ARTICLE

Self-control – the moral muscle

Roy F. Baumeister outlines intriguing and important research into willpower and ego depletion

The capacity of the human mind to alter its own responses is one of the wonders of nature. It is a vital foundation for culture, progress, achievement, morality and individual success. This article provides an overview of a research programme that has been pursued for the past two decades. It has led the researchers to bring back the Victorian notion of willpower as a limited supply of energy that is used for control and self-discipline – and several other important phenomena, including making decisions. Self-control processes link together mind with body, present with future and past, resisting temptation with making choices, and a remarkably wide range of daily activities with each other.

questions

How can people harness their natural but limited powers to get the most out of life?

resources

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What is the most important and desirable trait? What would you most wish your child to have, or your rivals to lack? What trait is most important for helping people lead happy, successful and useful lives? Decade after decade, psychologists keep coming up with the same two answers. One is intelligence. The other is self-control. Nothing else comes close.

Early in my career I studied self-esteem, which in the 1970s and 1980s seemed to hold the promise of being a powerful key to mental health and successful behaviour. But self-esteem ultimately disappointed most of us: its benefits are quite limited (see Baumeister et al., 2003). So for the past two decades my research has focused on self-control .

People use self-control quite frequently. A recent study (Hofmann et al., in press) had 200 people wear beepers for a week, and at random intervals they were asked to report on whether they felt any desire, and if so how strongly, whether they tried to resist it, and how successful that resistance was. Out of 10,000 responses, 7000 desires were reported. Efforts at self-control were common: people reported resisting two out of every five desires. Thus, much of the average day is spent trying to control one's wants and needs. What's more, this resistance was often successful. With no resistance, people enacted 70 per cent of their desires; with resistance the rate dropped to only 17 per cent.

Self-control is what people use to restrain their desires and impulses. More precisely, it can be understood as the capacity to override one response (and substitute another). It is largely synonymous with 'self-regulation', a term preferred by many researchers because of its greater precision. To regulate is to change; namely, change in the direction of some standard, some idea about how something could or should be. Self-regulation thus means changing responses based on some rule, value or ideal.

Most self-regulation occurs in one of four spheres. People regulate *thought*, such as trying to concentrate or shut an annoying tune out of their minds. They regulate *emotion and mood*, such as when trying to feel better. They regulate *impulse*, such as when resisting temptation. And they regulate *performance*, such as by trading off speed and accuracy, or persevering despite a discouraging failure.

How self-control works

Self-control depends on multiple processes. Pioneering work by Carver and Scheier (e.g. 1981) applied feedback-loop theory to self-regulation. People compare their current status to the standard, make appropriate changes, compare again, and

Participants, after skipping a meal, had their hunger further stoked by seating them in front of a tray of freshly baked cookies

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exit the loop when the need for change has been satisfied.

My work has focused on the processes of change, and has shown that successful self-control depends on a limited energy resource. The folk notion of willpower is not far off the mark. When people exert self-control, they use up some of this energy, leaving them in a temporarily depleted state. If they try to exert self-control again soon after – even in some sphere unrelated to the first exertion – they tend to do worse than if they had not previously exerted self-control.

Thus, self-control is like a muscle that gets tired. People may start the day fresh and rested, but as they exert self-control over the course of the day, their powers may diminish. Many researchers have observed that self-control tends to break down late in the day, especially if it has been a demanding or stressful day. Most diets are broken in the evening, sexual misdeeds and addictive relapses occur at the end of long and demanding days. In some cases, there are more temptations available in the evening than the morning – though that may just reflect the marketplace adapting to where its customers are.

Some of our first experiments supported the view of self-control as a limited resource. In one, participants arrived at the lab after skipping a meal, and their hunger was further stoked by seating them in front of a tray of freshly baked cookies and candies. Also in front of them was a bowl of radishes. Some were told that their task was to eat only the radishes and not the sweets. They were left alone for five minutes, ostensibly to do their radish tasting, but the real point was to make them struggle to resist eating the sweets. There were two control conditions, one of which was told to eat the sweets (and not the radishes), and the other skipped the food part of the study altogether (Baumeister et al., 1998).

