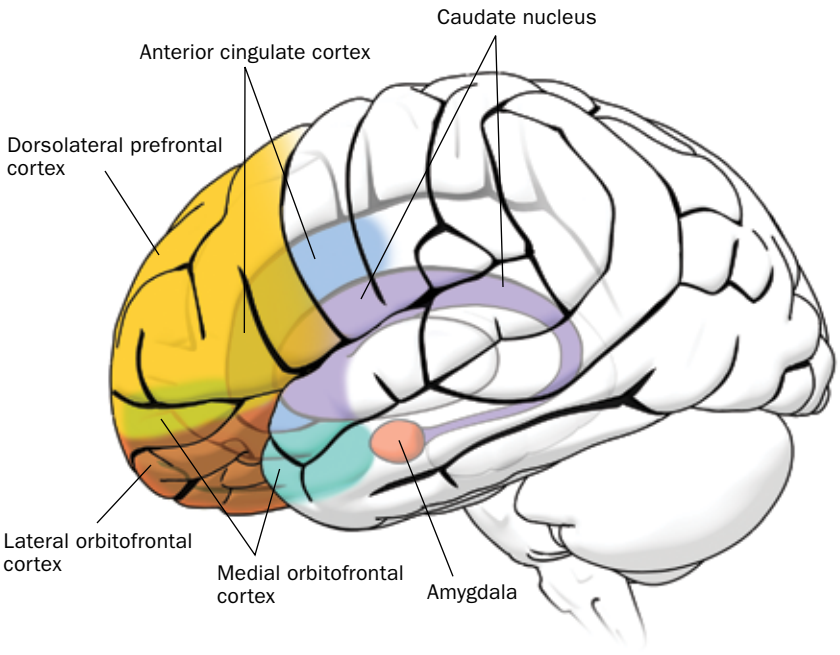
GRAEME MONTGOMERY *Trunk Archive*

Other work suggests that frequently eating extremely palatable food high in sugar and fat may trip a kind of trigger for overeating in the nucleus accumbens, a brain site that evolved to direct us toward things that were evolutionarily advantageous, according to Baldo. In previous work, scientists had seen that rats would frantically binge after injections into their nucleus accumbens of a drug that mimicked the neurotransmitter gamma-aminobutyric acid (GABA).

Baldo was curious about whether this phenomenon was relevant to ordinary eating behavior. In a study published this past May he and his colleagues showed that a high-sugar, high-fat diet prompts the nucleus accumbens of rats to be hypersensitive to GABA. In addition, they found that injecting endogenous opioid peptides, known pleasure molecules, into the nucleus accumbens induced the same hypersensitivity as the palatable diet. The findings explain how a diet consistently high in sugar and fat can prompt overeating: the repeated rushes of opioid peptides that accompany habitual consumption of pleasurable food sensitize the nucleus accumbens so that a small surge

Food Addiction in the Brain

In 2009 psychologists at Yale University got a snapshot of what addiction to food might look like in the brain. They showed pictures of chocolate milk shakes to 48 women who took a test of food addiction. In a brain scan, the more food-addicted women showed higher activity levels in four regions that are also implicated in drug cravings and expectation of reward: the caudate nucleus (*purple*), the medial orbitofrontal cortex (*light blue*), the anterior cingulate cortex (*dark blue*) and the amygdala (*red*). These women also had increased activity in the dorsolateral prefrontal cortex (*yellow*), known to be active when people try to resist pleasurable foods. When the women actually drank the milk shake, the women prone to food addiction, like drug addicts, showed diminished activity in the lateral orbitofrontal cortex (*brown*), a pattern linked to a lesser ability to inhibit responses to cues for rewards such as food or drugs.



of the omnipresent GABA could bring on a binge. "If you eat a little bit and the on switch is sensitized, you might lose control and not be able to stop," Baldo says.

Sugar Withdrawal?

In 2006 at Brighton Hospital, a substance abuse treatment center in Michigan, then training director John Hopper was noticing something strange about his patients. Many of them had recently had bariatric surgery, such as a gastric bypass, to lose weight. They had shed pounds—but became saddled with another heavy weight: a drug or alcohol addiction, many for the first time in their lives. Hopper asked Karen K. Saules, an addiction researcher at Eastern Michigan University, to help the hospital staff investigate. In 2010 Saules and Brighton physician Dan Schwartz reported that 2 to 6 percent of the hospital's clients had had bariatric surgery—a rate at least 100 times higher than in the general population, suggesting that something about bariatric surgery puts people at risk for addiction. Saules believes that bariatric surgery removed these patients' ability to feed their addiction to food—and so they replaced food with a different "drug." "These are middle-aged men and women, of modest or good socioeconomic status, suddenly eating pills or drinking boxes of wine, totally out of control," Saules says.

In the reverse phenomenon, recovering drug and alcohol addicts tend to gain a lot of weight—as if replacing their drug with food. And it has long been known that food and drugs compete for the same reward systems in the brain, bolstering the argument that food has addictive qualities similar to those of drugs.

Some data also suggest that sugars and fats can induce withdrawal: the distress, cravings and pain that can occur when an individual suddenly stops habitually consuming drugs or alcohol. For example, in a study published in 2012 neuroscientist Stephanie Fulton and her colleagues at the Montreal Diabetes Research Center fed rats a high-fat, sugary diet for six weeks. When they abruptly returned the rats to their normal fare, the rodents became anxious, displaying fearful behavior such as avoiding open areas. They also showed increased motivation to get to either high-fat or high-sugar food: they were willing to press a lever more times to obtain a sugar or fat pellet. In the rats' brain, the scientists also found elevated levels of certain chemicals characteristic of drug withdrawal. In other experiments, the researchers showed that not all fats lead to these withdrawal signs in rats. The monounsaturated fats present in olive oil and avocados seem to be far less problematic than the saturated types prevalent in butter, red meat and many processed foods.

Food addiction is distinct from obesity, Gearhardt points out. Many food addicts have a normal weight, and the rats in Fulton's study displayed withdrawal symptoms without becoming obese.

(The Author)

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GEORGE RETSECK

In addition, some obese people are not food addicts. To separate those who might be addicted from those who just tend to gain weight, Gearhardt, then at Yale University, and her colleagues developed a food addiction scale [*see box on opposite page*].

Though intriguing, the idea of food addiction remains unproved. Not all criteria for drug addiction apply when the putative addictive substance is food. We need food to survive in a way we do not need recreational drugs. For example, irritability, lethargy and a tendency to seek out the substance in its absence are not signs of pathology when it comes to food. We may, after all, just be hungry. As a result, experts need to agree on an adjusted definition of addiction in this case. And unlike drugs, food in general cannot be defined as an addictive substance; scientists still need to tease out which foods or ingredient combinations are the most likely to lead to addiction.

Nevertheless, experts agree that certain foods trigger what are clearly addictionlike behaviors in some people. And the food addiction concept is gaining momentum in the face

Screaming for Ice Cream

Some foods are more "addictive" than others. Psychologist Ashley Gearhardt, then at Yale University, and her colleagues asked about 200 young adults to pick from a list the foods that made them feel out of control: for instance, by triggering strong cravings or consistently causing them to eat more than they had intended. The results (*below*) suggest creations high in sugar and fat are the most troublesome. "Combining sugar and fat into one package is something that doesn't occur in nature; it's a novel result of human processing," Gearhardt points out.

THINKSTOCK (*food*); ISTOCKPHOTO (*plate*)

Are You Addicted to Food?

Scientists have developed a food addiction scale based on criteria psychiatrists use to diagnose drug addiction. Scores on the scale correlate with brain activity indicative of addiction. In a study published in 2009 clinical psychologist Ashley Gearhardt, then at Yale University, and her colleagues scanned the brains of 24 women who scored high on the scale and 24 women who scored low while the women looked at images of a chocolate milk shake. Those with high scores had higher levels of activity in brain areas, such as the orbitofrontal cortex and caudate nucleus, known to be involved in craving and motivation. When the women drank the milk shake, those with high addiction scores had suppressed activity in self-control regions, mirroring results seen in drug users.

Portions of the addiction scale are paraphrased at the right. If you identify with some of these statements, you may be struggling with the addictive qualities of certain foods. Although not everyone agrees food can be truly addictive, many people who self-identify as food addicts benefit from talk therapy or 12-step programs such as Overeaters Anonymous. —*K.S.S.*

- ❑ I find that when I start to eat certain foods, I end up eating much more than planned.
- ❑ I eat to the point where I feel physically ill.
- ❑ I find that when certain foods are unavailable, I go out of my way to obtain them.
- ❑ There have been times when I have consumed certain foods so often or in such large quantities that I spent time dealing with negative feelings from overeating instead of working, spending time with family and friends, or engaging in recreational activities that I enjoy.
- ❑ There have been times when I avoided professional or social situations where certain foods were available because I was afraid I would overeat.
- ❑ I have had withdrawal symptoms such as agitation, anxiety or other physical symptoms when I cut down or stopped eating certain foods.
- ❑ My behavior with respect to food and eating causes me significant distress.
- ❑ My food consumption has caused significant physical problems or made a physical problem worse.
- ❑ I have tried to cut down or stop eating certain kinds of food.

of accumulating data supporting it and new thinking about obesity. In June the American Medical Association officially recognized obesity as a disease. Many experts think acceptance of food addiction cannot be far behind. Some say that if society were to embrace the idea that sugary, fatty foods are dangerous enough to be taxed, regulated and avoided the way cigarettes are today, we would have a better chance of reversing the obesity epidemic.

For now we can use the lessons from recent research to put ourselves on a fitter path. To enlist sensory-specific satiety as an aid, choose flavorful or unusual foods and carefully regulate the amount of food choice you give yourself at any given sitting—and over time. In addition, realize that just walking past a vending machine at work or sitting down in front of the television can trigger a craving. "Make sure you are aware of and avoid situations where you are conditioned to eat," Volkow says. A lot of people eat when they are bored or stressed, she notes, so instead of turning to food at those times, train your brain to want a more beneficial reward, such as taking a walk. And when you do find yourself unable to resist the junk food—at a party for instance—go ahead and have some but keep your portions moderate. Your small indulgence may prevent a far bigger fall off the wagon.

As for me, incorporating unusual international cuisine into my diet and cooking varied, nutritious meals has been a welcome relief after years of boring, restrictive regimens. I find that experimenting with new flavors makes eating healthfully easier and more fun. And now that I know how my brain is poised to overeat and crave certain foods, I think twice about munching mindlessly out of a bag in front of my computer. Yet I still enjoy my favorite treats now and again—an occasional ice cream cone is all the more enjoyable knowing it is helping to steer my inner glutton down a healthier road. M

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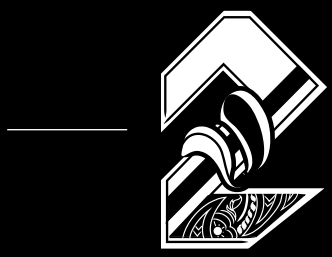

UNTANGLING ENVY

THE FEELING CAN HELP US EVEN WHEN IT HURTS

BY **JAN CRUSIUS AND THOMAS MUSSWEILER**
ILLUSTRATIONS BY **SAM WOLFE CONNELLY**

ENVY. Socrates viewed it as "the ulcer of the soul." Shakespeare's Iago, in *Othello*, gave us the term "green-eyed monster," forever tingeing it an emerald hue. In Dante's *Divine Comedy*, once resentful individuals trudge through purgatory with their eyes wired shut, never to see the world through jaundiced lenses again.

Most of us are well acquainted with this powerful sentiment, often defined as the pain of occupying an inferior position relative to another and a desire for what that other person has. The yearning could be directed toward a gleaming red Ferrari, a fortuitous business deal or something as simple as a piece of Scharffen Berger chocolate. Among the seven deadlies, it occupies a unique position: it's the only sin that is never fun.

Yet envy has come under closer scrutiny recently, and psychologists have begun to adopt a more nuanced view. In its familiar sinister form, envy can lead us to harm others and even take pleasure in their suffering. But it need not always be laced with evil. Envy can also motivate us to try harder and perform better on challenging tasks. The trick is to learn to channel the more productive of its two forms.

Envy's Two Faces

The idea that envy need not always be destructive dates back to none other than Aristotle. He described its dark, destructive side and the pleasure a person can take in another's pain, today captured by the German term *schadenfreude*. He also suggested that envy could encourage people to strive harder to reach a desired state—a facet that was long overlooked in empirical investigations of envy.

Recent findings support Aristotle's early characterization. Social psychologist Niels van de Ven of Tilburg University in the Netherlands and his colleagues compared how people from their home country and those from the U.S. and Spain expressed intense feelings of envy in their respective languages. (In Dutch, as in German, Polish and Thai, two words can mean envy, whereas English and Spanish have a single word.) In 2009 the psychologists found that regardless of language, their subjects' experiences divided into two types: malicious envy, characterized by negative thoughts and ill will, and benign envy, in which hostility is less evident. Although dark feelings still factored in, the subjects mentioned more positive sentiments, such as admiration. They were more likely to believe that the envied person deserved good fortune and to express a desire to make up the difference through their own efforts.

The various brands of envy affect human behavior in distinct ways. In a follow-up experiment, they instructed some of their Dutch-speaking students to recall a situation in which they felt admiration, benign envy or malicious envy. (The other subjects recalled nothing.) All students then tackled a brainteaser. The participants who experienced benign envy were more persistent and successful in solving the puzzle than their peers in the other groups. The researchers concluded that Danish philosopher Søren Kierkegaard was correct when he surmised, "Admiration is happy self-surrender; envy is unhappy self-assertion."

Other potential benefits of envy have emerged from the work of researchers interested in our history as a species. Evolutionary psychologists Sarah E. Hill of Texas Christian University and David M. Buss of the University of Texas at Austin suggest that repeatedly comparing ourselves with our neighbors could have helped us assess how we were faring in the competition for resources. Furthermore, the frustration and feelings of inferiority ignited by envy can act as a warning signal that alerts us to disadvantage. Those who are motivated by envy to make up for a deficiency might then outperform those who felt indifferent.

Of course, evolutionary explanations are notoriously difficult to test. So Hill and her colleagues examined a related hypothesis—that envy might enhance our performance even today. In one study, they asked students to recall situations in which they felt envious. Then in a seemingly unrelated activity, the participants read fictitious interviews about the career goals of students their own age. The people who had reflected on envious memories spent more time reading the interviews and remembered more details in a memory test than a control group. Envy appears to sharpen our attention to our social surroundings and heighten our interest in potential competitors.

FAST FACTS

The Duality of Envy

1» **Feelings of inferiority and desire can spur us to bring down our competitors—or to better ourselves.**

2» **Our ability to successfully control envy impulses is hampered by outside factors such as stress, exhaustion and inebriation.**

3» **Transforming malicious envy into its more productive cousin, benign envy, may be a way to harness the emotion's power to motivate.**

(The Authors)

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Managing the Malaise

Although most of us covet the advantages of others more often than we care to admit, we generally do not respond with full-blown envy. To understand why not, our team at the University of Cologne in Germany set out to learn how we suppress envious impulses before they take hold. We are finding that we tamp down these reactions for a couple of reasons: not only is envy socially undesirable, it can also be extremely unpleasant and painful—hence, we go to great lengths to either conceal our discontent or transform the attendant emotions. In other words, we exert self-control to quell an upwelling of envy.

Self-control can be diminished, however, by any factor that limits our thinking—for example, dealing with complex interactions, time pressure or other stresses. So we hypothesized that by taxing a person's alertness and emotional well-being, we could stir up envy. As part of a 2012 study, we conducted a "sweets test" with passersby at a street carnival in Cologne. We guessed that most people would be inebriated and thus in a weakened state of self-control. One by one, the carnival-goers drew straws to see whether they or our assistant would eat an expensive chocolate versus a mediocre candy. But we rigged the drawing so that our revelers always settled for the so-so sweet. As it turned out, the people with higher alcohol levels admitted to feeling especially envious of our assistant. When we repeated the test with more passersby but without our assistant (we told participants that other subjects had already gotten a chocolate), the effect disappeared. It seems a person must be physically present to become an object of envy.

