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The Self Guides Conservation of Its Regulatory Resources

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Self-regulation is a highly adaptive ability, allowing individuals to alter their responses based on their own and the group's goals, rules, norms, plans, and other standards. It has promoted the biological success of humans by facilitating the cooperative development and maintenance of culture, which is humankind's innovative survival and reproduction strategy (Baumeister, 2005). With that context, we found Elliot T. Berkman, Jordan L. Livingston, and Lauren E. Kahn's (this issue) identity-value model (IVM) of self-regulation compelling. The IVM fits with the theoretical framework we have continued to update and apply to our empirical work, which may add additional nuance to the IVM. In our commentary, we review the strength model of self-regulation, highlight complementary aspects of the IVM and our model and identify how the IVM can benefit from consideration of the self as a cultural animal, and discuss the implications and potential research avenues of an integrative model.

The Strength Model of Self-Regulation

We define self-regulation (often used interchangeably with *self-control*) as the processes by which the self intentionally changes its own prepotent responses, including thoughts, emotions, and behaviors, as guided by standards. Standards can be set by the self or others and include values, goals, norms, laws, expectations, moral codes, or other group members' responses. Trait self-control abilities predict good interpersonal functioning, academic and occupational success, and health and psychological well-being, and they protect against addiction and criminal behavior (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012; Tangney, Baumeister, & Boone, 2004). Self-regulation can also vary within persons. Indeed, early evidence suggested that a person's self-control could be exhausted: After performing one task that required self-control, performance on the second task requiring self-control suffered (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998).

This diminishment of self-regulatory resource, or *ego depletion*, has been demonstrated in a variety of contexts, including in controlled cognition, decision making, impulse and emotion regulation, dieting, health, fitness related, and substance abuse and addiction domains (for review, see Maranges & Baumeister, 2016). Depletion can refer to partial or complete exhaustion of the resource, though, as we discuss next, we do not think that people often reach the point of total exhaustion. Indeed, ego

depletion seems to emerge from the body's and brain's attempts to conserve the self-regulatory resource.

Over time, the strength model was further supported by research demonstrating that self-regulation paralleled a muscle in other ways. Its strength could be restored with rest or energy in the short term and improved with exercise in the long term. Giving people a sugary lemonade beverage has counteracted the effects of depletion in many studies (e.g., Gailliot et al., 2007). Likewise, allowing people a 10-min break, versus a 1- or 3-min break, to rest led to a reversal of the depletion effect such that rested depleted participants performed a self-regulation task as well as nondepleted participants (Tyler & Burns, 2009). With respect to long-term improvements, practicing self-control in one domain, such as by not swearing, resisting sweets, practicing good posture, or exercising with a hand grip for 1 or 2 weeks can benefit self-control performance in other domains, such as overcoming prejudicial stereotyping, persevering with a hand grip, and quitting smoking (Gailliot, Plant, Butz, & Baumeister, 2007; Muraven, 2010; Muraven, Baumeister, & Tice, 1999).

The initial, simplistic view that self-regulation depends on fuel and ego depletion indicates running out of fuel soon proved inadequate, and a more complex theory is emerging. Various manipulations have been shown to enable people to overcome depletion effects, suggesting that energy reserves are available for self-regulation despite partial depletion. As examples, positive affect (Tice, Baumeister, Shmueli, & Muraven, 2007), prayer (Friese & Wänke, 2014) or exposure to terms associated with God (Rounding, Lee, Jacobson, & Ji, 2012), money (Vohs, Mead, & Goode, 2006), and power (DeWall, Baumeister, Mead, & Vohs, 2011) counteracted depletion effects. Lending support for the compatibility of the strength model and IVM, thinking of values important to the self (Schmeichel & Vohs, 2009), thinking of one's own standards (Wan & Sternthal, 2008), and thinking of the word *I* (in a phrase-making task; Alberts, Martijn, & de Vries, 2011), as well as taking responsibility for one's actions (Muraven, Gagné, & Rosman, 2008) and reading "You can do it" (Alberts, Martijn, Greb, Merckelbach, & Vries, 2007), have all led to people overcoming depletion. Still, the human body eventually goes into conservation mode regardless of motivation, and situational factors that counteract mild depletion cease to be effective with more severe levels of depletion (Vohs et al., 2008). The early, simple notion that ego depletion effects indicate that the brain has run out of fuel gave way to the view that depletion effects