Later, all participants were given some difficult (in fact unsolvable) puzzles, and we timed how long they kept trying until they gave up, a procedure adapted from stress research. Trying over and over despite discouraging failure takes inner strength, including the self-discipline to persevere instead of quitting so as to go do something more pleasant.

We found that the participants in the radish condition gave up significantly faster than those in the control conditions. Apparently, resisting the temptation to eat sweets took something out of them – depleted their willpower – leaving them with fewer resources to persevere on the next, seemingly unrelated task.

Over the next decade, many more studies of this sort were done. A meta-analysis by Hagger et al. (2010) combined results from 83 such studies and confirmed the general pattern of what has come to be called 'ego depletion' – the idea that self-control or willpower is an exhaustible resource, and that if it is used up, mental activity requiring self-control is impaired. The term 'ego depletion' was chosen in part as homage to Freud, because he was one of the last theorists to discuss the self in terms of energy. By the 1980s and 1990s, most self theories had emphasised information and concepts, not energy. But our work indicates that one important part of the self is the well of energy that it expends when it regulates its responses.

Two important implications of these findings require emphasis. First, all self-control tasks draw on the same energy resource. That is, when you, for example, hold your tongue, resist an urge to smoke, drink or eat, restrain aggression, postpone using the toilet, feign mirth at an inane joke, push yourself to keep working, it depletes some crucial energy and leaves you with less available for meeting the next challenge. Many seemingly unrelated things are therefore linked in this regard.

Second, willpower is limited. In the radish study, five minutes of resisting the temptation to eat chocolate cookies produced a drop of ten minutes in how long people persevered at a stressful task. Thus, even just minor exertions of self-control can make a substantial difference.

Extending the strength model

Self-control resembles a muscle in more ways than one. Not only does it show fatigue, in the sense that it seems to lose power right after being used, it also gets stronger after exercise. (The fatigue effect is immediate; the strengthening is delayed, just like with muscular exercise.) After people perform exercises designed to strengthen self-control for a couple weeks, they do better on lab tests of self-control (even ones completely different from what they exercised) and report improvements in multiple spheres of their lives (for review, see Baumeister et al., 2006). Smokers who strengthened their self-control by doing handgrip muscle exercises or avoiding sweet foods were later more successful than others at quitting smoking (Muraven, 2010).

How much willpower do people have? It might seem that they do not have much, given that ego depletion effects begin after just a few minutes of exerting self-control. But this is misleading, and again the muscle analogy is helpful. When athletes exert their muscles, they get tired gradually. After some exertion, they begin to conserve their remaining energy (which may be considerable). Hence fatigue effects can show up relatively early, whereas complete exhaustion of the muscles is rarely seen.

Ego depletion effects are mostly conservation effects rather than exhaustion effects. Muraven et al. (2006) showed that even after people become depleted they can perform well if there is a compelling reason to do so – but then they are much more depleted if another demand for self-control comes along. Like a tired athlete who summons up a great exertion for the last lap, they allocate their resources judiciously once these begin to be depleted. Muraven et al. (2006) also showed that people hold back more when

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they expect subsequent demands than when they think they are confronting the final demand.

What gets depleted?

Willpower is folk term and a metaphor for psychological processes. What is the actual process? By accident, my research group stumbled on an important key to the physiology of willpower.

Glucose is a chemical in the bloodstream. It is 'brain fuel' in the sense that it provides energy for brain activities. Neurotransmitters are made from glucose. Glucose is also used to furnish energy for much of the body's other activities, including muscular exertion and even the immune system. Glucose is made from nutritious food (not just sugar) and either used or stored for later use.