Envy can also exaggerate desires. If a neighbor buys a luxury car, for example, we may suddenly find ourselves toying with the same idea. To observe the interplay between envy and desire, we conducted another taste test, this time in our laboratory. We taxed some of our study participants' self-control by placing them under a heavy cognitive load. (The load consisted of holding a difficult eight-digit number in mind.) We also gave them simple butter cookies, whereas others in the room received high-quality ice cream. Here, too, we found that those with diminished self-control expressed more envy and a stronger desire for the fancy dessert.

So are we simply at the mercy of our impulses, or can they be voluntarily controlled? We looked into this question in a final taste test, in which our participants were told they had been randomly assigned to drink sauerkraut juice rather than a fruit smoothie. We measured their impulsiveness under different conditions: when they were alone, when a smoothie drinker was in the room, and when they were under either a heavy or a light cognitive load.

All our participants then viewed images of the two drinks and other random objects. They used a joystick to indicate as quickly as possible where the image appeared on the screen. Pulling the joystick caused the images to grow larger, as if they were approaching; pushing it caused the images to recede. We found that participants whose self-control had been compromised by a difficult task were much quicker to pull the joystick when the smoothie appeared than a random object or the sauerkraut juice—but only when our smoothie-sipping accomplice sat next to them. Yet we observed the exact opposite response for the participants with intact self-control. If our accomplice with the fruity beverage sat next to them, they more swiftly pushed away the smoothie. To reiterate, they expressed *less* desire for the smoothie than for the random objects and sauerkraut juice. Perhaps to mitigate their negative emotions, they rejected the envied beverage in a case of sour grapes. Much like Aesop's fabled fox, they may have first coveted and then disparaged a delicious treat that was out of reach.

Yet we need not denigrate our desires, because that which causes pain can also lead to gain. To defang malicious envy, it may help to concentrate on the aspects of the situation that are within your control. For example, if you find yourself fixated on a colleague's blockbuster success, focus on fleshing out a game plan for a goal of your own. If envy fails to fuel your motivation, try invoking a sense of gratitude instead. Dwelling not on what we lack but on all that we have can help us value our own numerous boons and lucky breaks. M

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TAMING GREED IN FAVOR OF COOPERATION WOULD BENEFIT BOTH INDIVIDUALS AND SOCIETY

BY **DAN ARIELY** AND **ALINE GRÜNEISEN**

ILLUSTRATIONS BY **JOHN RITTER**

THE PRICE OF GREED

"I AM NOT A DESTROYER OF COMPANIES. I AM A LIBERATOR OF THEM!

The point is, ladies and gentleman, that greed, for lack of a better word, is good. Greed is right, greed works. Greed clarifies, cuts through and captures the essence of the evolutionary spirit." These are the words of Gordon Gekko, played by Michael Douglas in the 1987 film *Wall Street*. The poster boy for unharnessed greed echoes the sentiment of rational free-market economists, who view greed as not only an inevitable aspect of human nature but ultimately a desirable one.

As the prevailing (yet simplistic) economic theory goes, greed motivates competition, and competition is essential for growth in a functioning market. By focusing on personal gains, people directly contribute to the greater good. The late American economist Milton Friedman espoused this ideology of greed when he said, "The world runs on individuals pursuing their separate interests." He asked, "Is there some society you know that doesn't run on greed?" *Homo economicus*, the rational self-interested being that represents standard economic theory, benefits society only to the extent that he maximizes his own utility.

Yet greed has historically had a bad reputation. Even today the overwhelming majority of people shun greedy behavior. When we consider the situations in which financial self-interest benefits individuals and society and when it impedes, there are few of the former and many of the latter. The belief that greed allows markets to flourish is more likely a reflection of the ability of *Homo sapiens* to justify our selfish motivations than it is a prescription for economic success. Understanding this fact, along with a greater appreciation of greed's harm, can go a long way toward curtailing selfish behavior.

FAST FACTS

Ruined by Avarice

1» **Because competition fuels a market economy, many economists believe that people contribute to the greater good by focusing solely on personal gain.**

2» **Yet greed is not good. Among its downsides: it can lead people of all income levels to spend more than they can afford, leading to bankruptcy, longer commutes and even divorce.**

3» **The belief that greed is necessary for markets to flourish more likely reflects our ability to justify selfish motivations than true economic wisdom.**

"Thou Shalt Not Covet …"

If we rewind to ancient times, the idea of greed as a sin is planted throughout history. Philosophers from Socrates and Plato to David Hume and Immanuel Kant viewed greed as a moral violation, to be avoided and denounced. Roman Christian poet Prudentius depicted greed in the Early Middle Ages as the most frightening of all vices. And in its itemized treatment of this sin, among others, the Bible set forth the 10th commandment: "Thou shalt not covet thy neighbor's house, thou shalt not covet thy neighbor's wife, nor his manservant, nor his maidservant, nor his ox, nor his ass, nor any thing that is thy neighbor's."

Today, rather than taking a purely moral approach, much of the opposition to greed appears to stem from its negative effects on others. When people prosper at the expense of others, for example, observers are repulsed. In a study published in 1986 psychologist Daniel Kahneman, now emeritus professor at Princeton University, and his colleagues showed that consumers refuse to support companies that take advantage of their customers for the sake of profit (through price gouging, for example). More recently, in unpublished work, Amit Bhattacharjee, now at the Tuck School of Business at Dartmouth, and his colleagues at the University of Pennsylvania reported that people judge even the mere act of profit seeking as harmful to society. The researchers found that more profitable firms were regarded as less deserving of their winnings, less subject to competition and more motivated to make money regardless of the consequences. Furthermore, when asked to compare two hypothetical organizations that were identical aside from their "for-profit" or "nonprofit" status, people perceived for-profit firms as less valuable and more socially damaging than the nonprofits. Thus, the perception of greed as harmful extends to the mere act of profiting, which is of course the only way that capitalist markets can function.

This aversion to greed-driven, profit-seeking behavior may be based on a fundamental desire for fairness, including, for example, more equal wealth distribution. In a study published in 2013 sociology graduate student Esra Burak of Stanford University showed that 61 percent of Americans claim that they would support a cap on compensation for extremely high earners, regardless of how hard they have worked or what they have achieved. In addition, in laboratory games in which people are asked to contribute to a public pool of money that will later be split among all participants, players readily penalize those who greedily hold on to their resources. They keep defectors in check and will do so even when restoring fairness comes at a personal financial cost.

Yet not everyone finds value in suppressing greed. In a series of studies published in 2011 organizational behavior professor Long Wang of the City University of Hong Kong and his colleagues had students play the "dictator game," in which participants are granted a sum of money that they can divvy up among themselves and an anonymous partner in any way they choose. The researchers found that the more a student had studied economics, the more money he or she kept for himself or herself and the less likely the individual was to explain his or

her actions in terms of fairness. In a second study, students reflected on their past greedy behavior in writing, rated the morality of greed in general, and tried to define greed in their own words. By all three measures, the more students had been schooled in economics, the more positively they viewed greed. And as a third experiment showed, even just a hint of exposure to economic theory can convince people of the virtues of greed. The researchers found that students with no prior training held more positive opinions of greed just after they read a statement on the economic benefits of self-interest.

Corrosive Competition

Although we may be easily swayed by these convenient rationalizations, the economic justification for greed is nonetheless shortsighted. Ferocious competition may occasionally lead to optimal market outcomes, but it can also have harmful side effects. Think about competition in sports. At first glance, the drive to be the best appears to propel human achievements to new heights. World records are surpassed, and yesterday's Olympic medalists pale in comparison with today's champions. Yet extreme dedication has costs. Athletes may not spend enough time with their friends and families, or they may sacrifice their long-term health to perform better in the short term—by overexerting their body or taking performance-enhancing drugs such as steroids.

The consequences of unchecked greed can also spill over into society. In his 2011 book *The Darwin Economy,* economist Robert H. Frank of Cornell University outlines some of the disastrous effects of allowing competition to run free. Take, for example, neighbors gunning for social status. Each tries to outdo the others, purchasing a slightly flashier car, bigger pool or more expensive grill. When Joe Jones down the block builds a home theater and Jane Smith across the street installs a 3-D amphitheater, you will no longer be satisfied with your meager widescreen television. We don't simply try to keep up with the Joneses, we try to surpass them—triggering what Frank calls "expenditure cascades." That is, high spending by top earners shifts the reference point for those earning just a bit less, affecting those next in the ladder of prosperity, and so on. This chain of events can culminate in all classes spending more than they can afford, leading to a higher likelihood of bankruptcy (from increased debt), divorce (from the pressures of financial instability) and longer commutes to work (after moving to cheaper neighborhoods to cope with the debt).

The financial crisis of 2008 arose from a similar conflict between eagerness for short-term gains and long-term prosperity. High competition among financial institutions drove them to "financial innovations" that eventually left many of us with bankruptcies, foreclosures, a lack of trust in the market and a substantial national debt that we will be paying for generations to come.

Greed can also encourage ethically dubious behaviors. In an unpublished experiment with Lalin Anik of Duke University, we investigated whether people would be more willing to profit at the expense of others if they could rationalize their actions more easily—specifically by claiming that their motives were intended to benefit another group: shareholders. To explore this hypothesis, we asked participants to imagine themselves as the CEO of a publicly traded bank. We gave them a list of ethically questionable actions that would profit their company and asked which ones they would take. They could, for example, charge overdraft fees, increase interest on securities held or use tax shelters to offset income with losses from previous years. When participants were told that their primary goal as CEO was to maximize shareholder value, they were much more willing to partake in these ethically questionable acts. And when some of these participants were told that their year-end bonuses depended on satisfying this goal, the questionable behaviors became even more popular.

Perhaps shockingly, these results were most pronounced for those who aced the three-item financial literacy test we gave

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them. That is, those who were more educated in finance were even more inclined toward questionable behavior. Although most of us *perceive* avarice in a negative light, we can be greedy ourselves when given the right justifications for our behavior.

Cultivating Cooperation

Despite this capacity to rationalize selfishness, people do not always avail themselves of it. They can often be quite selfless, sacrificing their own welfare to benefit others. People help those in need, donate money to charities and volunteer their time. (Yes, even economists sometimes help the elderly lady carry her groceries across the street.) In scenarios such as the dictator game, most participants reliably share some of their wealth—despite the fact that the rational economic decision is to keep it all.

All in all, humans are part Scrooge and part Robin Hood. We are more likely to be selfish when we can easily explain our choices or when we fail to consider the people who could suffer from them. Yet when we think about the people whom we can hurt and help, we behave more considerately. The lessons are straightforward: we must not let rational economic theory eclipse the fact that greed can be damaging. Next, we should work to make the consequences of our actions clearer, with the hope that our cooperative spirit will be boosted by concrete examples of those who might bear the brunt of our actions. And finally, we must combat the rationalizations of self-interest, including the simplistic mantra that greedy behavior propels society forward.

Yet if you are still trying to surpass the Joneses, bear in mind that above the poverty line, having more money will not make you appreciably happier. In fact, research shows that individuals who focus on financial success are less stable and less happy overall. So rather than splurging on a high-end grill that will make your neighbor jealous—and perhaps add to your debt—choose instead to help your neighbor assemble her grill for a block party cookout. And if the party small talk turns to the economy, slip in a pitch for cooperation rather than greed. M

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History of Sin

TRACKING THE SEVEN DEADLY SINS—FROM THEIR EGYPTIAN ROOTS AND INFLUENCE ON THE ARTS TO THEIR DEBUT IN BLOCKBUSTER FILMS AND IPHONE APPS

BY LUCIANA GRAVOTTA

A.D. 375 Monks living in the desert in Egypt identify eight thoughts that weaken their devotion. *Talking Back,* a book by Roman monk Evagrius of Pontus, instructs monks on how to fight gluttony, lust, love of money, sadness, anger, listlessness, vainglory and pride.

Early fifth century John Cassian, a student of Evagrius, proposes that the sins connect sequentially. For example, he suggests that lust comes from gluttony and avarice arises from lust.

Late fifth century Priest-historian Gennadius of Massilia translates Evagrius' work into Latin. He posits that the devil and human nature alike lead us into temptation.

590 Pope Gregory the Great revises the list to create the one we know today: pride, wrath, envy, sloth, greed, gluttony and lust. He considered pride to be the root of all sins.

1215 Texts detailing the seven deadly sins abound after a church council decrees that all Christians must go to confession at least once a year.

1265–1274 Thomas Aquinas writes *Summa Theologica,* in which he defines lust more precisely as adultery, rape, seduction, bestiality, sodomy, or sex without reproduction in mind.

Early 14th century The rise of a wealthy middle class leads some theologians to decry avarice as the number-one sin.

Circa 1308–1321 Dante Alighieri writes the *Divine Comedy,* which delves into the punishments doled out in purgatory for every sin. For example, the proud were humbled by having to carry heavy stones.

1500 Hieronymus Bosch paints *The Seven Deadly Sins and the Four Last Things*. In a series of everyday scenes, Bosch depicts the aristocracy as proud and lustful, merchants as envious, avaricious and slothful, and the poor as wrathful and gluttonous.

1556–1558 Pieter Brueghel the Elder's engravings use cartoonish characters and surreal landscapes to depict the sins.

1812 The Brothers Grimm publish their famous book of fairy tales, establishing envy as a common trait of stepmothers.

1892 Charles Allan Gilbert draws his famous visual pun *All Is Vanity,* an image of a woman admiring herself in the mirror that, when viewed from afar, looks like a skull.

1933 First performance of George Balanchine's ballet *The Seven Deadly Sins*. Every act takes place in a different city: wrath in Los Angeles, lust in Boston and envy in San Francisco, to name a few.

1950s A win for sloth: TV remote controls enter mass production. One early model was Zenith Radio Corporation's "Lazy Bones."

1964 Gluttonous Augustus Gloop, greedy Veruca Salt and wrathful Mike Teavee take a fateful tour of Willy Wonka's factory in Roald Dahl's *Charlie and the Chocolate Factory*.

1987 The movie *Wall Street* picks apart the greed behind corporate raiding and insider trading.

1989 One of the first empirical studies on how Christians rank the sins is published. This sample of parishioners views "life-rejecting melancholy" as the worst sin, followed by lust and anger.

590

1308–1321

1500

1556–1558

1995

1993 Australian artist Susan Dorothea White proposes that today's deadly sins are the opposite of the original ones. Indifference has replaced anger, workaholism has ousted sloth and squandering is more prevalent than avarice.

1995 The movie *Seven* is released. In the film, a serial killer targets "sinners," with every "punishment" designed to fit the "crime."

1995 Homer Simpson proclaims sloth to be part of American culture: "If you don't like your job, you don't strike. You just go in every day and do it really half-assed. That's the American way."

1997 The International Federation of Competitive Eating is born, establishing gluttony as a sport.

1998 Cognitive-behavior therapy, which emphasizes reframing thoughts and behavior change, is shown to be effective for anger management.

2002 Pride takes a venomous turn: the FDA approves Botox to improve the appearance of forehead lines.

2008 Bishop Gianfranco Girotti announces that the Catholic Church has added seven new sins: polluting, genetic engineering, obscene wealth, drug abuse, abortion, pedophilia and the perpetration of social injustice.

2009 Roberto Busa, an Italian priest and Jesuit scholar, tallies up confessions he has received. He concludes that men's number-one sin is lust, whereas pride tops the list for women.

2011 First confessional iPhone app is developed. It helps users keep their sins straight and includes a "custom examination of conscience" and the ability to "choose from seven different acts of contrition."

2012 Pride and envy get a facelift. The American Society for Aesthetic Plastic Surgery reports that the number of cosmetic procedures is up 250 percent since 1997.

(The Author)

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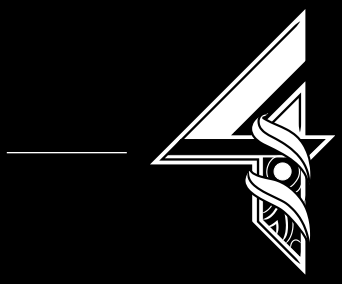
REDUX PICTURES (*Pope Gregory, top*); GETTY IMAGES (*other images*)



WE GET AN EMOTIONAL BOOST WHEN WE PROCRASTINATE, BUT RESEARCH OFFERS STRATEGIES TO HELP STAY THE COURSE

BY **SANDRA UPSON**
ILLUSTRATIONS BY **JAN FEINDT**

PRODDING OUR INNER SLOTH

Timothy Pychyl, a psychologist at Carleton University, dotes on his eight huskies. On winter weekends he takes them dogsledding on the snow-covered trails near his house in Ottawa.

