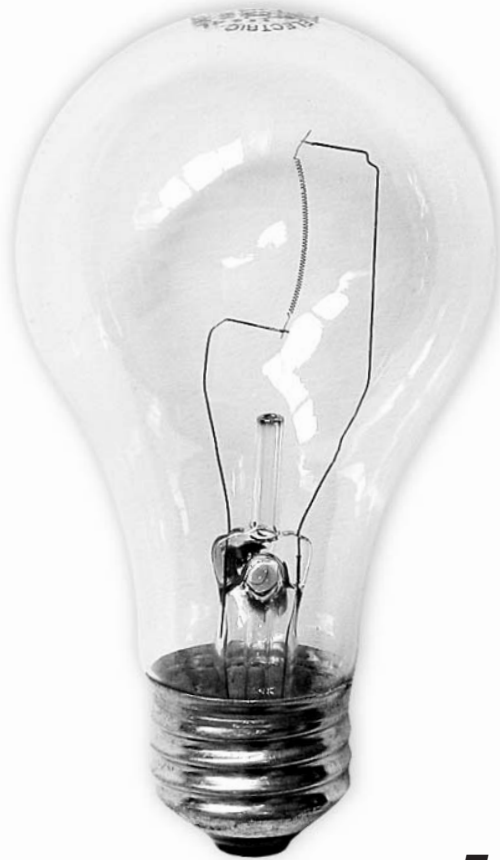


MIND HACKS™

Tips & Tools for Using Your Brain



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O'REILLY®

Foreword by Steven Johnson, author of Mind Wide Open



HACK

#92

Make the Caffeine Habit Taste Good

Caffeine chemically hacks the brain's reward system, boosting the value we give not only to the morning cuppa, but also to everything associated with it.

I couldn't even begin to write this for you until I'd made myself a coffee. Some days I drink tea, but coffee is my normal stimulant of choice, and a cup of that ol' "creative lighter fluid" is just what I need to get started on my morning writing.

After you've drunk a cup of tea or coffee, the caffeine diffuses around your body, taking less than 20 minutes to reach every cell, every fluid (yes, *every* fluid [1]) of which you're made. Pretty soon the neurotransmitter messenger systems of the brain are affected too. We know for certain that caffeine's primary route of action is to increase the influence of the neurotransmitter dopamine, although exactly how it does this is less clear [2]. Upshifting the *dopaminergic* system is something caffeine has in common with the less socially acceptable stimulants cocaine and amphetamine, although it does so in a different way [3].



Neurons [Hack #9] use neurotransmitters to chemically send their signals from one neuron to the next, across the synapse (the gap between two neurons). There are many different neurotransmitters, and they tend to be used by neurons together in systems that cross the brain. The neurons that contain dopamine, the dopaminergic system, are found in systems dealing with memory, movement, attention, and motivation. The latter two are what concern us here.

Via the dopaminergic system, caffeine stimulates a region of the subcortex (the brain beneath the *cerebral cortex* [Hack #8]) called the *nucleus accumbens*, a part of the brain known to be heavily involved in feelings of pleasure and reward. Sex, food, all addictive drugs, and even jokes cause an increased neural response in this area of the brain. What happens with addictive drugs is that they chemically hack the brain's evolved circuitry for finding things rewarding—the ability to recognize the good things in life and learn to do more of them.

The jury is still out on whether most caffeine addicts are really benefiting from their compulsion to regularly consume a brown, socially acceptable, liquid stimulant. While some killjoys claim that most addicts are just avoiding the adverse effects of withdrawal, it is more likely that most people use caffeine more or less optimally to help them manage their lives. One study even went so far as to say "regular caffeine usage appears to be beneficial,

with higher users having better mental functioning.” [4] So it’s not just pleasure-seeking, it’s performance-enhancing.

Coffee is strongly associated with two things: keeping you awake and helping you do useful mental work. In fact, it can even be shown to help physical performance [5]. The association with creative mental work is legendary, although the cognitive mechanisms by which this works are not clear. As early as 1933, experiments had shown that a cup of coffee can help you solve chess problems [6], but the need for experiments has been considered minimal given the massive anecdotal evidence. As the mathematician Paul Erdos said, “A mathematician is a device for turning coffee into theorems.” Academics, designers, programmers, and creative professionals everywhere will surely empathize.

But this isn’t a hack about the addictive effects of caffeine, or even about the mental stimulation it can provide. This is about how coffee can work its magic on me without passing my lips. It’s having its effect while it’s still brewing. I need to make a cup to get started, but I haven’t begun drinking it yet.

In Action

Just knowing you have a caffeine hit coming tends to perk you up. To see this in action, find someone who is a certified caffeine addict. It doesn’t matter if she is into tea or coffee, as long as she is *really* into it. I’d wager that she is also rather particular about how she takes it too. Does she have a favorite mug? Does she like the milk poured in before the tea? Is she picky about how the coffee beans should be ground?