Our interest in glucose began when an experiment on another hypothesis went awry. We were testing the alluring hypothesis that if resisting temptation weakened self-control, maybe yielding to temptation would strengthen subsequent self-control. Participants underwent a depleting exercise in self-control, and some were given a bowl of ice cream to eat. Sure enough, the people who enjoyed this pleasant indulgence showed an improvement in self-control performance on the next task. Unfortunately for that hypothesis, we included a control condition in which people consumed a large portion of tedious, unappetising food, which hardly constituted a pleasant indulgence – and they also showed an improvement in self-control afterwards. This got us to wondering, if the recovery of willpower was not attributable to the pleasure, could it be simply the calories?

A series of experiments confirmed that willpower is tied to glucose (Gailliot et al., 2007). After people exert self-control, even on artificial lab tasks, their blood glucose levels drop. Low levels of blood glucose predict poor performance on tests of self-control. Most dramatically, the effects of ego depletion can be counteracted by giving people a dose of glucose.

The link to glucose provides a new perspective on self-control. For example, a recent study showed that the decisions of judges regarding parole fluctuate over the day in a manner that suggests ego depletion and glucose (Danziger et al., 2011). Sending a convict back to prison is the safe and easy decision, whereas granting parole puts the judge at risk, because if the parolee commits another crime, the judge will look bad and possibly be blamed. It therefore takes more energy to grant parole than to deny it. Judges get depleted as they make decision after decision. Hence a convict applying for parole fares reasonably well first thing in the morning, when the judge is fresh and well-fed, but as the morning wears on, the chances go down. The judges then have a break for a mid-morning snack, and another for lunch, and their rates of granting parole shoot up dramatically at these points – and then resume dropping. A convict whose case comes up just before lunch has a near zero probability of being paroled, whereas one who comes before the board right after lunch has a good (65 per cent) chance of getting out of prison.

A convict whose case comes up just before lunch has a near zero probability of being paroled

Glucose may also hold a key to understanding premenstrual syndrome (PMS). Folklore suggests that PMS occurs because women mysteriously acquire antisocial impulses and tendencies at a certain time each month. Instead, Gailliot et al. (2010) proposed that the extra metabolic demands of the luteal phase of the menstrual cycle siphon off a large portion of the body's glucose supply, leaving less available for self-control. (Many women eat more during this stage, but most do not increase their caloric intake enough to offset the extra metabolic demands of the reproductive system). Hence the self-discipline and restraint that normally manage the woman's behaviour are harder to sustain, and a broad variety of breakdowns occur – aggression, petty crime, smoking, drinking, overeating, emotional outbursts, drug use, and so forth. In other words, PMS is not a matter of new antisocial impulses but rather a wholesale weakening of restraints, caused by the body's relative lack of glucose available for self-control.

When willpower is low

Researchers have illuminated many of the effects of ego depletion on a wide assortment of behaviours. Some are standard foci of self-control. As a standard example, dieters eat more fattening food when their willpower has been depleted (Vohs & Heatherton, 2000); and the same study showed no change in eating among non-dieters. Thus, depletion only alters behaviour when people are trying to restrain or control it. Dieters wish to restrain their eating, and so ego depletion makes them eat more. In a similar vein, aggression increases with ego depletion – but only among people who have been provoked and angered and therefore have aggressive impulses that they would normally restrain (DeWall et al., 2007).

Aggression is of course a particularly prominent social problem as well as a professional concern of many psychologists. In 2011 I attended the conference of the Division of Forensic

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Psychology of the British Psychological Society and had lively discussions with researchers and practitioners interested in domestic violence. Laboratory and field studies by Finkel et al. (2009) have shown that even nonviolent couples tend to treat each other in more abusive ways when their self-control resources are depleted. Fortunately, that work also showed that strengthening willpower via self-control exercises reduced the tendency to engage in intimate partner violence.

Even apart from violence and abuse, close relationships benefit from self-control (Vohs et al., 2011), and good practices deteriorate when willpower is depleted. Intimate partners in good relationships often shield their partners from blame, but under ego depletion they start to blame their partners more (Vohs & Baumeister, 2008). Depletion makes them also pay more attention to attractive members of the opposite sex, which could increase their temptation to stray (Vohs & Baumeister, 2008). Sexual inhibitions are also reduced during ego depletion, making people unusually willing to do sexual things they would normally resist (Gailliot & Baumeister, 2007).