As the number of dogs has grown, though, so have the chores. Pychyl dreads one duty above all others: clipping their claws, all 150 (or so) of them.

"One of my dogs takes two or three people to pin him down, that's how much he doesn't like it," Pychyl recounts. Although he wants the dogs to be happy and healthy, when faced with spending a strenuous evening wrangling husky paws, he finds himself severely tempted to sink into the couch with a beer.

This trade-off is the essence of procrastination. We know what we want to do, yet we bellyache, sabotage ourselves and settle for second-rate mental diversions. Why?

The easy answer is that we prefer to seek fun things now rather than waiting for a distant payoff, even when that long-term reward is significantly greater. Yet that tendency fails to explain why we sometimes twiddle our thumbs but other times get down to business. "The 'why' is emotional processes," says psychologist Fuschia Sirois of Bishop's University in Quebec. "We face emotional conflict and tension, and one way to resolve that is to procrastinate."

Recent research suggests that feeling insecure or gloomy can make us more likely to procrastinate because yielding to our impulses offers an emotional boost. To morph from couch potato to action hero, we must learn to harness the subtle lifts and dips in our emotions. Transforming an initial aversion into a source of motivation can help us dodge temptations and chase bigger, bolder dreams.

FAST FACTS

Dawdle No More

1» **Chronic procrastinators tend to wrestle with anxiety, depression and self-critical thoughts more than others do.**

2» **Research is showing that procrastinators use distractions and temptations as a way to neutralize negative emotions.**

3» **Learning more effective techniques for regulating emotions can counteract the tendency to delay important tasks and help people commit to their goals.**

Deconstructing Delay

Procrastination is an engine of regret, one that has steamrolled human accomplishment since the dawn of civilization. As early as 800 B.C., Greek poet Hesiod offered a now familiar piece of advice: "Do not put off your work until tomorrow and the day after." We can procrastinate about anything: work, exercise, starting a diet or sending a birthday card. More formally, it has been defined as the voluntary delay of any action that we realize we ought to pursue now.

Perhaps because of its universality, the phenomenon is also the frequent butt of jokes—the procrastinators club that never met, the book on procrastination that was never written. One writer even cited fake procrastination research in a journal article: two fictional scientists named Stilton and Edam used cheese to observe procrastination in mice. And Saint Augustine, during his hedonistic youth in the fourth century, famously prayed, "Grant me chastity and continence—but not yet."

For habitual practitioners, though, the reality is anything but humorous. Frequent dawdlers tend to harbor self-critical thoughts and wrestle with depression and anxiety. They are consistently found to yield to impulses more often than other people. Now researchers are discovering a causal link among procrastination, impulsivity and mood. "A lot of the literature says that [such people] have higher levels of depression, anxiety, etcetera," Sirois observes. "It's not just about being driven purely by pleasure seeking but about avoiding negative emotions."

When chronic procrastinators are queried about their thoughts, they tend to share snippets of a dark, gloom-ridden internal dialogue. "I'm too stupid for this," they say, or "If I can't complete this paper, everything else I've done is meaningless." In one case study, an accountant named Tom procrastinated so much that he failed to file his own taxes. We may chuckle at the irony, but when asked how he felt about the situation, Tom said he felt defective, incompetent and pathetic.

Numerous studies by psychologist Roy F. Baumeister of Florida State University and his collaborators have demonstrated that negative emotions diminish self-control. Anxiety undermines diets as well as smokers' efforts to quit. When people feel upset, they are more likely to act aggressively, spend too much money or play games when they know they should be studying. Feeling down is also a strong predictor of relapse in a number of addictive behaviors, such as alcoholism and gambling.

A fundamental function of the brain is to regulate emotion, including dispelling negative feelings when they do not signal a threat to survival. At the sight of a disturbing image, for instance, we deflect our gaze. When preparing to give a

talk, we try to look cool and collected as a way to quiet the turmoil inside. And it is no accident that after a breakup, some of us reach for a tub of ice cream. All three strategies serve to patch up psychological injury, just as we might bandage a cut.

Distraction, it turns out, is a fabulous way to cast off unwanted feelings. Students doodling in the margins of their notebooks might have discovered on their own what psychologists only recently have shown in the laboratory: that drawing can quell negative emotions not through its expressive power but by distracting us from our feelings. Not all diversions need be so active: another effective way of restoring self-control and a chipper mood is simply to take a nap—a tried-and-true tactic of procrastinating college students.

Turning the mind away from a dull or disturbing thought is one reason we dillydally, but other emotional processes may also be at work. Psychologists Jeffrey A. Hancock and Catalina L. Toma of the University of Wisconsin–Madison speculated that a bruised ego might compel someone to procrastinate as a way to repair his sense of self. After a setback at a meeting, a person who is feeling defeated might return to his desk, check the scores from last night's game and browse Facebook as a way to affirm, unconsciously, his feelings of social connectedness.

To test this idea, Hancock and Toma asked 86 study participants to prepare and deliver a short speech. Half the subjects then received criticism, whereas the rest heard neutral comments. The participants had the opportunity to either browse their own Facebook profile or engage in one of four other online diversions: watching YouTube videos, reading news, listening to music or playing video games. The results, published this year, showed that the people who weathered criticism were twice as likely to choose Facebook over the other online diversions as those receiving neutral feedback; the time spent on the social network seems to indeed repair mood. In a related experiment, in which ego-bruised participants viewed either their own Facebook profile or that of a stranger, Hancock and Toma found that people who checked out their own page dealt with the criticism better than those who visited the stranger's page. (They were more likely to assume responsibility and less inclined to blame others for the negative feedback.) Although you may think you procrastinate for no reason, the dawdling may be a subconscious move to self-affirm: to check in with the values and passions that shape your identity.

Other subtle emotion-regulation strategies also differentiate the doers from the dawdlers. Sirois investigated how procrastinators use a set of thoughts known as counterfactuals. These statements often begin with phrases such as "at least" or "if only"—for example, "at least I didn't crash the car!" or "if only I'd gotten a good night's sleep." Downward counterfactuals, which illustrate how things could have been worse, serve to elevate mood. Upward counterfactuals, which capture how we might have avoided a mistake, do the opposite.

In a study published in 2004 Sirois measured 80 students' tendency to procrastinate and then asked them to read a story that described what it might be like to watch one's house burn down. Afterward the participants wrote as many counterfactuals related to the tale as they could think of. As she discovered, the students who procrastinated more egregiously dreamed up more downward counterfactuals than those less prone to postponement. Sirois reasons that chronic idlers might be less resilient when beset by negative feelings, so their defense mechanisms kick in sooner. "There is a discomfort

(The Author)

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that comes when you approach a task that brings up insecurities, and for some people that is just not a place they like to be," Sirois reflects.

Getting to Work

One obstacle for any procrastination-beating technique is that managing our internal state—herding our thoughts and feelings so they align with our highest goals—often demands self-control, and this effort can leave us with less cognitive firepower for the tasks at hand. Resolving to not check e-mail for an hour, for example, can make you more likely to sneak into the kitchen for a bag of chips.

The idea that negative emotions drive procrastination has opened up new approaches for bolstering resilience. Several strategies that leave self-control intact are now emerging from the labs. They can help us tackle household chores, finish projects at work or finally make a date with the dentist. And, as I learned recently, they apply to the tardy disposal of a Christmas tree.

In April I found myself in the ridiculous position of having a tree, ornaments and all, firmly ensconced in my living room. That winter I had postponed tossing it out of a sense of sadness at condemning a perfectly good tree to the city dump. Plus it served nicely as a hat stand—not to mention ongoing storage for all those ornaments.

Suddenly it was March. In a blink another month passed, and my feelings started to shift. I dreaded lugging it out to the street for garbage collection. What would the neighbors think? I avoided entertaining visitors so that they could not mock my brittle Douglas fir. I was now hostage to the tree.

A shift in motivation eventually saved the day. Instead of dwelling on the potential for embarrassment, I focused on a dinner party I had agreed to host. I needed to get this tree out of my house to make room for friends, and tossing the fir became virtuous, not vexing. Without realizing it, I had tapped into one key strategy for overcoming procrastination: cognitive reappraisal.

Cognitive reappraisal is a deliberate move to change the meaning of a situation by altering our emotional response to it. In research published in 2012 psychologist James Gross of Stanford University and his colleagues set out to assess whether reappraisal could help us diffuse the allure of temptations without depleting self-control. In one of Gross's studies, 51 students were asked to memorize details about several wines while sitting in a room with distracting pictures, such as the posters and photographs that decorate dorm rooms. Half the students were prompted to view the activity as an opportunity to strengthen their memory, which could help them in college. The remaining participants, the control group, were simply instructed to do their best.

SIEDE PREIS *Getty Images*

The researchers found that thinking of the task as self-improvement decreased the students' susceptibility to temptation and helped them remember more information about the wines. Several variations on this experiment similarly showed that reappraisal increases people's focus, enthusiasm and performance—three things most rueful procrastinators surely covet.

The finding is in line with prior work by two of Gross's coauthors on this study, Véronique Leroy and Jacques Grégoire of the Catholic University of Louvain in Belgium. They have shown that university students who routinely reappraise their emotional reactions tend to do better in school. As Gross explains, cognitive reappraisal "is a little like learning to surf. If you can harness the incredibly powerful force of your emotions, you'll have a lot more fun than if you're constantly turned around and around by them."

Pychyl overcame his aversion to trimming his huskies' claws by focusing on love and care. "There are other places in my inner landscape from which I can work," he muses. "My first emotions for a task are not the only emotions in me." He also breaks the chore down into smaller parts. He tells himself to take care of one animal and then permits himself to call it

quits. Inevitably the job is not as bad as he imagines, and all 150 claws get clipped.

Another way to view an event more positively is to give yourself a break. Because procrastination seems to trigger harsh self-criticism, it may be self-reinforcing, sending us spiraling further downward. For this reason, Pychyl has highlighted the importance of self-forgiveness: a three-step process to reduce the emotional distress that procrastination stirs up. It entails acknowledging having made a mistake, weathering feelings of guilt and then experiencing a shift in motivation as self-punishment gives way to the positive feeling of self-acceptance.

To test the value of forgiveness, Pychyl and his colleagues gave 119 students in a class questionnaires measuring their tendency to procrastinate and either forgive or berate themselves for it. The students reported on their procrastination twice, both times before a midterm. Between the exams, they indicated how they felt about their performance.

The researchers discovered that the students who were kindest to themselves after procrastinating for the first midterm experienced fewer negative emotions *and* improved their study habits for the subsequent test. Conversely, students who continued beating themselves up for procrastinating not only felt worse but also perpetuated their mistakes for the second exam. Thus, the next time you miss a deadline because you stayed up late watching cat videos on YouTube, don't dwell on the mistake. Acknowledge your error and feelings of guilt, then move on.

A partial explanation for why criticism fuels procrastination may come from self-affirmation—the same strategy that sent people in Hancock and Toma's study scurrying to Facebook for a fix of pleasant feelings. That self-affirmation was unconscious, but it can also be deliberate.

This idea is based on the theory that humans are powerfully motivated to pursue self-worth. A suite of studies has made it clear that consulting our deepest values can free a person from defensive responses. Starting with work published in 2009, psychologist Kathleen D. Vohs of the University of Minnesota and her colleagues have consistently found that self-affirmation can restore self-control.

For example, one experiment looked at how well people stayed on task when they either did or did not self-affirm. The participants in this study first wore out their self-control with a cognitively draining task—watching a video and keeping their attention trained on a woman's face on the screen while ignoring words that popped up periodically. They then wrote about either a personal value of great importance to them or about Bill Gates. Those who wrote about their own values persisted almost twice as long at a subsequent boring activity than did the ones who pondered the billionaire. Vohs and her colleagues theorize that reflecting on our core convictions helps us see the bigger picture. "My own pet theory is that it stops people from evaluating themselves for a moment and gets them to focus descriptively on what matters in life," Vohs says. A simple strategy such as having photos of family on your desk can serve as a reminder of what counts most.

With self-control all stocked up, we can shift away from our inner environments and begin tailoring external circumstances instead. Ultimately, it seems, the key is not to constantly fight temptations but to learn to avoid as many of them as possible. In a 2012 study Baumeister, Vohs and their collaborators asked 205 people from the city of Würzburg in Germany to wear smartphones for a week. Periodic signals to the phones cued them to record any desires they were feeling at that moment. The psychologists found that people reported some kind of desire in response to a whopping half of the cues. About half of those desires conflicted with a goal or value.

I AVOIDED ENTERTAINING VISITORS SO THAT THEY COULD NOT MOCK MY BRITTLE DOUGLAS FIR. I WAS NOW HOSTAGE TO THE TREE.

Looking more closely at the data, the researchers observed a funny thing: participants who scored high in self-control reported far fewer conflicting temptations than people on the low end. Thus, self-control may not be the capacity for titanic acts of willpower but instead an ability to shape one's environment proactively through effective habits and routines.

So if you plan to exercise in the morning, tuck your keys into your shorts and lay out your shoes the night before. Stash the alarm clock across the room. The fewer obstacles, the fewer opportunities for negative emotions to arise. And when you encounter an urge to avoid doing what matters most, check in with your feelings first. They may govern the moment, but you can still rule the day. M

(Further Reading)

- **The Nature of Procrastination: A Meta-Analytic and Theoretical Review of Quintessential Self-Regulatory Failure.** Piers Steel in *Psychological Bulletin,* Vol. 133, No. 1, pages 65–94; January 2007.
- **I'll Do It Tomorrow.** Trisha Gura in *Scientific American Mind,* Vol. 19, No. 6, pages 26–33; December 2008/January 2009.
- **Everyday Temptations: An Experience Sampling Study of Desire, Conflict, and Self-Control.** Wilhelm Hoffmann, Roy F. Baumeister, Georg Förster and Kathleen D. Vohs in *Journal of Personality and Social Psychology,* Vol. 102, No. 6, pages 1318–1335; June 2012.
- **Procrastination and the Priority of Short-Term Mood Regulation: Consequences for Future Self.** Fuschia Sirois and Timothy Pychyl in *Social and Personality Psychology Compass,* Vol. 7, No. 2, pages 115–127; February 2013.

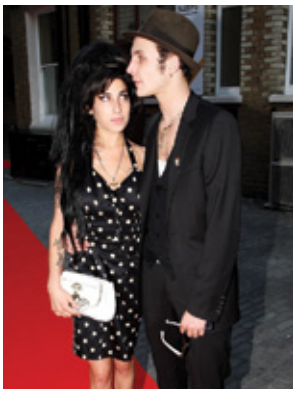
5

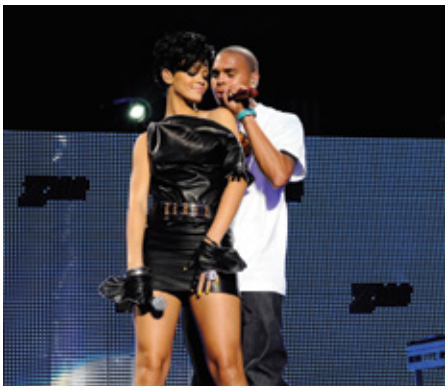
THE THIN LINE BETWEEN LOVE AND WRATH

INTIMACY SPAWNS STRONG EMOTIONS, WHICH CAN ERUPT IN VIOLENCE WHEN SELF-CONTROL FAILS

BY **ELI J. FINKEL AND CAITLIN W. DUFFY**
ILLUSTRATIONS BY **YUTA ONODA**

Tina Turner, the "Queen of Rock," rose to fame in the 1960s as half of the Ike & Tina Turner Revue. The singer, whom *Rolling Stone* once called one of the greatest of all time, was also, unfortunately, well known as a victim of domestic violence. Ike Turner was not only her musical partner but also her husband, and she suffered frequent and severe abuse at his hands. In 1976, while he slept, she crept out of their hotel room carrying only 36 cents and a gas card, fearfully shuttling from one friend's house to another's to escape him. After filing for divorce, she was so eager to be free of his terrorizing reign that she let him keep virtually all of their shared assets.





