

### Is Willpower a Limited Resource?

Although Mischel's hot-cool framework may explain our ability to delay gratification, another theory known as willpower depletion has emerged to explain what happens after we've resisted temptation after temptation.

Every day, in one form or another, you exert willpower. You resist the urge to surf the Web instead of finishing your expense report. You reach for a salad when you're craving a burger. You bite your tongue when you'd like to make a snide remark. Yet a growing body of research shows that resisting repeated temptations takes a mental toll. Some experts liken willpower to a muscle that can get fatigued from overuse.

Some of the earliest evidence of this effect came from the lab of Roy Baumeister. In one early study, he brought subjects into a room filled with the aroma of fresh-baked cookies. The table before them held a plate of the cookies and a bowl of radishes. Some subjects were asked to sample the cookies, while others were asked to eat the radishes. Afterward, they were given 30 minutes to complete a difficult geometric puzzle. Baumeister and his colleagues found that people who ate radishes (and resisted the enticing cookies) gave up on the puzzle after about 8 minutes, while the lucky cookie-eaters persevered for nearly 19 minutes, on average. Drawing on willpower to resist the cookies, it seemed, drained the subjects' self-control for subsequent situations.

Since that work was published in 1998, numerous studies have built a case for willpower depletion, or ego depletion, as some experts call it. In one example, volunteers who were asked to suppress their feelings as they viewed an emotional movie gave up sooner on a test of physical stamina than did volunteers who watched the film and reacted normally. In another, people who actively suppressed certain thoughts were less able to stifle their laughter in a follow-up test designed to make them giggle.

Unfortunately, depleting events are all too common. If you've ever willed yourself to be diplomatic with an infuriating colleague or forced a smile through your in-laws' extended visit, you've probably discovered that social interactions often demand self-control. Indeed, research shows that interacting with others and maintaining relationships can deplete willpower. In one demonstration of that effect, Kathleen Vohs, PhD, of the University of Minnesota, and her

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colleagues found that people who were asked to convince a hostile audience that they were likable suffered more willpower depletion than people who were asked to act naturally before the audience.

Dealing with a hostile audience (or your in-laws) may feel exhausting, but depletion is not simply a matter of being tired, as Vohs demonstrated. She subjected half of her study subjects to 24 hours of sleep deprivation before asking them to suppress their emotional reactions to a film clip. Then she tested the subjects' self-control strength. To her surprise, she found that the subjects who'd been up all night were no more likely to become willpower-depleted than those who'd spent the night snug in their beds.

So if depletion isn't physical fatigue, what is it? Recent investigations have found a number of possible mechanisms for willpower depletion, including some at a biological level. Scientists at the University of Toronto found that people whose willpower was depleted by self-control tasks showed decreased activity in the anterior cingulate cortex, a brain region involved with cognition. When your willpower has been tested, your brain may actually function differently.

Other evidence suggests that willpower-depleted individuals might be low on fuel. The brain is a high-energy organ, powered by a steady supply of glucose (blood sugar). Some researchers have proposed that brain cells working hard to maintain self-control consume glucose faster than it can be replenished. In a study lending support to this idea, obedient dogs made to resist temptation had lower blood-glucose levels than dogs that did not exert self-control.

Studies in humans have found similar patterns. Human subjects who exerted willpower in lab tasks had lower glucose levels than control subjects who weren't asked to draw on their self-control. Furthermore, restoring glucose appears to help reboot run-down willpower. One study, for example, found that drinking sugar-sweetened lemonade restored willpower strength in depleted individuals, while drinking sugar-free lemonade did not.

Yet evidence also suggests that willpower depletion can be kept in check by beliefs and attitudes. Mark Muraven, PhD, of the University at Albany, and colleagues found that people who felt compelled to exert self-control (in order to please others, for example) were more easily depleted than people who were

driven by their own internal goals and desires. When it comes to willpower, those who are in touch with themselves may be better off than their people-pleasing counterparts.

Muraven, Baumeister and their colleagues also explored the effects of mood. By lifting their subjects' spirits with comedy videos and surprise gifts, they demonstrated that a good mood can overcome some of the willpower-depletion effects normally seen after exercising self-control.

Other research suggests that a person's basic beliefs about willpower may be important. A 2010 study by Stanford University researcher Veronika Job, PhD, and colleagues found that individuals who thought willpower was a limited resource were subject to having their willpower depleted. But people who did not believe willpower was easily exhaustible did not show signs of depletion after exerting self-control.

In a second component of that study, the researchers manipulated volunteers' beliefs about willpower by asking them to fill out subtly biased questionnaires. The volunteers who had been led to believe that willpower was a limited resource showed signs of ego depletion, while those who had been led to believe that willpower was not limited showed no signs of dwindling self-control.

So is willpower a limited resource? Proponents of this idea point to a large and robust body of supporting evidence that has accumulated over the last decade. They argue that factors such as mood and belief may only buffer the effects of willpower depletion in its earliest stages. Still, further research is needed to explore how beliefs, moods and attitudes might affect one's ability to resist temptation.

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