Likewise, most people normally restrain their prejudices, but these are more likely to emerge when people are depleted, and restraining prejudice can deplete people so that their self-control suffers in other domains (Richeson & Trawalter, 2005). Exercising self-control can help people restrain their prejudices, as can a dose of glucose (Gailliot et al., 2007).

Self-control has been called the 'moral muscle' because it provides the power to do what is right. Not surprisingly, virtue deteriorates quickly under ego depletion. Experimental studies have shown that people become more willing to cheat and steal when depleted (Mead et al., 2009).

Another easily overlooked application of willpower is for thinking. To be sure, some thought processes are automatic and therefore require minimal energy, but strenuous and demanding forms of thought such as logical reasoning and extrapolation require disciplined mental effort. People's IQ scores dropped substantially under ego depletion, as did their performance on other tests of logic, though rote memory and other automatic processes were unaffected (Schmeichel et al., 2003).

Beyond self-control

The processes by which the human body uses its central energy supply to override its responses and regulate its actions are clearly an important part of the human self. Yet perhaps those processes have even wider applications than just self-control.

One turning point came in a paper by Vohs et al. (2008). That article showed that making choices and decisions depletes the self: after making decisions, self-control was impaired. A companion paper a year later by Pocheptsova et al. (2009) reversed the sequence and showed that after exerting self-control, decision making was altered in various ways. Depleted deciders were less prone than others to compromise and more prone to fall prey to irrational bias. They also showed some tendency to duck or postpone decisions if they could.

> "people become more willing to cheat and steal when depleted"

The implication is that making decisions draws on the same (glucose) energy that is used for self-control. Possibly this could help explain the endless stream of news stories about politicians and other authority figures who get caught up in sex scandals or other forms of misbehaviour: they expend their energy making decisions, leaving them without enough for ordinary self-control. Lab work has in fact shown that leaders pour extra energy into their work, often rendering them more depleted than other people (DeWall et al., 2011).

Unpublished work also suggests that initiative is depleting. After exerting self-control, people tend to respond in passive ways and take default options (Vohs & Baumeister, 2010).

The combination of self-control, decision making, and initiative prompted me to begin discussing this work in the context of free will. Many philosophical works on free will invoke just those sorts of behaviours, without realising that they all share a common psychological and physiological substrate.

The notion of free will is controversial, but I assume most people accept the reality of self-control, initiative and rational choice. The common process that produces those three types of behaviours is almost certainly the psychological reality behind the popular notion of free will. Either it is exactly what free will is, or it is what is mistaken for free will. In any case, this link further extends the importance of understanding and knowing how to use this important human resource.

Getting the most from life

This article has provided an overview of my research program, but many other questions remain, such as how to raise children with good self-control, and how to manage the limited resource for best results. Those wishing for a broader and fuller discussion are invited to consult my co-authored book *Willpower: Rediscovering the Greatest Human Strength* (2011).

One important conclusion in that book is a newly emerging sense of how successful people manage the limited resource. The popular image of self-control and willpower still conforms to traditional ideas of the person using inner strength to fend off strong temptations and cope with crises. Yet increasingly the evidence is suggesting that the most successful people, and indeed those with the best self-control, spend relatively less time than others struggling with temptations and crises. Yes, willpower can be used for such things – but it can also be used to set up one's life to run smoothly so as to avoid those demands and problems. Trait self-control has been especially successful at predicting performance at school and work, which depends less on the single heroic feat of will than on having steady, reliable work habits. Put another way, some people use their willpower to study all night before the exam, but others use it more effectively by keeping up with their work so they don't have to stay up all night at the last minute. If anything, they make sure to get a good night's sleep so they are well rested for the exam.

Willpower may have an unappealing, Victorian reputation. But it is simply a matter of using one's physical and mental energy to reach one's goals and get the most out of life. It is one of the most important human traits and a key to long-term success in life.

Roy F. Baumeister
is a Professor of Psychology at Florida State University
baumeister@psy.fsu.edu

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