Left: **Tina Turner endured serious physical abuse at the hands of husband, Ike Turner.** ***Center:*** **Singer Amy Winehouse and husband, Blake Fielder-Civil, had fiery fights that ended in mutual violence.** ***Right:*** **Vocalist Chris Brown once gave his Grammy Award–winning girlfriend, Rihanna, a bruised face during an argument.**

The brand of brutality that Turner endured, which sociologist Michael P. Johnson of Pennsylvania State University calls intimate terrorism, stems from a desire to establish power and control in a relationship. The resulting violence is frequently one-sided—predominantly perpetrated by men—and prone to escalate over time. Less widely recognized, however, is a form of domestic wrath known as situational couple violence, which is mutual and emerges from relationship conflict that gets out of hand. For example, the late singer Amy Winehouse and Blake Fielder-Civil reportedly shared an intense love, and their passion intermittently boiled over into mutual violence. In 2007 guests at the hotel where the couple was staying reported hearing crashing furniture and screaming coming from their suite, and both partners emerged from the fight bruised and bloodied. Yet the next day the pair strolled arm in arm, publicly displaying affection. When they finally parted ways two years later, Winehouse said, "I won't let him divorce me … he's the male version of me, and we're perfect for each other."

Over the past decade researchers in our social psychology laboratory at Northwestern University have investigated intimate partner aggression, focusing on situational couple violence, which is far more common than intimate terrorism. Ten to 20 percent of married couples experience situational violence annually, and rates are even higher among dating and cohabiting couples, according to an integrative review by sociologist Murray A. Straus of the University of New Hampshire.

In contrast to prevailing perspectives on the topic, which suggest that societal influences push couples toward violence, we believe that most domestic violence grows out of the inherent tension present in intimate relationships, tension that couples would actually prefer to defuse in more peaceful ways. We have found that, in any given instance, a person's ability to control a violent urge likely hinges on the amount of self-control he or she has. That level may in turn depend on personality, recent events, sobriety or stress level [*see box on page 55*]. Regardless of which factors are at play, understanding more about how people inhibit or override violent urges is important for reducing the frequency and severity of disruptive behavior in intimate relationships. Moreover, by helping couples amicably work through conflicts, what we learn can limit the frequency with which individuals lash out verbally at or otherwise emotionally abuse their boyfriend, girlfriend or spouse.

FAST FACTS

Overcoming Aggression

1» **Most domestic violence stems from tension that accompanies intimacy rather than from societal influences that some scholars believe push couples toward violence.**

2» **A person's ability to control a violent urge in a fight with his or her partner hinges on the amount of self-control that person has.**

3» **Certain exercises known to bolster self-control can help people override violent urges and minimize the frequency and severity of aggressive behavior in a romantic relationship.**

Bitter Divide

Scholars began collecting compelling data about domestic violence in the 1970s. Yet as Johnson noted in an article in 1995,

LEFT TO RIGHT: MICHAEL PUTLAND *Getty Images*; DAVE HOGAN *Getty Images*; DAVID ATLAS *Corbis*

researchers from two distinct camps were studying fundamentally different forms of violence without fully recognizing that fact [*see box at right*]. Members of one camp typically collected data from battered-women's shelters, hospitals and police departments. These data indicated that men perpetrate most domestic violence and do so to establish power and control. These scholars of intimate terrorism suggested that patriarchy, a social system in which men aim to maintain a near monopoly on power and resources, plays a central role in relationship brutality. That is, men use aggression to exert control over "their" women. Sociologists Rebecca Emerson Dobash and Russell P. Dobash of the University of Manchester in England argued in their 1979 book that "men who assault their wives are actually living up to cultural prescriptions that are cherished in Western society—aggressiveness, male dominance and female subordination—and they are using physical force as a means to enforce that dominance."

Other researchers, meanwhile, tended to conduct nationally representative surveys of domestic violence or studied relationship aggression in individuals in and around college campuses. In these populations, men and women acted violently toward their partner at nearly equal rates. Further, rather than trying to establish power and control, perpetrators were acting out as a result of partner conflicts. Investigators explained these cases with the idea that society conveys subtle approval of violence in romantic relationships, especially given that conflict is a virtually inevitable feature of them. Family violence scholars Straus of New Hampshire and Richard J. Gelles of the University of Pennsylvania argued in a 1988 book chapter that "one of the most important differences between the family and other groups that helps explain the much higher rate of violence in families is the fact that there are cultural norms that permit or require violence … the marriage license is also a hitting license."

The level of vitriol between these camps became extreme in the 1980s, based in part on the perception of those in the first camp that those backing the mutual aggression concept were (in effect, at least) covering up the persecution of women by men. In one instance, a researcher in the mutual violence camp reported receiving a bomb threat from someone in the rival group. The acrimony has receded in recent years, and in 2005, when we began our studies, we realized that both perspectives rested on a shared assumption: that couples tend to be violent because they have been socialized to believe that doing so is appropriate.

Brands of Brutality

Intimate partner violence comes in two forms. When broader power motives are prominent, violence manifests in the form of intimate terrorism. Predominantly perpetrated by men, this form of aggression tends to escalate throughout the course of a relationship. But it is relatively rare, affecting fewer than 1 percent of couples a year in the U.S., according to an integrative review by sociologist Murray A. Straus of the University of New Hampshire. The far more common situational couple violence, on the other hand, is not driven by a desire to dominate. Committed at nearly equal rates by men and women, such violence tends to emerge intermittently (without escalating) as conflict situations get out of hand.

We found this assumption hard to swallow. Is it really true that society condones violence against a romantic partner? Our gut feeling was that aggression is instead something that people generally want to avoid, especially with those they love the most. Thus, it seemed to us that violence in relationships is more akin to a mistake, such as having unprotected sex, breaking your diet or drunk-dialing your ex—that is, an impulse you wish you had suppressed rather than something you believe is okay. Given this intuition, we sought an understanding of situational couple violence that is founded on a basic desire for peace rather than an acceptance of its opposite.

We suggested, for example, that people generally prefer to be nonviolent with their partners but that conflict—and the anger arising from it—is hard to avoid in intimate relationships. In addition, we knew from the scholarly literature that a central function of anger is to trigger an urge to lash out. Whether a person acts on that urge, we hypothesized, depends largely on self-control—that is, the general ability to work toward goals (for instance, adhering to personal standards of civility or maintaining a good relationship) when those goals conflict with a desire to do something else (such as throw a punch).

Over the past decade we have conducted a range of studies to test aspects of this model. First, we wanted to find out if people in intimate relationships frequently experience aggressive urges toward their partner that do not result in aggression. If so, that fact would suggest that people are trying to minimize relationship violence rather than acting on violent impulses because of implicit societal approval. In a study published in 2009 we asked undergraduates to describe the most significant fight they had with a romantic partner and to report whether they had been violent toward their partner during the fight. Did they slap, kick, bite or slam the person against a wall? The students also reported whether they had been *tempted* to enact such behaviors. We found that half of the respondents had been tempted to act violently

(The Authors)

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SELF-CONTROL IS IMPORTANT FOR REDUCING INTIMATE PARTNER VIOLENCE AT TIMES WHEN BELLIGERENT THOUGHTS ARE SIMMERING.

but that only 21 percent had succumbed to the impulse.

In a study not yet published we extended our findings to married couples, asking individuals to report any violent behavior or urges they had experienced during the previous year. We found that the married individuals, like the college students, were much more likely to have been tempted to be violent (25 percent) than to have actually been so (9 percent), underscoring the notion that couples are trying to hold back their fists. The results also indicated that both the men and the women were tempted to be violent about three times as often as they actually were physically aggressive. These parallel statistics argue against the explanation that people generally try to stop themselves from fighting physically out of fear of retaliation, given that this concern ought to be greater for women. Instead we believe that people override inclinations to use force so as to better align their behavior with their goals.

Loss of Control

To determine whether such purposeful restraint plays an instrumental role in minimizing violence, we assessed self-control along with violent behavior toward a romantic partner in 850 16-year-olds who were participating in an adolescent dating-violence prevention program at the University of North Carolina at Chapel Hill. We asked the teenagers how many times they hit, bit, punched or otherwise behaved aggressively toward a boyfriend or girlfriend over the previous year. Those who scored low in self-control perpetrated 7.5 times as many violent acts toward the teen they were dating as those who scored high, suggesting that a person's level of self-control strongly influences how often that person will be aggressive toward a romantic partner.

Although such correlations point to self-control as the lever people use to override their violent urges, we sought to draw a causal connection. In a third study in 2009 we led both members of 33 dating couples to believe that their partner had given them either supportive or negative feedback on a drawing they completed using colored pencils. (The negative feedback was designed to trigger anger and an urge to lash out.) To manipulate self-control, we had participants complete a task in which they were allowed to pay attention to—or asked to ignore—flashing words superimposed on a silent video clip. The need to direct attention—in this case, to focus on the video while disregarding the words—tends to deplete self-control, leaving less of it available for tasks performed immediately afterward.

We randomly assigned individuals to one of four conditions. Some participants were provoked by negative feedback, but others were not. We further subdivided the groups so that some of them tackled the challenging video task, depleting their self-control, whereas others performed the easier video task. Then we assigned each person to the role of "director" in a task involving his or her partner. Each director could determine the length of time that the partner had to maintain a series of painful, but not harmful, body poses. (In reality, the partner never actually had to assume the assigned poses.)

We predicted that participants would experience an urge to be aggressive in response to negative feedback from their partner but that having intact self-control would allow them to suppress that urge. Indeed, we found that the provoked participants whose self-control had been depleted required that their partner hold the painful body poses for 50 percent longer than did those whose self-control had not been sapped. In contrast, the participants who received positive feedback on their artwork made their partner hold the poses only briefly regardless of whether we had manipulated their self-control. These results suggest that self-control is important for reducing intimate partner violence at times when belligerent thoughts are simmering, but having that resource is not critical when nothing inflammatory is afoot.

Having established that self-control can put a strong brake on situational partner violence, we wanted to test whether we could bolster it and thereby reduce aggressive responses to in-

terpersonal conflict. In a fourth study in 2009 we asked 40 participants in dating relationships how likely they would be to respond violently to a series of 20 upsetting scenarios involving their partner, such as "My partner ridicules or makes fun of me" and "I walk in and catch my partner having sex with someone." Then we had some participants spend two weeks practicing one of two types of exercises that had been previously shown to strengthen self-control; others had no intervention. In one of the regimens, which focused on physical regulation, participants used their nondominant hand to perform everyday tasks, such as eating and brushing their teeth. In the other, which honed verbal regulation, they had to alter habitual speech patterns, such as avoiding sentences that began with "I" and saying "yes" instead of "yeah." Just as weight lifting builds muscles, both these two-week regimens were designed to build self-control by exercising it.

Top 5 Factors That Weaken Self-Control

The chance that a fight with your partner will remain nonviolent depends heavily on self-control—yours and your partner's. This ability to restrain an impulse to act on immediate desires in the service of long-term goals varies among people, but your behavior and the environment can also sap self-control. Here are the top five factors that can deplete this critical resource.

- Alcohol consumption
- Lack of sleep
- Too much stress
- Efforts to control your thoughts or emotions
- Distractions that orient attention away from a goal

Taming the Monster

Indeed, we found that those who engaged in the self-control exercises expressed significantly reduced violent tendencies when they completed our questionnaire again. In contrast, participants who did not engage in a self-control training regimen during the same two-week period indicated that they would act just as violently as they had before.

More recently, we developed a strategy to help people navigate conflict more effectively. In a study published this year we asked 120 married couples from the Chicago area, who had been married for an average of 11 years, to write about the most significant marital conflict they had experienced in the previous four months. Along with this exercise, which they did three times in one year, they also reported on the quality of their marriage, including their satisfaction with it, their trust in their partner, and the passion they felt for him or her.

In the second year of the experiment, we added a "conflict reappraisal" intervention for half of the couples: every four months these participants also spent seven minutes describing the same disagreement they had written about from the perspective of a neutral third party who wants the best for all involved. The aim was to give participants the psychological distance they needed to help get beyond any immediate anger and frustration.

Although marital quality declined during the first year for all participants (sadly, this is a robust finding in the literature on marriage trajectories), it continued to decline in the second year only among participants who did not do the additional writing task. For those who received the writing intervention, their relationship satisfaction stayed stable throughout the year—apparently because the exercise reduced their anger and distress. Combining this intervention with a regimen for strengthening self-control holds particular promise for diminishing the frequency and severity of situational couple violence. It might also help people whose relationships are tinged with strong emotions and who are motivated to throw verbal darts at their partner or deliver other forms of emotional punishment, even if the insults are hardly ever physical.

Such a strategy could benefit Rihanna, the Grammy Award–winning singer, and American vocalist Chris Brown. In February 2009 the couple got into an argument that left Rihanna with a bruised face and Brown with a restraining order. Earlier this year, though, Rihanna told *Rolling Stone* that she and Brown were again romantically involved. According to Rihanna, "He's not the monster everybody thinks. He's a good person. He has a fantastic heart. He's giving and loving. And he's fun to be around. That's what I love about him—he always makes me laugh."

Many couples experience a single bout of violence that does not recur, and perhaps Rihanna and Brown will be one of those pairs. Their chances of living happily ever after, however, will be better if they complement their love with good conflict-management skills and a concerted effort to bolster their self-control. M

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LUST FOR LIFE

NEUROSCIENTISTS ARE LEARNING HOW PURE SEXUAL DESIRE CONTRIBUTES TO LASTING RELATIONSHIPS

BY **STEPHANIE CACIOPPO** AND **JOHN T. CACIOPPO**

ILLUSTRATIONS BY **EDDIE GUY**

FAST FACTS

Decoding Desire

1» Brain imaging is revealing the distinct but interlocking patterns of neural activation associated with lust and love.

2» Lust is most likely grounded in the concrete sensations of the given moment. Love is a more abstract gloss on our experiences with another person.

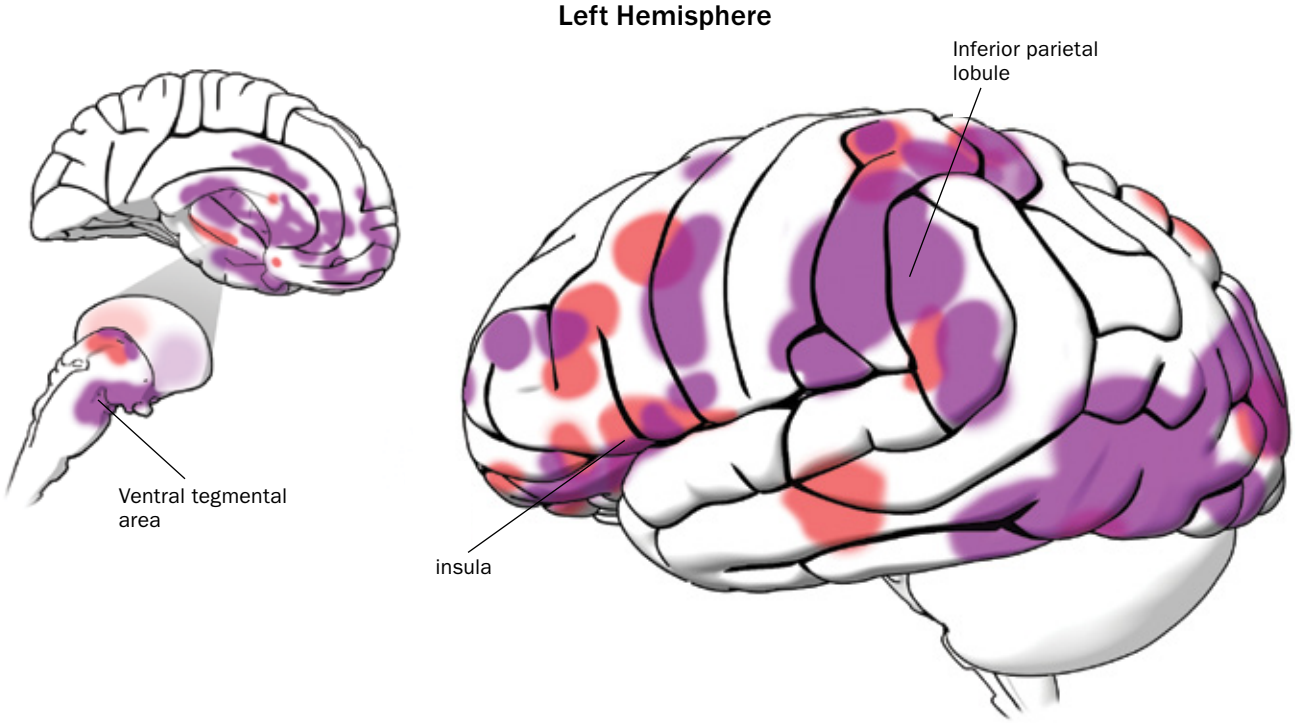
3» Imaging is also helping to decipher the disorders of lust, including anorgasmia. Dozens of discrete regions across the brain fire at the point of orgasm—suggesting many different ways to develop anorgasmia.

