

Monday, Mar. 05, 2012, TIME Magazine

Getting to No

By Jeffrey Kluger

Pity your prefrontal cortex--the CEO and chief justice of the bedlam that is your brain. It's the prefrontal that has to reconcile the artiste of your right hemisphere with the logician of your left, the tough guy of your hypothalamus with the drama queen of your anterior cingulate cortex. All that seems like more than enough. But then comes the job of wrangling the dorm rats and party animals of your midbrain, the place where your most decadent appetites--for drinking, gambling, eating, smoking, shopping, sloth, sex--come to get fed.

The battle between your noble lobes and your ignoble ones isn't even close. Eating, having sex and sleeping are vital for the survival of the species, so evolution arranged for them to be irresistibly pleasurable. Acquisitiveness is important too, so shopping and gambling carry kicks of their own. As for smoking, drinking and taking drugs, they have no survival value, but they don't need to, since they sidestep evolution and pick the chemical locks of the brain's pleasure centers directly.

The higher brain isn't completely unarmed in this fight. Indeed, it has one very powerful resource on its side: willpower. You need to lose 20 lb. (9 kg), so you pass up dessert and double down on exercise, and when your resolve starts to slip, you square your shoulders and push on through. The same resolve is at work when you say no to the new gadget you really, truly want but really, truly can't afford and even (or especially) when that sexy co-worker flirts with you at a party and you shake off the heady feeling and go home to your spouse and kids. We work that willpower muscle every day--and like any muscle, it often goes weak. Also like a muscle, however, willpower can be strengthened, and a growing number of researchers--using brain scans, virtual reality and more--are learning what kind of psychic calisthenics it takes to get us in shape. Much of that research

hasn't made it into popular consciousness yet, but the more the scientists publish, the more we all learn.

"Our brains operate at three levels: I will, I won't and I want," says psychologist Kelly McGonigal, author of *The Willpower Instinct* and a professor at Stanford University. "For many of us, the I-want part wins."

It's easy to call a lot of this addiction, particularly when drugs, alcohol or behaviors like gambling are involved. But that can be glib. Addiction is not always easy to define, but it might best be described as knowing that a substance or behavior is wrecking your life and yet being unable to stop. Failure of will is more about behaviors that are compromising your life--making it less healthy or prosperous than it could be--yet can't quite be controlled even though you try.

It's no wonder we get fatigued from the effort. Just deciding what to eat in the course of a day requires us to make 227 discrete choices, according to McGonigal. And food is only part of it. Every evening brings a happy hour that invites you to join; every block brings a store that's designed to make you buy. "We're living in a world that is constantly tantalizing the reward centers in our brains--retail, phones, computers," says McGonigal. "Short bursts of dopamine that come from things like e-mail make it hard to focus on long-term goals."

That comes at a high price. According to a 2007 study in the *New England Journal of Medicine*, 40% of all deaths are attributable to what behavioral researchers call poor self-regulation--the kind that causes 45 million American adults to continue to smoke, 67% to qualify as overweight or obese and nearly 600,000 to die of cardiovascular disease each year.

But if willpower is elusive, it's also "trainable and cultivatable," according to Roy Baumeister, a psychologist at Florida State University and one of the leaders in the new field. Baumeister and journalist John Tierney have written a book, *Willpower*. Yet

another, *The Power of Habit* (see box), by journalist Charles Duhigg, will add to the growing canon. The challenge could not be clearer. "The simple truth is that the brain evolved from the back to the front," says Baumeister. "The back is the wanting part, the front is the restraint part, and they're both with us all the time." The goal of this rising band of willpower researchers is to make peace between back and front.

It's All in Your Head

The I-want foot stomping of the lower brain may be trouble now, but it was not designed with moderation in mind. Human beings emerged in a world in which resources were highly limited and there was no percentage in reflecting too much on whether and when we availed ourselves of them. "It's a very adaptive system," says social neuroscientist Todd Heatherton of Dartmouth University. "You see an attractive food, you eat it. You see an attractive partner, you act on that too."

We don't even need real food or a real partner for those seize-the-moment impulses to be activated. Heatherton likes to describe experiments in which undergraduate males--a group motivated to mate if ever there was one--answer an onscreen questionnaire about how they might behave in situations that offered the possibility of reckless or dubious sex. Not surprisingly, the subjects generally rate themselves highly, predicting they'd behave honorably at all times. One way to make the scores plummet? Leave a picture of a scantily clad woman somewhere within the subjects' line of sight during the test. "You sensitize the reward system, so the impulse center of the brain goes up and the control center goes down," says Heatherton.

