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Self-regulation, ego depletion, and inhibition

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ABSTRACT

Inhibition is a major form of self-regulation. As such, it depends on self-awareness and comparing oneself to standards and is also susceptible to fluctuations in willpower resources. Ego depletion is the state of reduced willpower caused by prior exertion of self-control. Ego depletion undermines inhibition both because restraints are weaker and because urges are felt more intensely than usual. Conscious inhibition of desires is a pervasive feature of everyday life and may be a requirement of life in civilized, cultural society, and in that sense it goes to the evolved core of human nature. Intentional inhibition not only restrains antisocial impulses but can also facilitate optimal performance, such as during test taking. Self-regulation and ego depletion— may also affect less intentional forms of inhibition, even chronic tendencies to inhibit. Broadly stated, inhibition is necessary for human social life and nearly all societies encourage and enforce it.

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1. Introduction

Inhibition is one form of self-regulation. Self-regulation can be broadly defined as overriding or altering responses, especially as guided by standards of desirable responses (e.g., Baumeister, Heatherton, & Tice, 1994; Carver & Scheier, 1981, 1982). Inhibiting a response (that is, intervening to prevent the response from being felt or acted upon) clearly fits that definition. In fact, after surveying diverse research literatures, Baumeister et al. (1994) estimated that 80–90% of self-regulation in everyday life consists of stopping a response. That includes resisting desires and impulses, shutting unwelcome thoughts out of one's mind, and stifling emotions. In principle, self-regulation can be used to prolong or increase emotions, but in practice the most common form of emotion regulation is trying to reduce bad feelings.

The primacy of inhibition that is, the fact that the majority of self-regulation acts involve stopping a prepotent response can be seen in moral rules. Rules restricting and prohibiting various acts are far more common in morality than are rules prescribing and demanding actions. To use one familiar example, Ten Commandments articulated in the Judeo-Christian Bible mostly specify what “thou shalt not” do. Eight of the ten specify what behaviors are forbidden. Even the other two are not purely prescriptive or promotional requirements. The commandment to keep the

Sabbath holy is generally implemented by not performing a wide assortment of activities on that day (though also attending religious services or doing other positive things may also be involved). Likewise, the commandment to honor one's parents is likely a combination of doing and not doing.

2. Self-regulation, feedback loops, and ego depletion

A highly influential model of self-regulation was proposed by Carver and Scheier (1981, 1982) based on cybernetic theory (e.g., Powers, 1973). Their model emphasized the feedback loop on supervisory monitoring. The self-regulator tests the reality against the standard. If the reality falls short, an operation is performed to rectify the difference, the success of which is verified by another test. Testing can be repeated intermittently until the operation reaches success. Once the test indicates that reality matches the standard, the loop is exited, and that self-regulation process is terminated.

To illustrate, one might imagine a person saving money. He has a financial goal of saving a certain amount each month, and he compares his actions against that standard. It is necessary to inhibit other expenditures in order to reach that target. Once he has reached his monthly goal, he does not have to regulate his saving until the next month.

Carver and Scheier's theory grew out of their research on self-awareness, and indeed they theorized that one major purpose of

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human self-awareness was to facilitate self-regulation. This theoretical approach helped them elucidate the process of monitoring that guides self-regulation, but that emphasis meant that the “operation” phase did not receive much attention by them and other early researchers. The “operation” phase has been the focus of other research programs, however, including the present author’s.

The initial survey of research literatures on self-regulation led Baumeister et al. (1994) to hypothesize that regulating depended on a limited resource, akin to strength or energy. Although the folk notion of willpower contained the idea that some sort of energy is needed for self-control, hardly any psychological theorizing at that time invoked energy models. The proposal that self-regulation required and consumed energy was therefore fairly radical, and it was certainly at odds with the prevailing style of theorizing that featured information processing.

The initial studies were carefully set up to distinguish energy models from two sets of rival theories. An energy model is based on the idea that a limited resource is expended by self-regulation, and so performance on the second self-regulation task will be worse than the first (because some energy is depleted). In contrast, information-processing models suggest that performance should improve on the second self-regulation task, because the first one has primed or otherwise activated the relevant mental programs. A third view from developmental psychology the view of self-regulation as a skill. Skill does not change from one trial to the next but can improve slowly over many trials.

The energy hypothesis received preliminary support in two sets of laboratory experiments by Baumeister, Bratslavsky, Muraven, and Tice (1998) and Muraven, Tice, and Baumeister (1998). These tested the hypothesis that regulating oneself, such as by inhibiting one incipient response, would use up some energy and thereby cause impairment in performance of a subsequent act of self-regulation. Most of the studies involved intentional inhibition. To deplete willpower, participants in various studies were first instructed to stifle emotional responses to an upsetting film or to block an intrusive thought out of their minds (Muraven et al., 1998). In other studies, they first formed a habit and then had to break it, or they had to resist the temptation to eat chocolate and instead consume unappetizing radishes. Participants who had undergone these procedures subsequently performed worse on other, quite different and seemingly unrelated tests of self-regulation, such as perseverance in the face of failure, or maintaining a poker face despite provocative humor.