People often think of love and lust as polar opposites—love exalted as the binder of two souls, lust the transient devil on our shoulders, disturbing and disruptive. Now neuroscientists are discovering that lust and love work together more closely than we think. Indeed, the strongest relationships have elements of both.

The bifurcated treatment of love and lust dates to antiquity. The study of love as an academic subject is nearly a century old, with the sentiment covered in introductory textbooks of social psychology. Psychologists, primatologists, neuroanatomists and neurophysiologists came to see love—defined as an intense and complex feeling of deep affection—as responsible for long-term coupling and close relationships. The first psychological tools for measuring love appeared in the 1940s. In a review of the literature published in 2011, psychologist Elaine Hatfield and her colleagues at the University of Hawaii at Manoa identified 33 scales for measuring love's gradations.

The Brain in Love (and Lust)

The color hues in the "heat maps" show brain networks related to lust (*purple*) and love (*red*). Although numerous distinct brain regions contribute to our experience of love and lust, a few regions are particularly significant.



Ventral tegmental area: A dopamine-rich region that underlies both lust and love. It contributes to motivation, goal pursuit, emotion, reward expectancy, euphoria and habit formation.

Insula: Plays a role in emotion and self-awareness. The posterior (back) part perceives body states and visceral sensations; it is more active in lust than in love. The anterior (front) area forms abstract ideas about these body states; it revs up more in love than in lust.

Inferior parietal lobule: Associated with social-cognitive functions involving the abstract representation of the self, including body image and self-esteem, as well as metaphors and goal-directed actions.

ILLUSTRATION BY GEORGE RETSECK; SOURCE: MODIFIED FROM "THE COMMON NEURAL BASES BETWEEN SEXUAL DESIRE AND LOVE: A MULTILEVEL KERNEL DENSITY FMRI ANALYSIS," BY STEPHANIE CACIOPPO ET AL., IN *JOURNAL OF SEXUAL MEDICINE*, VOL. 9, NO. 4; APRIL 2012

In contrast, researchers have traditionally regarded lust as little more than uncontrolled sexual urges. The scientific study of lust remained verboten or limited to clinicians, psychiatrists and sex therapists dealing with social and behavioral problems. When the topic of lust did appear in the scientific literature, it was cast as an archaic emotion, a sinful feeling that needed to be suppressed or denied lest it challenge societal order, or an addiction that hijacked human thought, emotion and behavior in insidious ways.

Now, though, neuroimaging investigations are beginning to flesh out the relationship between lust and love. Some research does support the Jekyll and Hyde dichotomy. Studies have revealed that lust and love both have unique brain signatures, suggesting they are separable, with the brain able to generate lust in the absence of love and vice versa. In one study of 500 individuals conducted in the mid-1960s by psychologist Dorothy Tennov of the University of Bridgeport, 53 percent of the women and 79 percent of the men agreed with the statement, "I have been sexually attracted without feeling the slightest trace of love"; 61 percent of the women and 35 percent of the men agreed with the statement, "I have been in love without feeling any need for sex." Neuroimaging studies have also shown considerable overlap between the network for lust and the network underlying addiction, suggesting that the craving associated with lust brings with it impulsivity, lack of self-control and risk taking.

Other studies reveal a more complex and synergistic connection between lust and love. Both feelings can activate

(The Authors)

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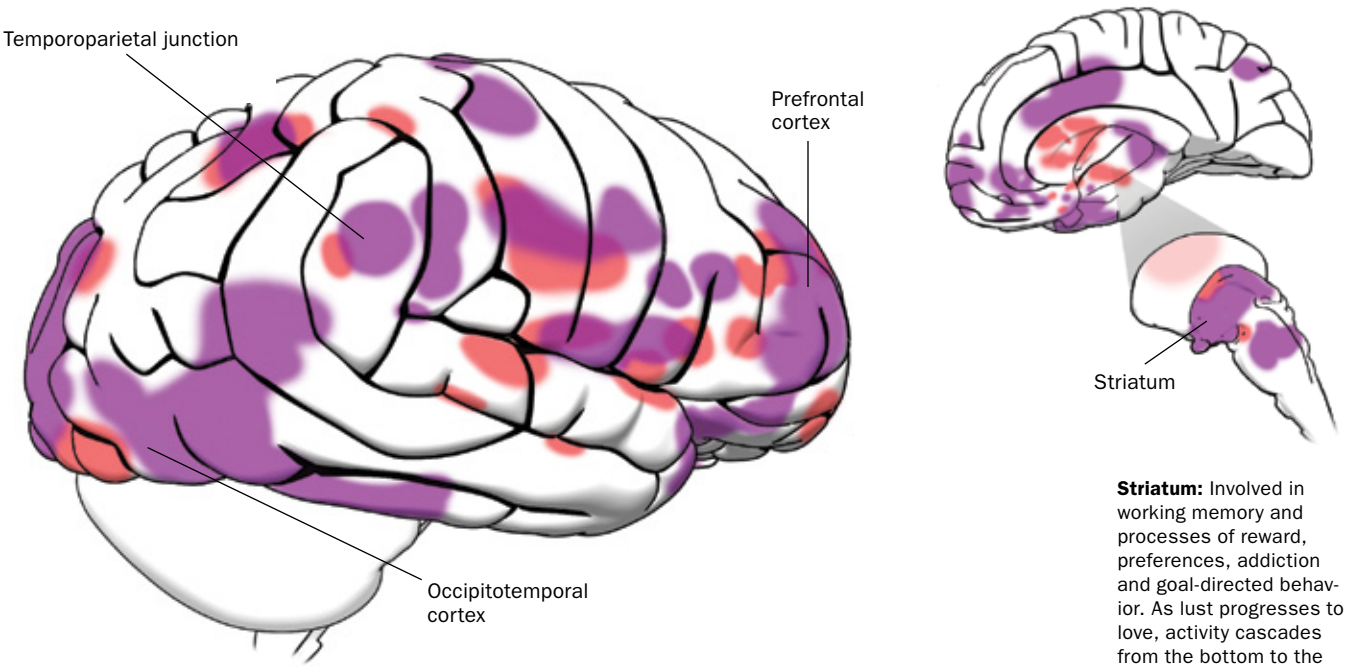
Right Hemisphere



Temporoparietal junction: Integrates bodily sensations and extracts a common, abstract mental representation from them. It also assists in the generation of empathy.

Occipitotemporal cortex: Linked with vision, associative memory, episodic retrieval and conceptual knowledge. The brain regions sustaining self-awareness and memories of experiences may tell this system what to interpret as sexually desirable and lovable and how to feel.

Prefrontal cortex: Generally associated with complex cognition, personality, decision making and social behavior. It also helps to regulate emotional arousal and the seeking of rewards.

Striatum: Involved in working memory and processes of reward, preferences, addiction and goal-directed behavior. As lust progresses to love, activity cascades from the bottom to the top, with the bottom active in response to sexual incentive cues and the top involved in tracking stimuli and activating stereotyped motor behaviors.

regions in the brain related to emotions, including euphoria, reward, motivation, addiction and body image. What is more, lust and love activate different parts of the same brain structures, the insula and the striatum.

A recent meta-analysis that we conducted of 20 studies with a total of 429 participants revealed that the posterior region of the insula activates more for lust than love and the anterior region of the insula activates more for love than lust. This back-to-front distinction is in line with a broader principle of brain organization: posterior regions are involved in current, concrete sensations, feelings and responses, and anterior regions are involved in the integration of abstract concepts ranging from the distant past to alternative futures. In this model, lust would be grounded in particular sensory and motor experiences, with love as a more abstract, future-oriented gloss on those experiences with another person.

Studies show that as lust progresses to love, activity cascades from the back of the insula to the front, with the pleasing sensations of lust (sparked at the back) joined by the abstract feelings of affection (triggered at the front). A similar pattern for lust and love emerges in the striatum, this time traveling from bottom to top.

The research suggests that the strongest relationship—passionate love—involves activation of the home bases of both love and lust. Passionate love builds on the neural circuitry for lust, adding regions associated with reward expectancy, habit formation, and abstract representation and control to those associated with rewards for sensations and the satisfaction of cravings.

For any two individuals, the strongest relationship is not necessarily the best outcome: some couplings are just meant to be one-night stands. Love and lust can exist in any combination, with either, both or neither emotion present, and present to any degree. The combinations result in a variety of affiliations. When both people feel the same emotions, the relationship can range from passionate love (high love, high lust) to acquaintanceship (a little of each), with one-night stands (high lust, little love) and companionate love (as in a friendly marriage) in the middle. When the feelings of two people diverge, the results may be unwanted attention for one and unrequited love or lust for the other. The ideal state in any pairing is when the two people agree on their love-lust formula, creating a healthy balance between love and desire and the best chance for a stable, satisfying, monogamous relationship. But whatever the end point, getting there is half the fun. M

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LUST's Reward

FOR MANY WOMEN, ORGASM REMAINS ELUSIVE. HELP MAY SOON BE AT HAND

BY **KAYT SUKEL**

Six months after the birth of her second child, Patricia, a woman with an active and fulfilling sex life, found herself unable to achieve orgasm. "My partner and I tried everything," she says. "And it was so frustrating because I'd almost reach climax, time and time again, and then … nothing."

After a few months, her frustration led her to visit a local clinic for sexual disorders. "They brought in a social worker who asked me a lot of questions about abuse. They seemed worried about possible psychological causes," she notes. After grilling her about her sexual habits, her marriage and other potential stressors, they suggested her inability to reach orgasm might be because of birth-related nerve damage. "They told me, 'Hopefully, the nerves will regenerate, but we don't know,'" she says. "And I left thinking, 'Wow, that was massively unhelpful.'"

They may say that all you need is love—but lust, love's partner in crime (or, as some may say, its evil twin), refuses to be denied. And like love, it begs to be fulfilled.

Patricia is far from alone in her frustration. The statistics vary, but most sources agree that less than one third of women consistently reach orgasm during sexual activity. If such an inability persists for more than six months and results in distress to the individual, the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM,* for short) classifies the condition as a psychosexual disorder: anorgasmia. The problem may be lifelong—the diagnosis for those who have never experienced an orgasm—or it may be acquired, as in Patricia's case. And although a small percentage of men acquire anorgasmia later in life, usually as the

result of chronic medical issues, anorgasmia is primarily a disorder of women.

Today scientists are hard at work to understand the causes of anorgasmia and inhibited sexual response. Laboratories across the globe are using a variety of imaging techniques to pinpoint what happens in the brain during orgasm, how ideation can interfere with sexual response, and how our hormones can help—or hinder—climax. Clinicians are now pulling together these different research threads in the hope of discovering new, more effective treatments.

Before scientists can figure out how to help people who cannot have orgasms, though, they need to better understand what happens in the brains and bodies of people who can. "We're only really beginning to understand the orgasm, especially from a neuroscience perspective," says Barry R. Komisaruk, a neuroscientist at Rutgers University.

Orgasm and the Brain

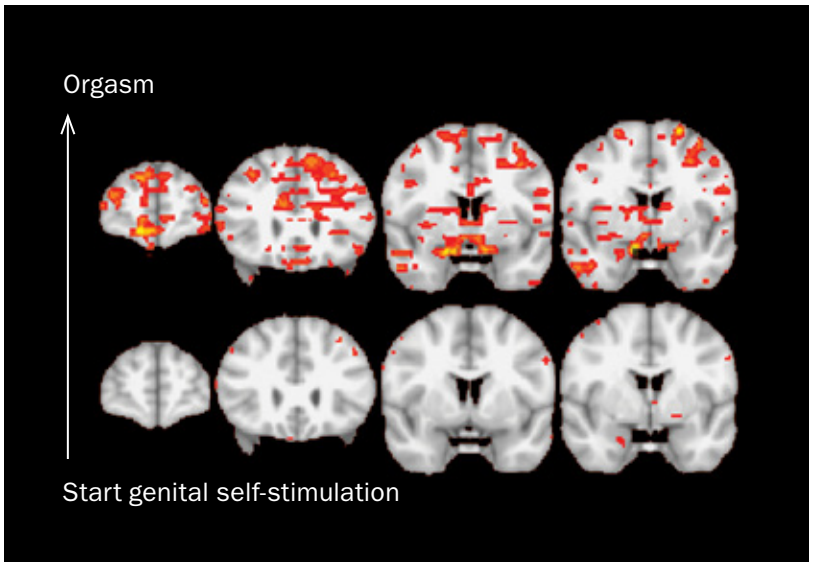
The first comprehensive scientific studies of orgasm were led by William H. Masters and Virginia E. Johnson in the 1960s. By considering both physiological and psychological factors, the duo came up with the four-stage model of sexual response: excitement (or arousal), plateau (full arousal), orgasm and resolution. They arrived at their findings primarily through direct observation in the laboratory; many of their initial study participants were professional sex workers. But the pair did not have the tools to investigate the neurobiological factors that might be in play.

Neuroimaging techniques such as positron-emission tomography and functional MRI are giving neuroscientists a unique way to study the phenomenon. Komisaruk and his colleague Nan Wise, a doctoral candidate at Rutgers and also a licensed sex therapist in New Jersey, have been using fMRI to study orgasm in a variety of populations.

I volunteered to be one of their guinea pigs. Komisaruk and Wise were looking to track the time course of the orgasm—identifying which areas of the brain are recruited during genital stimulation, during the orgasm itself, and then postclimax. By doing so, they may be able to find potential candidates for what Komisaruk calls a "blockage," or an area that may interfere with orgasm when not activated properly.

When it came time for me to do my part at their laboratory in Newark, N.J., I found myself a bit apprehensive. My romantic soundtrack would consist of the spine-jangling clunks, clanks and whirs of the fMRI's magnetic apparatus—about as far from Barry White as you can get. Clad in a paper-thin cotton hospital johnny, I was slotted into the machine's claustrophobia-inducing tubular metal housing, my head immobilized in a tight mesh mask to keep it as still as possible while the magnet virtually sliced my brain. I wasn't feeling particularly sexy. Would I be able to climax in such a setting?

I could but try. Using my hand to stimulate my clitoris while the scanner belched and bellowed overhead, I found that pure determination (and fear of disappointing the researchers



Activation in four sections of the author's brain (*shown here*) is higher during orgasm than when genital stimulation began. Active regions include the basal forebrain, nucleus accumbens, amygdala, anterior hypothalamus, insula and anterior cingulate cortex.

calmly waiting in the control room) did the trick. Within a few minutes, I pushed a button to let Komisaruk and Wise know that I had successfully donated my orgasm to science. The two then analyzed the data from my session, along with those from approximately a dozen other study participants, focusing on 80 discrete regions of the brain. They found a complex pattern of activation at the point of orgasm—suggesting many different ways to develop anorgasmia.

Parsing the interplay among all those regions is a daunting task. "We know the orgasm starts with activation in the sensory cortex," Komisaruk says. "But do anorgasmic people have a normal sensory cortex response? Is the sensory information not being integrated by other parts of the brain? We don't know yet."