That teeter-totter relationship plays out constantly, and while studying the phenomenon used to depend on subjective reports, it's now possible to watch the process in real time, thanks to functional magnetic resonance imaging (fMRI). Very broadly, when the midbrain--particularly the nucleus accumbens--lights up, it indicates a desire on the rise; activity in the dorsolateral

prefrontal cortex, situated at the top forward portion of the brain, indicates an effort to control that impulse. Ideally, the dorsolateral wins, but a lot of things can prevent that. Alcohol and drugs, for example, not only thrill our lower brains but also compromise the prefrontal cortex's ability to contemplate consequences. That's a powerful one-two blow. But external chemistry is hardly needed to make us stray.

In one particularly revealing bit of research, cognitive neuropsychologist Reza Habib of Southern Illinois University teamed up with Mark Dixon, an addiction specialist, to peek inside the brains of problem gamblers and compare them with those of casual and nongamblers. When the subjects were inside the fMRI scanner, Habib and Dixon showed them images of slot machines displaying one of three results: a win, a loss and a near miss with, say, two cherries on the center line and a third just below it. "Near misses are inserted into slot-machine cycles to keep you hooked," Habib says. "They cause you to think, Oh, I'm getting close!"

In games of chance, close means nothing, and the rational brain knows that. But the lower brain is another story. When problem and nonproblem gamblers witnessed a payoff, both groups registered reward in the pleasure centers. A loss caused the cautionary regions of the higher brain to light up in both. When it came to a near miss, though, the groups parted ways: the nonproblem players processed it as a loss, while problem players experienced it as something like a win.

As with all such studies, it's difficult to tease out whether a malfunction in the brain led to the compulsive behavior or the compulsive behavior changed the brain. It's even harder to know exactly where on the spectrum problem gambling becomes addictive, though at some point it does. Still, the behaviors have similar roots. "In both cases there is an imbalance between the restraint and indulgence systems," says McGonigal. "Indeed, when you look at true addiction, compared to a moment of giving in, it doesn't even look all that different in the brain."

The Best Intentions

If it's clear that we all occupy different spots on the willpower continuum, it's much less clear why. The first place to turn for an answer is our genes. Few psychologists doubt that the fundamentals of our temperament are set at birth; we're factory loaded for introversion or extroversion, coolheadedness or temper, so why not willpower--or the lack of it? "I wouldn't bet against a genetic piece to willpower," says Baumeister. "Impulsivity data show a pretty good hereditary component, for example."

But environment, as always, plays a role too, and in ways that go beyond the habits you pick up at home. All species are good at reading the larger world into which they're born and determining if it's a safe one, in which moving slowly and taking care will pay dividends, or a dangerous one, in which it pays to grab what you can. Robert Kurzban, an evolutionary psychologist at the University of Pennsylvania, cites studies of neighborhoods torn by gang violence, where people have shorter life expectancies and make their decisions--about smoking, drinking, sex, criminality--accordingly.

"If you're in an environment in which patience is rewarded, you're likelier to put off reward than people who have shorter to live," he says. "They pursue a fast-life strategy." In other words, they never develop a willpower muscle because, really, what's the point?

Of course, the brain is not actually a muscle, apt as the analogy seems, so what makes it behave like one? One thing may be glucose--the brain's fuel of choice--with willpower rising and falling along with our glucose levels. In a 2010 study at the University of South Dakota, investigators recruited 65 undergraduates and had them participate in a classic delayed-gratification game, offering them the chance to roll dice and win either \$120 that day or \$450 that they couldn't have for 31 days. Many of the typically cash-strapped students decided an

immediate payout was more valuable than a larger one later. But one thing helped them defer the reward: subjects who had consumed sugary sodas before the experiment were likelier to pick the later \$450 than those who had drunk artificially sweetened sodas.

"The brain is always monitoring its resource levels," says McGonigal. "If sugar is rising, we feel like we can defer indulging ourselves. In other studies, investigators control people's willpower as if with a joystick by putting them on a glucose infusion and regulating it up and down."

Not everyone agrees that this how neural metabolism works. The brain does need a lot of glucose, but like a computer, it can run many programs at once, and willpower is not a very costly one--it requires the sugar equivalent of less than half a Tic Tac per minute, says Kurzban. "The glucose model is metabolically implausible," he argues. "The brain isn't a hydraulic system that needs a constant pressure; it's an information-processing system. If your browser's running slowly, you don't check your battery."

Getting in Your Own Way

Even as the glucose model is being debated, psychologists agree on a few other, less technical phenomena that can sabotage willpower. Take the what-the-hell effect--which is exactly what it sounds like. You're on a diet, you have a bit of ice cream, and then--what the hell, the day's a loss anyway--you might as well finish the whole pint. There's a lot of what passes for thinking in this, which makes it hard not to blame yourself after a binge is done. But you may be less responsible than you think.