Now, find something that doesn’t affect the taste of the drink, but that she always does—it doesn’t really matter what. Stop her from doing it. Give her coffee to her in a glass. Put the milk in after the tea. Do the opposite of the way she likes something done.

She’ll freak. Or at the very least she *really* won’t like it.

The more she’s into caffeine, the more particular she’ll be about the drink being made and delivered in just a particular way. Weird, eh? She’s addicted to a complex molecule; the delivery of it into her system, in any form, is enough to create the positive effects of the drug and remove any associated withdrawal symptoms. But she insists on the precise method of delivery. How come?

How It Works

By chemically hacking the reward circuitry of the brain, caffeine gives us a stark view of a couple of the basic animal learning mechanisms. These are called *classical conditioning* and *operant conditioning* and are associated with the scientific school called *behaviorism*, which dominated modern psychology until the 1970s.

You've probably heard of Pavlov, the Russian scientist whose experiments with dogs established the basic principles of classical conditioning. This basically says that, if something happens at the same time as something rewarding, it comes to be associated with the response to—and can eventually substitute for—the rewarding stimulus. In this case, the caffeine is the intrinsically rewarding stimulus (because it hacks your reward circuitry) and everything else (the smell, the taste, the cup, the time of day) comes to be associated with the reward. This is why decaf can actually work wonders (particularly if your subject doesn't know it is decaf, thanks to the [Placebo Effect \[Hack #73\]](#)) and why just making a cup of coffee makes me feel more alert, even without drinking it. When I used to write essays late at night at college, just the sound of the kettle reaching the boil would make me feel more alert. The response (perking up) becomes associated with the things that normally accompany the actual cause (the caffeine)—the smell of coffee, the sound of the kettle boiling, and so on.

The other major kind of conditioning, *operant conditioning*, states that rewards reinforce the actions that precede them. While this sounds pretty obvious, you can get a very long way just by looking at the world through the lens of “What actions are rewarded? Which are punished?” In the case of our caffeine experimentation, everything leading up to the consumption of the caffeine is rewarded. No wonder we develop superstitions about how the caffeine should be prepared. In fact all drugs are associated with preparation rituals: from the Japanese tea ceremony, to clinking glasses of beer, and up to the harder drugs and things like the shooting rituals of heroin users.

These learning mechanisms are intrinsic and are found in all complex animals. They are deeply programmed into our brain and can operate without conscious effort or memory. Decades of work have explored how the time scales, constraints, and interactions of these forms of learning combine with different stimulus and response pairings and different combinations of reward and punishment. For example, we know that rewards are often better motivators than punishments, partly because they are more precise; you can simply reward the behavior you want, whereas with punishment you tend to punish getting caught, rather than accurately punishing the behavior you don't want.

This associative form of learning is basic to human nature, and its effects are widespread. If you reward your child by giving in after 20 minutes of nagging, is it surprising that this habit becomes common? If your manager punishes people who make mistakes, is it any wonder that people at work cover up their errors rather than admitting them? And if I've drunk a cup of coffee on a thousand previous occasions just before starting work, is it any wonder I feel a sense of contentment when sitting down to write with a steaming mug of the black stuff beside me and feel distress when I'm deprived of it? It may be arbitrary which mug I started drinking my coffee in, but now it has been wired into my brain via the reinforcing effects of caffeine. The coffee really does taste better when drunk from my favorite mug.

See Also

1. Two thoughts for you: (1) plants probably evolved caffeine as an insecticide, and (2) caffeine is used in animal artificial insemination to make sperm swim faster.
2. Caffeine probably blockades a messenger chemical that competes with dopamine (adenosine), so this in turn causes an increase in the effect of dopamine. The "inhibition of inhibition" pattern is standard for many connections and chemicals in the brain.
3. Some indication of the levels of obsession invoked by caffeine can be seen at <http://coffeegeek.com>.
4. Discussed and referenced in Stafford, T. (2003). Psychology in the coffee shop. *The Psychologist*, 16(7), 358-359. Available online from <http://www.bps.org.uk>.
5. "Caffeine and Exercise Performance" (<http://www.elitetrack.com/caffeine.pdf>).
6. Holck, H. (1933). Effect of caffeine upon chess problem solving. *Journal of Comparative Psychology*, 15, 301-311.

Fake Familiarity word game part 2. See "Fake Familiarity" [Hack #83].

Table 9-6. Which of these have you seen before?

BASEMENT	MEUNSTAH
CADPECHT	MESTIC
BLENTIRP	FASHION
DETAIL	TUMMEL
NOTIRGIN	SUBBEN
GARDER	FISSEL
GERTPRIS	COELEPT

Make the Caffeine Habit Taste Good

Table 9-6. Which of these have you seen before? (continued)

FRAMBLE

FAMILIAR

CRIPPLE

ISOLATE