Searching for Answers

In trying to identify the cause of anorgasmia, scientists are exploring different realms: the physiological, the psychological and the chemical. Cindy M. Meston, director of the Sexual Psychophysiology Lab at the University of Texas at Austin, points to a few well-known medical and physiological factors that inhibit orgasm, including the nerve damage that Patricia may have suffered. "There are vascular disorders, spinal cord injuries, neuropathy, drug effects from antidepressants and other medicines," Meston says. But, she adds, once you rule those factors out, no scientific evidence supports the idea that anorgasmia arises from dysfunctions in body systems.

A likelier culprit is the brain's frontal lobe. This part of the brain is responsible for executive function—allocation of the mind's attention and control as circumstances require. Komisaruk's fMRI studies show that at the point of orgasm, the frontal pole, part of the frontal lobe, fires in tandem with areas in the temporal lobe associated with the senses and with regions down deep, near the brain stem, that are associated with rewards.

Those linkages may account for a barrier to orgasm that Masters and Johnson called "spectatoring"—staying outside of a sexual encounter to monitor and judge it instead of fully experiencing it. The frontal lobe governs all that monitoring and judgment. "You may not get to the high level of arousal needed for orgasm if you are paying attention to what you look like, or how you measure up to past partners, or what's happening in your relationship instead of what you're actually feeling and experiencing during sex," Meston says. "That kind of stuff is just not conducive to increasing arousal—and so it's going to get in the way of your orgasm."

The primacy of the mind in sexual response helps to explain a seemingly counterintuitive finding in clinical practice: treating anorgasmia is easiest in individuals for whom it has been a lifelong condition. The reason is that attitude is easier to alter than physiology. "It's often a shame thing," says Wise, who has treated many patients as a sex therapist, "and once you give someone permission to explore their body, to masturbate and learn what feels good, they figure it out. After all, you have to learn how to play your own instrument before you can play in a band."

Directed masturbation, introduced back in the 1970s by Julia Heiman, now director of the Kinsey Institute, and Joseph LoPiccolo, a sex researcher at the University of Missouri, has proved to be remarkably effective in the treatment of lifelong anorgasmia. The technique is much as it sounds—patients work with therapists on focused masturbatory activities during one-on-one sessions. "A ton of research shows that women who have never had an orgasm can learn how just by learning more about their sexual anatomy and how to explore their own bodies," Meston says, with directed masturbation succeeding for about 90 percent of participants. As early as 1978, for instance, a study led by researchers Alan J. Riley and Elizabeth J. Riley of the University of London found that 18 of 20 women were able to reach orgasm after following a directed masturbation program. Other studies have since shown similar success. Indeed, the greatest obstacle to an antidote for anorgasmia may be squeamishness about masturbating in the presence of a stranger.

(The Author)

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COURTESY OF BARRY R. KOMISARUK *Rutgers University*

Acquired anorgasmia could require a different kind of toolkit. Sometimes partner conflicts are to blame; they can often be resolved with communication and psychotherapy. But what if talking does not provide the cure?

One day people may be able to fine-tune their own brain for a remedy. Komisaruk is optimistic that neurobiofeedback techniques will help in complex cases. In such a setup, a person hooked up to an electroencephalogram or an fMRI would see real-time displays of brain activity and learn to self-regulate and correct the problem. "Let's say we see that the genital sensory cortex response is normal but other areas down the line are not being activated," Komisaruk says. "We may be able to coach those with anorgasmia to voluntarily activate [those areas] and move themselves toward orgasm."

THE GREATEST OBSTACLE TO AN ANTIDOTE FOR ANORGASMIA MAY BE SQUEAMISHNESS ABOUT MASTURBATING IN THE PRESENCE OF A STRANGER.

Biofeedback has proved effective in the treatment of conditions such as blood pressure regulation and anxiety and has even helped stroke patients regain function in paralyzed muscles. But given how much is still unknown about the timing and sequence of neural connections during orgasm, this kind of system remains an exciting possibility for another day [see "A Transparent, Trainable Brain," by Heather Chapin and Sean Mackey; Scientific American Mind, March/April 2013].

Chemistry Matters

In the meantime, relief may come from intervention in our brain chemistry. Researchers studying animals and human patients have identified an array of neurochemicals that help to promote orgasm. Testosterone, a sex steroid, works its magic in the brain and the genitals, and although its role in female sexuality remains controversial, it is linked to feelings of both desire and arousal. Oxytocin, often called the "cuddle chemical," is released by the paraventricular nucleus—a small cluster of cells in the brain's hypothalamus—at the onset of climax. It then floods oxytocin receptors on cells in the nucleus accumbens, a reward center in the brain, and releases a glut of dopamine, a feel-good neurotransmitter, which delivers the pleasant rush that accompanies orgasm. To counter dopamine's effects (and keep us from having too much of a good thing, which could interfere with the brain's natural learning mechanisms or lead to addictive behaviors), the neurotransmitter serotonin and the protein prolactin act as brakes, resulting in feelings of satisfaction and relaxation after orgasm—although too much of either interferes with sexual response and may prevent orgasm from occurring.

Researchers of anorgasmia are now trying to fine-tune this natural pharmacopeia. One new female desire drug, Lybridos, under development by Dutch research firm Emotional Brain, consists of serotonin-inhibiting buspirone coated in testosterone. Preliminary results from a four-week trial conducted last year with 56 women who have hypoactive sexual desire disorder, or low libido, indicate that Lybridos may increase desire and orgasms more than a placebo or testosterone with a serotonin promoter.

Waguih W. IsHak, a psychiatrist specializing in sexual medicine at Cedars-Sinai Medical Center in Los Angeles, has successfully treated anorgasmia with oxytocin and Dostinex, an antiprolactin agent, in individual case studies. But IsHak expresses caution. Anorgasmia is more complicated than an imbalance in one or two chemicals—and tinkering with these natural systems may result in fixes that may be only temporary or that bring unwanted side effects. "These are innovative interventions," IsHak says. "But they should be used only as a last resort after you've ruled out everything else."

Patricia, who found her own visit to the clinic "massively unhelpful," regained her ability to reach orgasm after about three years. Her nerve damage, the likely cause, healed over time. In the future, better understanding of the brain may help improve diagnosis and treatment for individuals like Patricia—showing which pathways are damaged and perhaps how to redirect them. Wise is cautious but hopeful: "In more complex cases of anorgasmia, we're probably looking at a combination of psychological, social and biological factors. If we can figure out how they interact as we better map out what is happening in the brain during orgasm—perhaps identifying critical structures or processes in the timeline that push people from arousal over into orgasm—there's the possibility we can do a lot more."

And that's an outcome many women are waiting for. M

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THIS TWO-FACED EMOTION MOTIVATES US TO ACHIEVE, INTIMIDATE OTHERS AND CLIMB THE SOCIAL LADDER

PRIDE & POWER

BY **JESSICA L. TRACY** | ILLUSTRATIONS BY **I LOVE DUST**

Mark Zuckerberg did not invent Facebook because he wanted to find a new way of connecting millions of people all over the world. Nor did he found his multibillion-dollar company solely for the money, judging by his trademark jeans and hoodie sweatshirt. He did it, author Ben Mezrich implies in *The Accidental Billionaires,* because he wanted to show up a girl who dumped him and the guys in Harvard's most elitist social club. The desire to prove he was smarter than them gave Zuckerberg the motivation he needed to start on a path toward becoming one of the world's preeminent innovators.

Many successful people—Bill Gates, Margaret Thatcher and physicist Murray Gell-Mann come to mind—are driven not simply by wealth or a desire to solve a particular problem but rather by a need to *be the person who did it*. They want to feel pride.

Pride is what compels us to aim high rather than simply get by—and in this sense it is a virtue. Yet pride also has a darker side, a facet that has earned it a billing as a deadly sin. As my collaborator Richard W. Robins of the University of California, Davis, and I discovered in a series of psychological studies, people can feel pride in two very different ways. One type of pride motivates the hard work and creative thinking displayed by Gates and Zuckerberg. Another kind involves arrogance and egotism—think Donald Trump and Muhammad "I Am The Greatest" Ali. Depending on which kind of pride we feel, this emotion can have almost opposite effects on our thoughts and behavior. One brings out the very best in human nature, and the other elicits the worst. By understanding pride's two-sided nature, we can learn to harness this emotion to make the most of our goals and aspirations.

What Is Pride?

Pride is a pleasurable emotion that arises when people feel good about themselves, often in response to success. Almost a decade ago, when Robins and I began our studies on pride, psychological research into emotions placed great emphasis on those feelings with clear biological import. Inspired by Charles Darwin, researchers viewed emotions such as fear, anger, disgust and happiness as an evolved part of human nature that aided survival. Not so for pride and other so-called self-conscious emotions, which drew less interest. Because they require complex judgments about who we are and how we feel about ourselves, the self-conscious emotions were deemed socially constructed, rather than fundamental to our nature.

AUTHENTIC PRIDE GALVANIZES US TO PUT IN EXTRA EFFORT TO SUCCEED. SUCCESS, IN TURN, ALLOWS PEOPLE TO IMPROVE THEIR PLACE IN SOCIETY.

Psychologists were, however, producing a great deal of research on narcissism and self-esteem—two concepts relevant to pride but rarely explicitly linked to it. According to psychoanalytic theory, initiated by Sigmund Freud, narcissism is a classic defense mechanism. In this view, narcissists experience pride as a way to ward off unconscious insecurities and shame. Self-esteem research falls on the opposite end of the emotional spectrum. It seeks to understand the genuine good feelings people can hold about themselves.

As the emotion underlying narcissism, pride should promote aggression, hostility and conflict. As the emotion also underlying self-esteem, pride should spur achievement, perseverance and caring for others. Superficially, these two sets of behaviors could not seem farther apart. Nevertheless, we had good reason to believe they are indeed two facets of the same emotion—psychoanalytic researchers studying narcissism and social psychologists investigating high self-esteem assume that pride is a central emotion driving both personality profiles.

To solve this puzzle, we set out to learn what, exactly, pride is. Robins and I conducted a study in which we asked undergraduates to list the feelings and behaviors they associate with pride. We then analyzed the associations and dissociations among all the words in our collection—for example, "achieving" versus "successful" or "accomplished" versus "egotistical." These associations revealed to us that college students think of pride as *both* the destructive emotion that underlies narcissism *and* the achievement-promoting emotion that underlies self-esteem.

A similar analysis of how people react when they say they are proud of themselves netted complementary results. Judging by the emotions people reported, we determined, for example, that feeling productive tended to occur with feelings of self-worth but not arrogance. It seemed clear that we were

FAST FACTS

Good Pride, Bad Pride

1» Pride is a pleasurable emotion that arises when people feel good about themselves; it can bring out both the best and worst in human nature.

2» It appears to manifest as one of two types: hubristic pride and authentic pride.

3» Both types appear to facilitate the attainment of power and high status. Hubristic pride can harm mental health and damage friendships, however, whereas authentic pride can motivate achievement and concern for others.

looking at two types of pride—a distinction that helps us answer the age-old question of whether pride is a sin or a virtue. It can be either, and we have dubbed the two hubristic pride and authentic pride.

Yet it was clear that our participants viewed both feelings as part of the same emotion. As subsequent studies published in 2007 showed, participants identified both kinds of pride with a single nonverbal display—chest expanded, arms outstretched, head tilted slightly upward—which we coined the "pride expression."

We and other researchers have further learned that the two types promote different behaviors. Using questionnaires tailored to exploring pride, we found that individuals who frequently feel authentic pride have high self-esteem and tend to be extroverted, agreeable, creative and popular. These individuals also report wanting to help and advise others. They are generally communally oriented and more likely to engage in volunteer activities. In contrast, people who frequently feel hubristic pride have low self-esteem. They tend to be disagreeable, aggressive, manipulative, socially anxious and even clinically depressed, and more interested in derogating others than helping them.

Recall for a moment the psychoanalytic view of narcissism, that narcissists hold grandiose views of themselves not because they genuinely believe these inflated self-representations but because these views buffer them from unconscious insecurities. Integrating this theory with our research findings, we realized that hubristic pride and its associated aggressive and manipulative tendencies might allow narcissists to maintain an artificially positive sense of self. Derogating less powerful individuals so as to feel better about oneself is a well-known tactic of bullies, whether in the schoolyard or the corporate conference room.

In Search of Status

Although we now had an explanation for the purpose of pride—ensuring or restoring a positive sense of self—we still lacked a good framework for why hubristic pride exists in the first place. We needed a stronger theory to unite both facets.

Authentic pride motivates people to do the things that make them feel good about themselves, and those who are particularly successful at their pursuits—the Mark Zuckerbergs and Bill Gateses of the world—acquire status and power. In an evolutionary framework, status and power drastically increase our likelihood of surviving long enough to reproduce. To demonstrate how pride inspires people to work hard, psychologists Lisa A. Williams of the University of New South Wales in Australia and David DeSteno of Northeastern University made participants in their study feel authentic pride by praising their performance on a tedious cognitive task. Other participants received no feedback and, not surprisingly, reported far less pride.

They then asked all participants to complete a similarly tedious task for as long as they chose. Those who were made to feel proud persisted at the second task significantly longer than those who received no feedback. In fact, the more proud they felt, the longer they stuck with it. As this study illustrates, authentic pride galvanizes us to put in extra effort to succeed. Success, in turn, allows people to improve their place in society. Becoming a high-achieving, empathic person is a surefire route to gaining acceptance in a group. For a social species such as humans, that acceptance is a prerequisite for long-term survival.

But what about hubristic pride—how could an emotion that makes people act like jerks be adaptive? My student Joey T. Cheng and I were discussing precisely this question when we stumbled on an article written by our colleague Joseph Henrich, a psychologist at the University of British Columbia who is an evolutionary anthropologist by training. He had noticed that leaders in small traditional societies all over the world acquire power through two routes. He described some leaders as prestigious, meaning they had built up a set of skills or knowledge that benefited the group—and their compatriots hoped to learn from them. Other leaders, he noted, gained status simply through dominance: they used force to control resources and bully others into granting them power. Follow-

(The Author)

JESSICA L. TRACY is an associate professor in the department of psychology at the University of British Columbia and author of a forthcoming book on pride.

Pride-filled people spontaneously assume a pose of arms raised and chest puffed out, as these judo wrestlers illustrate. The wrestler at the left is congenitally blind, which suggests the expression is innate.

ers deferred to these aggressive, manipulative people because they felt they had no choice.

Cheng, Henrich and I teamed up to explore how this two-facet model of status attainment might help us understand hubristic pride. In a study published in 2010 we asked university varsity team members to rate one another's prestige and dominance. Then they rated themselves on their tendency to experience authentic and hubristic pride. As we expected, the athletes who tended to feel authentic pride were most likely to be viewed by their teammates as prestigious, and those who more often felt hubristic pride were considered dominant. This makes sense in light of Henrich's theory. Hubristic pride, we found, facilitates all the behaviors needed to become dominant: arrogance, a sense of superiority, and a willingness to intimidate and derogate others. Authentic pride, meanwhile, is ideally suited to prestige. It motivates achievement and concern for others.

Both types of pride seem to be adaptive because they help us secure social status—albeit through completely different routes. Yet we still wondered whether hubristic pride, with all its negative connotations, did serve us well in the long run. Sure, it might promote high rank in tribal groups of villagers, but would it do so in modern Western society? To address this question, the three of us brought groups of undergraduates who did not know one another into our lab, six at a time. We asked everyone to imagine being an astronaut lost on the moon. The challenge was to rank 15 items—oxygen tanks, signal flares, and so on—by how useful they were for survival. After completing this task in private, they were asked to do it again as a group and to use their private rankings to guide the discussion. We videotaped them as they talked. Finally, the subjects rated one another on prestige and dominance and on how much influence every person had over the group. We also asked other students who were not involved in the discussions to watch the video and rate our participants' influence.