The state of reduced self-regulatory capacity stemming from prior exertion of self-control was dubbed *ego depletion* by Baumeister, Bratslavsky, Muraven, and Tice (1998). The term was chosen in homage to Freud, because he may have been the last major theorist to posit that the human self consists partly of energy sources and processes. To be sure, Freud’s ideas about energy and self were underdeveloped and led in many directions that have no resemblance to ego depletion theory and the so-called strength model of self-regulation (Baumeister, Vohs, & Tice, 2007). The use of the Freudian term was meant simply to recognize that Freud had invoked energy – and that after his death, energy largely vanished from self theory for half a century.

The basic ego depletion pattern has been well replicated with many different procedures, as confirmed by a meta-analysis by Hagger, Stiff, Wood, and Chatzisarantis (2010) that integrated over a hundred experiments by many different laboratories. An informal count suggests that the volume of similar published findings has more than doubled in the few years since then.

Inhibition is impaired during ego depletion. Assorted findings indicate that depleted persons fail to inhibit a broad range of actions and responses that they would otherwise (i.e., if not depleted) inhibit successfully. These include aggression (DeWall,

Baumeister, Stillman, & Gailliot, 2007), inappropriate sexual responses (Gailliot & Baumeister, 2007b), prejudice (Muraven, 2008), overeating of unhealthy food (Vohs & Heatherton, 2000), alcohol consumption (Muraven, Collins, & Neinhaus, 2002), and impulsive spending (Vohs & Faber, 2007).

Subsequent findings have added important aspects to the strength model. First, ego depletion does not mean that the brain has run out of fuel, as was first proposed. (Indeed, the word *depletion* has two meanings, referring to partial and total reduction in a resource, and this ambiguity has confused some.) Instead, it appears that most ego depletion findings represent an effort to conserve a resource that is only somewhat diminished (Muraven, Shmueli, & Burkley, 2006). The analogy of a muscle is apt: As muscles get tired, the body naturally seeks to conserve energy, long before the point of exhaustion is reached. Hence people in the state of ego depletion can still self-regulate effectively if an important situation arises and they are accordingly motivated to do so (e.g., Slessareva & Muraven, 2003; see also DeWall, Baumeister, Mead & Vohs, 2011).

Because ego depletion is typically a matter of conserving a slightly depleted resource, its effects can be overcome with a variety of cognitive and motivational stimulants. For example, offering a cash incentive, or inducing people to think their willpower is unlimited, can produce good performance despite an initial amount of ego depletion (Job, Dweck, & Walton, 2010; Muraven & Slessareva, 2003). However, as ego depletion becomes increasingly severe, these other procedures become less effective at counteracting the behavioral decrements of ego depletion (Vohs, Baumeister, & Schmeichel, 2013). The reason for these is most likely that the body has ample reserves of energy, which it conserves after some energy has been expended. When motivation (e.g., the chance to win money) is high, however, the person expends more from the reserves. Likewise, the belief that one’s willpower is unlimited can cause the person to expend energy more freely – rather like people might spend more money if they came to believe that their bank account was unlimited.

The limited resource is used for more than self-control. Vohs et al. (2008) showed that making choices depletes the same resource, thereby impairing subsequent self-control. Conversely, initial acts of self-control impair subsequent decision-making (Pocheptsova, Amir, Dhar, & Baumeister, 2009). Initiative, as in responding actively rather than taking a passive approach or choosing the default option, also depends on the same resource and suffers when people are depleted (Vohs, Baumeister, Vonasch, Pocheptsova & Dhar, 2014). There is some evidence that planning is also involved (Webb & Sheeran, 2003).

Taken together, these findings on decision-making, initiative, and planning indicate that the same energy resource is used for far more than intentional inhibition, though inhibition remains a major category of its applications. Baumeister (2008, 2014) proposed that the philosophical and folk concept of free will is an apt umbrella term for all these interrelated functions. That is, the expenditure of energy in volition may be the psychological reality behind the idea of free will.

3. Glucose: fuel for inhibition?

Another line of work has explored the idea that glucose is a major part of the resource behind self-control. Glucose is a chemical in the bloodstream that conveys energy to the brain, other organs, and muscles. Initial discussion of the strength model had treated energy and willpower as metaphors, but it was plausible that those processes were linked to the body’s actual energy dynamics, through glucose.

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