In a 2010 study, Heatherton and two colleagues recruited 100 subjects, half of whom were chronic dieters and the rest of whom had little history of having to control their weight. They were slid into an fMRI scanner to see how their brains reacted to images of food. The nondieters showed activity in the nucleus accumbens, one place appealing cues are processed, and little activity in the

amygdala, which would have indicated an aversion to food. The dieters showed just the opposite, suggesting that they were trying--successfully--to control their appetites. All of the subjects were then taken out of the scanners and given 15-oz. (444 ml) milk shakes to drink. They then went back in and were shown the same images.

This time, the nondieters' nuclei accumbens stayed quiet, showing no interest in any more food, and their amygdalae lit up, flashing a "stay away" signal. The dieters, curiously, had the opposite reaction: even though they had consumed as much as the other group, their nuclei accumbens went into action--effectively saying "more"--and their amygdalae grew quieter. This didn't mean they were insatiable. Rather, as any recidivist dieter knows, it suggested that the very idea of food had become so fraught for them that drinking a milk shake triggered an anxiety response, which they then sought to medicate with other foods. "The what-the-hell effect has always been seen as a decisional thing," says Heatherton. "In fact, it's subtler than that."

One paradoxical way to contain cravings is what McGonigal calls mindfulness, which is a lot less squishy than it sounds. Studies of smokers in fMRI scanners have shown that trying to deal with an urge through brute resistance exacerbates the problem, with the lower brain effectively going from orange alert to red. People who instead acknowledge their feelings and nudge them back in line with deep breathing or other relaxation exercises can calm their brains faster. "Acceptance doesn't have to mean endorsing the feelings," McGonigal says.

Another willpower booby trap is known as the halo effect. You go to the gym and sweat for an hour, then you go out to lunch. You've been good, so why not get some fries with that sandwich? The flaw in your thinking is as basic as arithmetic: burning off 400 calories and gobbling 500 does not add up. But the halo effect doesn't care. The mere concept of behaving virtuously--even if you haven't actually done so--may be enough to give you

the license to indulge.

Ayelet Fishbach, a professor of behavioral science at the University of Chicago, has run a study that takes this idea to its preposterous extreme. When she offers subjects a bowl of carrots and a bowl of chocolates side by side, they eat less chocolate and more carrots than they do when she mixes them in one bowl. That the two foods touch seems to cause some of the magical goodness of the carrots to rub off on the chocolate.

Another perceptual sleight of hand involves what psychologists call future-self continuity--and what Jerry Seinfeld once described as Tonight Guy vs. Tomorrow Guy. Tonight Guy can go drinking as late as he wants, because getting up in the morning is Tomorrow Guy's problem. We play the Seinfeldian game not just in such small ways but also in more consequential ones, like saving too little for retirement. "We feel closer to the self of a year from now than to the one 10 years from now," says psychologist Hal Ersner-Hershfield of New York University's Stern School of Business. "A very distant future self may be like a stranger."

It's possible to bridge that gap, and Ersner-Hershfield has come up with an imaginative way, by taking pictures of subjects and running them through software that adds 30 years to their age. People who see the self of tomorrow and then participate in a simulated 401(k) exercise put away more money than those who haven't gotten a glimpse of the person who awaits them three decades hence. Ersner-Hershfield has even developed virtual-reality goggles that allow subjects to meet their future selves by walking up to them in a full-length mirror.

Most folks trying to strengthen their willpower muscles do not have access to virtual-reality systems, to say nothing of fMRIs. But low-tech methods like mindfulness work. So can something called a pause-and-plan strategy, a phrase coined by psychologist Suzanne Segerstrom of the University of Kentucky. Cravings trigger the fight-or-flight response, narrowing the mind's focus

until the danger--in this case the powerful urge for something--is resolved. Pausing and planning well in advance of the crisis widens the options and brings the rational prefrontal cortex online.

Even something as simple as candidly evaluating how much time you'll have to achieve your goals helps. In an ideal world, we'd always be able to get to the gym or go for a jog, but the ideal world has no sick days or overtime at work. That doesn't mean we shouldn't exercise, but it does mean we need to take a cold look at when we can fit it into our schedule and stick to that realistic plan instead of chasing a fanciful one.

None of this is easy--and the fact is, none of it is fun, at least in the very short term. But if there's a happy side to all the new research, it's that the muscle analogy works both ways. It's true enough that exercising willpower can lead to a kind of psychic ache, and it's true too that that can lead to a short-term failure of resolve. But over time, incrementally, fatigue becomes strength and ache becomes commitment. Your lower brain may always have the fun, but your higher brain, with practice, can still say how much.