As it turned out, the people in the group and the outside observers agreed that both highly dominant and highly prestigious individuals were the most influential group members. We also measured influence another way: we examined the extent to which every participant's private rankings on the task converged with the group's final decision. Our thinking was that those participants who were more influential would sway the opinion of other group members more successfully. Indeed, as we noted in our study published this year, both dominant and prestigious group members deftly convinced the group to adopt their rankings.

In short, dominance, just like prestige, helps us get our way and influence others. Hubristic pride gives people the necessary push to behave like arrogant jerks, which can win them power at the expense of friends. Like it or not, it pays to be a bully and not only in a prison or schoolyard—even in a group of high-achieving college students trying to solve a puzzle.

Should You Seek Pride?

But that doesn't mean that hubristic pride is a good idea. As we noted earlier, it can cost friendships, relationships and even mental health. Authentic pride, however, is critical: without it, we would not be motivated to reach the highest peaks of success. Authentic pride can be safely sought and nourished; in fact, accepting that pride is an important human motivator may allow us to pull off even greater feats. It is what makes us care whether we are good, hard-working people—pushing us to sign up for volunteering activities, for example, or to get involved in a political cause—and thus is a critical source of motivation.

The trick lies in recognizing the inherent riskiness of certain prideful feelings. Research has yet to clarify how we cross from one kind of pride to the other, but we have some early hints. When we become too dependent on our pride—when it goes beyond being motivating and becomes a crutch for our sense of self—it can become dangerous. For example, finding ourselves more interested in basking in the glow of a compliment than taking pleasure in a hard-earned success can be a clue that our pride has become hubristic and potentially damaging. Given that prestige reaps the same benefits as dominance, those who have the self-awareness to choose one over the other can attain all the benefits of pride, without the costs. M

BOB WILLINGHAM

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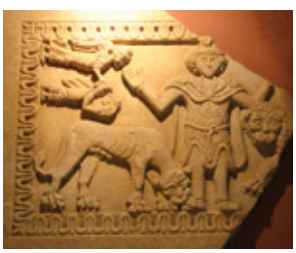

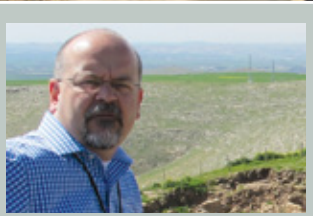

YOUR GUIDE: HAKAN EDIRNE

Hakan Edirne was born in Izmir, Turkey, and studied archaeology at Ege University, where he graduated in 1994. After working on archaeological excavations in the Aegean region of Turkey, Edirne earned his professional tour guide license, and has led numerous archaeological, historical, and biblical study tours.

Watch the National Geographic short (February 2013) on the meaning of Gobekli Tepe.

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The Cutting Edge

People who intentionally hurt themselves are often seeking relief from pain

BY HAL ARKOWITZ AND SCOTT O. LILIENFELD

"YOU DON'T FEEL like you're hurting yourself when you're cutting. You feel like this is the only way to take care of yourself," a young woman we will call Alice told journalist Marilee Strong for her 1998 book, *A Bright Red Scream: Self-Mutilation and the Language of Pain*. As with many adolescents and young adults, Alice habitually harmed herself by cutting her arms and wrists.

Such behavior has long puzzled laypeople and scientists alike. Many have assumed that it is the same as a suicide attempt or a ploy to manipulate others. In reality, a person who deliberately engages in self-harm may be at risk of suicide, but the act is, by definition, not an attempt to mortally wound. In addition, there are numerous reasons for the behavior, attention seeking being only one of the more rare ones. Indeed, as Alice's comment suggests, people drawn to these behaviors often report that their actions bring positive psychological effects. Recent work suggests that self-injury might in some cases provide a form of pain relief, an insight that might lead to new treatments for the condition.

Deliberate Destruction

In a 2009 book psychologist Matthew K. Nock of Harvard University defined nonsuicidal self-injury as "the direct and deliberate destruction of one's own body tissue in the absence of suicidal intent." By far the most common method of self-harm is cutting and scratching the skin. Other means of hurting oneself include head banging, hitting, burning, and picking at wounds, thereby interfering with their healing. In rare cases, people go to grotesque extremes, such as self-castration or plucking out their eyes.

Self-harming is neither uncommon nor new. During the late 19th century European women were known to puncture themselves with needles. More recently, the list of public figures who have self-injured includes Princess Diana, actors Johnny Depp and Angelina Jolie, singers Amy Winehouse, Courtney Love and Marilyn Manson, and an early pioneer in sex research, Alfred Kinsey.

In 2011 psychologist E. David Klonsky of the University of British Columbia surveyed by telephone 439 randomly selected adults between the ages of 19 and 92 about whether they currently or had ever engaged in self-injury and, if so, when such behavior occurred and the types of injury inflicted. His data revealed that a staggering 6 percent of his sample displayed some kind of self-injurious behavior during their lifetime. Klonsky found that self-injury usually begins between the ages of 13 and 15 and is most frequent among adolescents. Only 35 percent of the subjects started hurting themselves at or after age 18. Half of those who harmed their own body used more than one method to do so. Results of studies on gender differences are mixed, but most find the habit

COURTESY OF HAL ARKOWITZ (*Arkowitz*); COURTESY OF SCOTT O. LILIENFELD (*Lilienfeld*); DANIEL STOLLÉ (*illustration*)

to be more common among women.

Worse than the wounds themselves—although these sometimes require medical treatment—is the heightened risk of attempted and actual suicide among chronic self-injurers. Numerous researchers have found a strong association between self-harm and suicidal behaviors, such as thoughts of, plans for and attempts at suicide, as well as completed suicide. In a 2002 review article psychiatrist David Owens of the University of Leeds in England reported that more than 5 percent of patients hospitalized for self-harm died by suicide within nine years of their discharge.

Self-injury was once thought to be limited to borderline personality disorder, a serious illness marked by instability in mood, identity, impulse control and relationships. We now know that people who physically abuse themselves very likely are afflicted with any of various mental illnesses. These ailments include major depression, bipolar disorder, anxiety disorders, eating disorders, schizophrenia and some personality disorders, including the borderline type [see "The Truth about Borderline Personalities," by Scott O. Lilienfeld and Hal Arkowitz; Scientific American Mind, January/February 2012].

To highlight its pathological significance, nonsuicidal self-injury was for the first time categorized as a distinct condition in the 2013 edition of the American Psychiatric Association's diagnostic manual, *DSM-5*. Rather than being an official diagnosis, however, the problem appears in a section of the publication entitled "Conditions for Further Study," which lists behaviors or issues that merit further research. The new entry emphasizes that self-injury is not associated with one particular mental illness and may constitute a stand-alone problem. For example, some people might be diagnosed with major depressive disorder and nonsuicidal self-injury to distinguish that person from someone who is depressed but does not harm himself or herself.

Coping and Changing

Despite numerous attempts to determine why people deliberately hurt themselves, no one is certain of the answer. When asked why they do it, individuals most commonly say their actions help them suppress or release negative emotions, such as anxiety, anger or depression. Psychiatrist Leo Sher, then at Columbia University, and Columbia psychologist Barbara Stanley concluded in 2009 from their review of biological research that self-injury releases opiatelike chemical messengers in the brain known as endorphins. The release leads to a euphoric state that reduces pain and offers reprieve from emotional distress, supporting the reason most self-injurers give for their behavior. This state may also explain why people such as Alice say they feel as if they are being good to themselves. A smaller percentage of afflicted individuals report that the pain helps to snap them out of an emotional numbness, that they want to punish themselves for wrongdoing or that they are using their injuries to get attention from others.

Based on the endorphins hypothesis, some researchers have examined whether naltrexone—a drug used to treat alcohol dependence that blocks the release of these hormones in the brain—might limit this self-destructive behavior by reducing its palliative properties. So far, however, the results of studies of the effectiveness of this and other medications for the condition have been unconvincing.

For now an approach called dialectical-behavior therapy, developed by psychologist Marsha M. Linehan of the University of Washington, offers the best hope for patients. In this therapy—which was initially designed for people with borderline personality disorder, 80 percent of whom self-injure—clients learn how to better tolerate stress and reduce negative feelings, among other coping strategies. The approach combines emotion-regulation techniques used in cognitive-behavior therapy with mindfulness training, which emphasizes acceptance and living in the moment. At least five well-designed studies show that dialectical-behavior therapy reduces rates of self-injury in individuals and lowers the number of suicide attempts and episodes of substance abuse in people with personality disorders.

Although its effectiveness in people with other psychological problems remains unsubstantiated, the treatment is an excellent starting point for the Alices of the world who need less harmful ways to take care of themselves. M

> In one study, **a staggering 6 percent** of 439 adults displayed some type of self-injurious behavior during their lifetime.

HAL ARKOWITZ and SCOTT O. LILIENFELD serve on the board of advisers for *Scientific American Mind*. Arkowitz is an associate professor of psychology at the University of Arizona, and Lilienfeld is a psychology professor at Emory University.

Send suggestions for column topics to editors@SciAmMind.com

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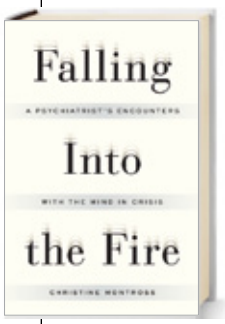
- **Doing Dialectical Behavior Therapy: A Practical Guide.** Kelly Koerner. Foreword by Marsha M. Linehan. Guilford Press, 2012.

books



ILLUSIVE BRAIN

Falling into the Fire: A Psychiatrist's Encounters with the Mind in Crisis

by Christine Montross. Penguin Press HC, 2013 ($25.95)

If Joan of Arc were alive today, she probably would not be heralded as a saint. The 15th-century French peasant girl instead would be institutionalized or put on heavy antipsychotic medications for claiming divine visions urging her to overthrow the English government. As our knowledge of the brain has advanced since those days, so, too, has our approach to treating mental illness. Yet we still face significant gaps in knowledge.

In *Falling into the Fire,* psychiatrist Montross describes her experience as a resident and attending physician in a hospital ward. Her tale reveals the incredible challenges psychiatrists face when trying to understand, diagnose and treat severely mentally ill patients.

Consider Eddie, a man who endured 25 elective cosmetic procedures in an attempt to rid his skin of acne, despite having no blemishes. Montross diagnosed Eddie with body dysmorphic disorder, a condition in which patients obsess about one aspect of their body, often checking their imagined affliction hundreds of times a day. Eddie refused the treatments Montross proposed, believing he would be better off saving his money for another plastic surgery. The episode left Montross feeling helpless. She lacked the tools to help difficult patients who reject sound judgment and potentially lifesaving treatment.

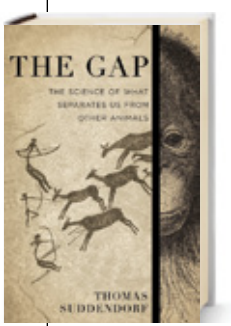
Eddie was not the only baffling case. One day a patient named Colin entered the clinic calmly stating he was Jesus. People claiming to be possessed by divine or demonic entities are not as rare as one might think. He showed many symptoms of a strange condition known as Jerusalem syndrome, which manifests most commonly in travelers who visit the Holy Land and suddenly begin wrapping themselves in tunics and preaching scripture.

When Montross saw him, Colin appeared harmless and blissful, but his girlfriend said he had been behaving strangely, such as urinating in soda bottles. Euphoria often opens the floodgates to psychosis, so before her shift ended, Montross sent Colin home with orders to take an antipsychotic. But her limited time with him and understanding of his illness precluded her from assessing the best course of treatment or ascertaining whether he was a threat to himself or others. Montross left the hospital that night feeling uneasy, thinking perhaps she had underestimated Colin's mental illness.

Reflecting on her experiences, Montross writes: "As psychiatrists, we see the mind while it careens and lists, and we are not always sure how—or whether—we can right it. How do we respond when a patient's suffering breeds unbearable discomfort and unease within our own selves?"

Many of the case studies leave the reader hanging. A psychiatric ward physician may see patients only once during their stay and never know what becomes of them later. Uncertainty comes with the territory. In psychiatry as in everyday life, there are no easy fixes or cures. Sometimes, Montross writes, empathy is the best or only tool at our disposal.

—Brian Mossop



LAST MAN STANDING

The Gap: The Science of What Separates Us from Other Animals

by Thomas Suddendorf. Basic Books, 2013 ($29.99)

As recently as 30,000 years ago, several species of upright-walking, intelligent hominins shared the earth with our ancestors. Tiny *Homo floresiensis* made stone tools on the island of Flores in Indonesia, Denisovans inhabited caves in southern Siberia, and Neandertals, with brains at least as large as our own, ranged across Ice Age Europe and the Middle East. They learned to survive in the cold, used fire, wore clothes, cared for the sick, buried the dead and maybe even wore jewelry. These fellow members of the genus *Homo* most likely shared many qualities we now deem uniquely human. We can claim to be exceptional among the animals, psychologist Suddendorf writes, only because our closest relatives have gone extinct.

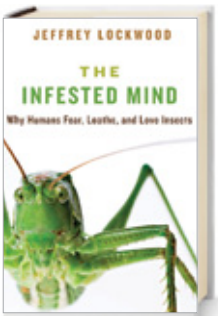
In *The Gap,* Suddendorf examines the apparent chasm that separates humans from other animals. He covers six domains—language, mental time travel (thinking about the past and future), theory of mind (thinking about thinking), intelligence, culture and morality—in which multitudes of clever studies have probed the minds of animals and, for comparison, young children. What does it mean that great apes can recognize themselves in the mirror and monkeys cannot? Whales learn songs from one another, but does that count as culture?

"If you set the bar low," Suddendorf writes, "you can conclude that parrots can speak, ants have agriculture, crows make tools, and bees cooperate on a large scale." He sets the bar higher. Although he presents both "romantic" and "killjoy" interpretations of animal ability, his sure-handed, fascinating book aims neither to exaggerate the wisdom of animals nor to promote the exceptionalism of human beings.

Instead Suddendorf distills the gap into two overarching capacities: the ability to imagine different scenarios beyond what our senses perceive and a strong drive to link our minds together, by looking to one another for information or understanding. These two capacities transform common animal traits into distinctly human ones: communication into language, memory into planning, and empathy into morality. Suddendorf reminds us that many extinct hominins shared both capacities, making them more similar to us than to the great apes.

Ultimately, taking measure of the current gap may be less important than understanding how it came to be. Genetic evidence shows some interbreeding between *Homo sapiens* and Neandertals. Nevertheless, we very likely had an unfriendly hand in their extinction, through violence or competition. Suddendorf, exercising his own fine scenario-building skills, asks whether we will continue to widen the gap by driving the great apes, already endangered, to extinction. Will our grandchildren think themselves more extraordinary for having monkeys as their closest living relatives?

—Nina Bai



FEAR FACTOR

The Infested Mind: Why Humans Fear, Loathe, and Love Insects

by Jeffrey Lockwood. Oxford University Press, 2013 ($24.95)

Salvador Dalí, the surrealist painter, was so afraid of grasshoppers that he jumped from a second-floor window at the sight of one. The 19 million Americans who suffer from insect phobias can relate, and I count myself among them. Lockwood suffered his own debilitating bout of grasshopper phobia after encountering a seething swarm, "a bristling carpet of wings and legs." But unlike most entomophobes, Lockwood has made a scientific career of studying grasshoppers.

In *The Infested Mind,* Lockwood shifts from entomology to psychology to examine the fascination that first drew him to insects and the terror that later repelled him. His exploration of our complex relations with these critters makes for an engrossing book. For the entomophobic reader especially, the experience is at times thrilling (watch out for the photos!) and therapeutic.

Entomophobes endure "a remarkable inner world of faulty reasoning, distorted perceptions, and selective perspectives," Lockwood writes. Yet even those without full-blown phobias share some level of fear and disgust toward insects and other "bugs" such as spiders and centipedes. Lockwood dissects the many ways these creepy-crawlies make us shudder and gag. Fear is a reaction to present danger. We are afraid of erratic motion (scurrying cockroaches) and alien features (exoskeletons, too many limbs). Disgust is a protective response against contamination, both physical and psychological. We are disgusted by morbid associations (maggots), excess fecundity (swarming locusts) and the invasion of our body (parasitic worms).

Is our aversion to insects evolutionarily ingrained or socially constructed? It seems silly to be instinctively fearful of creatures that are more likely than not harmless and sometimes even nutritious. The evolutionary psychologist, however, might contend that it is better to be safe from a harmless grasshopper than to be sorry from a deadly black widow. As with most questions of nature versus nurture, the answer lies somewhere in between.

With sensitivity and gusto, Lockwood tours the extremes of the "infested mind," including sexual fetishes involving crawling ants, insects as instruments of psychological torture, and infestations that flourish only in the imagination. We learn that poor Dalí's delusory parisitosis once drove him to attack his own back with a razor blade, trying to excavate an insect that was really just a pimple.

Only one in eight entomophobes seeks treatment, perhaps because the current gold standard, cognitive-behavior therapy, requires exposure to the dreaded insect, along with a rational examination of the fear. This means I would have to confront a caterpillar. Maybe someday. —*Nina Bai*

(ON OUR SHELF)

Masterminds and Wingmen: Helping Our Boys Cope with Schoolyard Power, Locker-Room Tests, Girlfriends, and the New Rules of Boy World
By Rosalind Wiseman. Harmony Books, 2013

Wiseman brings you into the cleverly cloaked world of boys. I read the book because it had begun to dawn on me that my preteen son was telling me very little about his social life. I had assumed that no news was good news, but as Wiseman explains, this notion is usually false in the case of boys.

—*Ingrid Wickelgren*
Editor

The City & the City
By China Miéville. Del Rey, 2009

Set in a shadowy world, what looks at first like a hard-boiled detective novel ends up being a parable about social mores—their necessity and their evil. I found myself transfixed as Miéville reveals an imagined city's laws about what residents can see and are forced to "un-see." When the protagonist looks where he should not, the consequences he faces made me question my assumption that truth should always triumph over illusion.

—*Karen Schrock Simring*
Contributing editor

Thief of Time: Philosophical Essays on Procrastination
Edited by Chrisoula Andreou and Mark D. White. Oxford University Press, 2010

I picked up *Thief of Time* to research an article on procrastination, in this issue. Yet the book is intellectually gratifying in its own right. When we act against our better judgment, do we exercise free will? Perhaps procrastination is an illusion—a sign of hypocrisy regarding our stated goals. I would never have guessed that the study of time wasting could be so fruitful!

—*Sandra Upson*
Managing editor

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Being **Our Best**

Three books describe how to thrive

How we think strongly influences our physical and emotional well-being. But according to physician and researcher Hilary Tindle, being optimistic may have a more far-reaching effect. In **Up: How Positive Outlook Can Transform Our Health and Aging** (Hudson Street Press/Penguin Group, 2013), Tindle reveals that seeing the world through rosier-colored glasses can improve physical health and slow the aging process. She provides readers with seven strategies to enhance their outlook, such as meditation techniques, to help them put a more positive spin on life.

Yet unrealistic optimism can incur costs. It is easy to look at your peers who ooze self-assuredness and wonder how they navigate social situations so seamlessly or approach a job interview with such certainty. What is less well recognized is that lower self-confidence may be an asset, especially in the workplace. In **Confidence: Overcoming Low Self-Esteem, Insecurity, and Self-Doubt** (Hudson/Penguin, 2013), Tomas Chamorro-Premuzic, professor of business psychology, reveals that people with lower self-confidence are often more motivated and self-aware and better able to take criticism constructively. To avoid tipping too far toward self-criticism, he offers tips to help keep insecurities in check.

If you scrape your knee, you know the protocol to heal. But there is no clear prescription for getting through a break-up or a death in the family. In **Emotional First Aid: Practical Strategies for Treating Failure, Rejection, Guilt, and Other Everyday Psychological Injuries** (Hudson/Penguin, 2013), clinical psychologist Guy Winch offers advice for how to cope with life's emotional wear and tear. Winch describes a range of common psychological issues, including loneliness and unhealthy rumination, and provides ways to increase our emotional resilience. Failure and loss are a natural part of life, he says, and embracing them can help make us stronger in the long run. —*Victoria Stern*

askthe**Brains**

Why do some people feel as though one of their body parts is not truly part of them and go to crazy lengths to get rid of it?

—***Emily Lenneville,*** *Baltimore*

Paul D. McGeoch, *a visiting scholar at the Center for Brain and Cognition at the University of California, San Diego, answers:*

CERTAIN PEOPLE HOLD a deep desire to amputate a healthy limb. They are not psychotic, and they fully realize that what they want is abnormal. Nevertheless, they have felt from childhood that the presence of a specific limb, usually a leg, somehow makes their body "overcomplete." Ultimately, many will achieve their desired amputation through self-inflicted damage or surgery.

During the past few years my work with neuroscientists Vilayanur S. Ramachandran of U.C.S.D. and David Brang of Northwestern University, along with research by neuroscientist Peter Brugger of University Hospital Zurich in Switzerland, has transformed our understanding of this condition. Our findings suggest that a dysfunction of specific brain areas on the right side of the brain, which are involved in generating our body image, may explain the desire.

Bizarre disorders of body image have long been known to arise after a stroke or other incident inflicts damage to the right side of the brain, particularly in the parietal lobe. The right posterior parietal cortex seems to combine several incoming streams of information—touch, joint position sense, vision and balance—to form a dynamic body image that changes as we interact with the world around us.

In brain scans, we have found this exact part of the right parietal lobe to activate abnormally in individuals desiring limb removal. Because the primary sensory areas of the brain still function normally, sufferers are able to see and feel the limb in question. Yet they do not experience it as part of their body because the right posterior parietal lobe fails to adequately represent it. The mismatch between a person's actual physical body and his or her body image seems to cause ongoing arousal in the sympathetic nervous system, which may intensify the desire to remove the limb. Given that sufferers date these feelings to childhood, the right parietal dysfunction most likely is congenital or arises in early development.

Based on our research, we have proposed the name "xenomelia" for the condition, which comes from the Greek for "foreign" and "limb." The study of this condition has served to illuminate how the normal human brain functions and how body image emerges in us all.

> Certain people hold a deep desire to amputate a healthy limb. They are not psychotic.

How does virtual-reality therapy for PTSD work?

—***Lauren Sippel,*** *State College, Pa.*

Robert N. McLay, *author of* At War with PTSD: Battling Post Traumatic Stress Disorder with Virtual Reality, *responds:*

POST-TRAUMATIC STRESS DISORDER (PTSD) can appear after someone has survived a horrific experience, such as war or sexual assault. A person with PTSD often experiences ongoing nightmares, edginess and extreme emotional changes and may view anything that evokes the traumatic situation as a threat.

Although medications and talk therapy can help calm the symptoms of PTSD, the most effective therapies often require confronting the trauma, as with virtual-reality-based treatments. These computer programs, similar to a video game, allow people to feel as if they are in the traumatic scenario. Just as a pilot in a flight simulator might use virtual reality to learn how to safely land a plane without the risk of crashing, a patient with PTSD can learn how to confront painful reminders of trauma without facing any real danger. Virtual-reality programs have been built to simulate driving, the World Trade Center attacks, and combat scenarios in Vietnam and Iraq. The level of the technology varies considerably, from a simple headset that displays rather cartoonish images to Hollywood-quality special effects.

A therapist typically observes what patients are seeing while they navigate the virtual experience. They can coach a patient to take on increasingly difficult challenges while making sure that the person does not become overwhelmed. To do so, some therapists may connect the subject to physiological monitoring devices; others may use virtual reality along with talk therapy. In the latter scenario, the patient recites the story of the trauma and reflects on it while passing through the simulation. The idea is to desensitize patients to their trauma and train them not to panic, all in a controlled environment.

The jury is still out as to whether virtual reality is superior to other forms of therapy for PTSD. Several studies have demonstrated that symptoms improve after virtual-reality exposure, and at least one study, which used functional MRI, indicated that the therapy tends to restore patients' brain activity to more normal patterns. No treatment works for everyone, however. Even in the most successful tests of virtual reality, about a quarter of patients continue to meet criteria for PTSD after treatment. Virtual reality may be a useful weapon in the battle against PTSD, but it is by no means the end of the war. M

Have a question? Send it to editors@SciAmMind.com

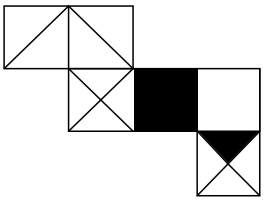
JAMIE CARROLL *iStockphoto*

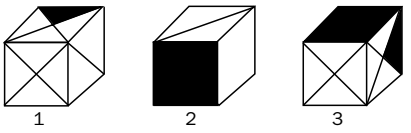
Head Games

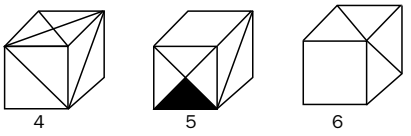
Match wits with the Mensa puzzlers

1 SPATIAL SENSE

Which of the six cubes below cannot be made from the unfolded cube at the top?

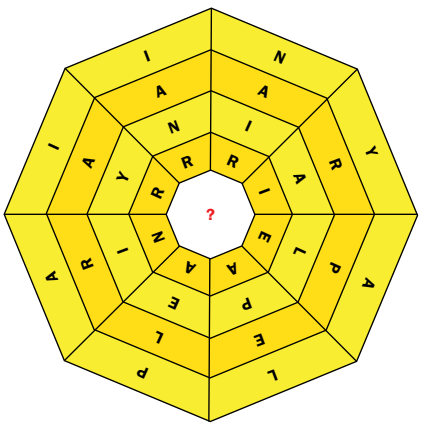






2 COMMON GOAL

If you take the letters in each of the sections reading down toward the center, add the mystery letter from the middle, then unscramble each group, you will make eight different five-letter words.



3 FILL IN THE BLANKS

Each of the following words contains the letters NOV. Using the definitions, complete the words.

A cosmic incident: _ _ _ _ _ N O V _

Still a mystery: _ N _ O _ V _ _

Teller of tales: N O V _ _ _ _ _

4 PREFERENCES

Reese likes 361 but not 360; she likes 900 but not 800; and she likes 576 but not 575. Does she like 1,600 or 1,700?

5 HEADY LABOR

If six puzzle makers can compose nine puzzles in a day and a half, how many puzzle makers does it take to compose 270 puzzles in 30 days?

6 WORD MATH

Replace each letter below with a number so that the addition will be correct. (Hint: K = 9.)

```
  M O M
  M O M
+   N O
-------
  B O O K
```

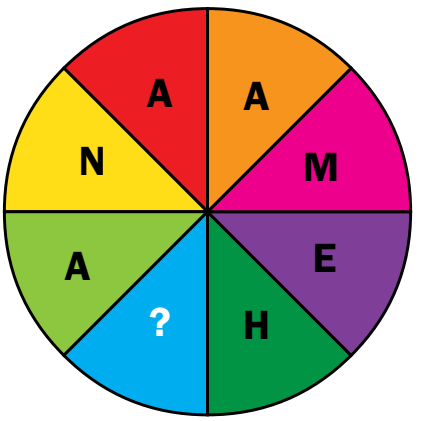
7 MYSTERY MULTIPLICAND

The following multiplication equation uses all the digits from 0 to 9. Three numbers have been filled in to get you started.

```
  ? ? ?
×   ? 3
-------
5 ?, ? 0 ?
```

8 WORD WHEEL

Find the eight-letter word spelled out in the wheel below by figuring out the missing letter.



9 CONFOUNDING COMPOUNDING

The same four-letter word can be added to each of the following words to make a common word or phrase. What is the word?

CHECK

PROOF

FALL

DANCE

OUT

Answers

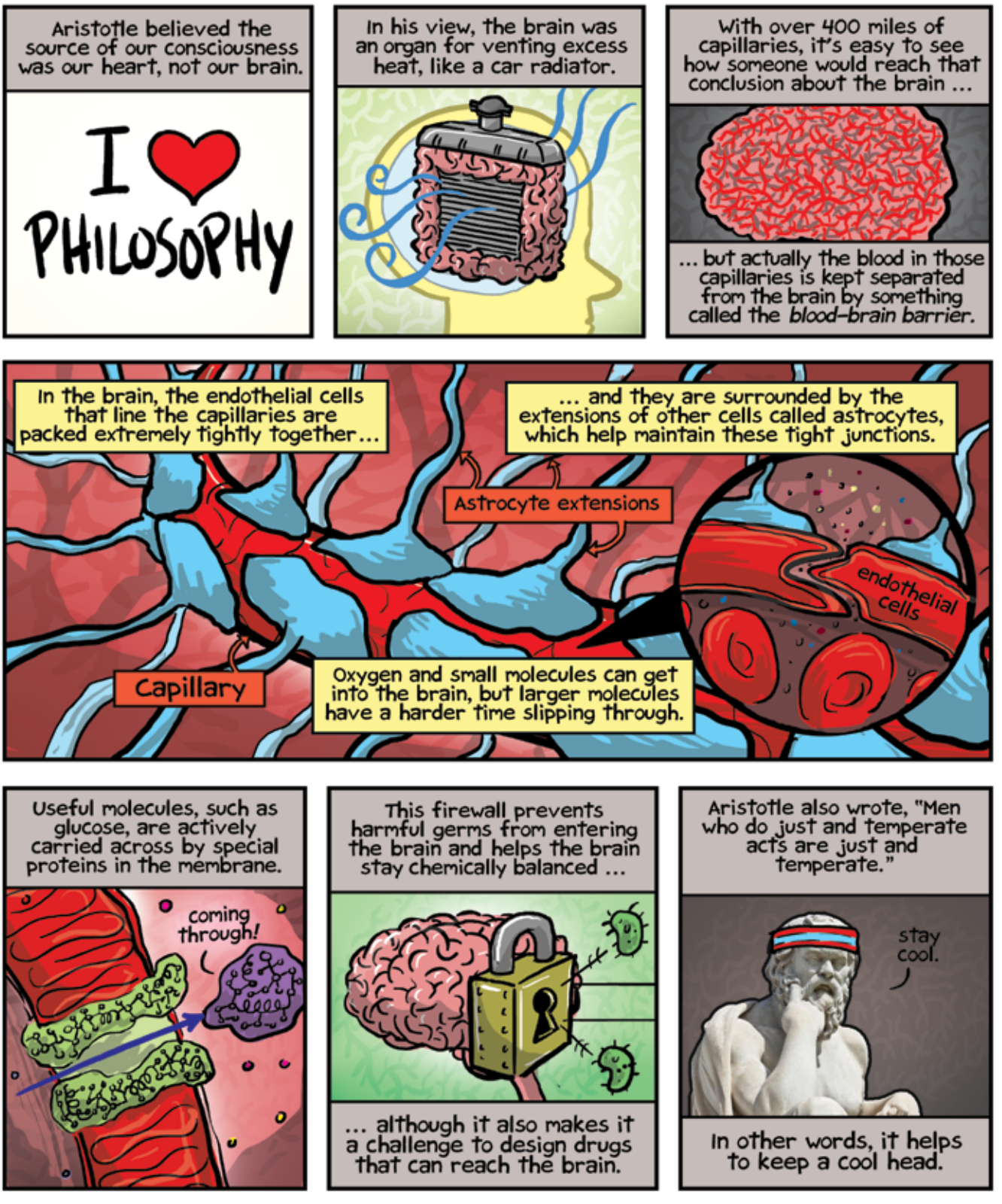
1. Cube 5.
2. The missing letter is D. The words are DRAIN, NADIR, DINAR, DIARY, DAIRY, PALED, PLEAD and PEDAL.
3. SUPERNOVA, UNSOLVED, NOVELIST.
4. 1,600. (Reese likes perfect squares.)
5. Nine. (Each puzzler can compose one puzzle a day.)
6. B = 1, N = 4, O = 5, M = 7, K = 9.

```
  927
×  63
------
58,401
```

8. ANATHEMA.
9. RAIN.

ARISTOTLE'S RADIATOR

by DWAYNE GODWIN & JORGE CHAM



Dwayne Godwin is a neuroscientist at the Wake Forest University School of Medicine. Jorge Cham draws the comic strip Piled Higher and Deeper *at www.phdcomics.com.*

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