resulted from selective allocation (Beedie & Lane, 2012) and conservation (Evans, Boggero, & Segerstrom, 2015) of a precious, once-limited resource (for a thorough review of challenges and updates to the strength model, see Baumeister & Vohs, 2016).

Although most self-regulation researchers and university students (the majority of experiment participants) have consistent access to food, are well fed, and have sufficient glucose stores, this was not the case for prehistoric humans. In humans' evolutionary past, food was not always available to restore energy that had been expended in activities necessary for survival and reproduction, such as hunting, foraging, and copulation. To serve those functions and to fuel the immune system, vital to survival, energy resources must have been safeguarded. Hence there may be an evolved tendency for people to conserve energy, even when they are well fed.

The conservation view of self-regulation strength holds that cognitive and behavioral effects of self-control depletion occur because the brain/body denies those processes a sufficient allocation of energy resources (Beedie & Lane, 2012). The body (almost) always has sufficient energy to support increases in brain and body activity, including for self-regulation, but it allows only for energy expenditures to the extent that output is consistent with the person's motivational priorities. Research supports the idea that depletion effects are conservation effects (e.g., Graham, Bray, & Ginis, 2014; Muraven, Shmueli, & Burkley, 2006; Muraven & Slessareva, 2003; Tyler & Burns, 2009). Recent work in our lab has shown that people use heuristics, or mental short-cuts, to conserve the self-regulatory resource (Vonasch, Sjøstad, Maranges, & Baumeister, 2017). We found that when people were instructed to solve difficult logic problems using critical thinking rather than intuition, subsequent self-control efforts were impaired. Another study demonstrated that depleted participants relied on heuristics to solve problems more than nondepleted people. And that strategy seemed to work: Use of heuristics on the first task led to better performance on a subsequent self-control task. Crucially, the final study of this investigation found that participants who merely anticipated a future effortful task (compared to anticipating no future task) were more likely to use heuristics. In short, people strategically employ lazy thinking to conserve the self-regulatory resource when they have already used some up or when they expect to use it later. Thus, degradation of self-control may represent a tendency to conserve the self's resources rather than an incapacitation of self-regulatory abilities. With the conservation updates to the strength model of self-control, the muscle analogy is still useful, as physical muscles feel tired and decrease exertion to conserve energy long before they reach the point at which they can no longer function (Abdel-Hamid, 2002; Noakes, 1997).

Integrating the IVM and Strength Model

Berkman et al. (this issue) propose that goal-directed behaviors that are identity relevant are more likely to be successfully enacted via self-regulation because they have greater subjective value, relative to identity-irrelevant behaviors. Self-regulatory dilemmas occur when a person is faced with two or more

response options that vary in their consistency with and support of ongoing goals, and so the person compares those options. Those authors argue that identity in a given domain increases the value of domain-relevant behaviors and that the increased subjective value increases self-regulation toward relevant goals.

We applaud Berkman et al. for their IVM, which has brought together myriad findings of the self-control field and fits quite nicely with the updated strength model of self-control. The more important the goal is to the self, the more likely self-regulatory resources will be allocated to that goal's pursuit. Indeed, much of the work cited by Berkman and colleagues is our own (e.g., Baumeister & Heatherton, 1996; Tangney et al., 2004; Tice et al., 2007).

As is the case for many models of self-regulation, the IVM's conceptual coherence is benefited by the primary assumption of the strength model—that the body treats its energy as a limited resource. Berkman and colleagues argue that “a successful act of self-control reflects the tipping point at which the cumulative subjective value of a self-controlled behavior ... exceeds that of the alternatives” (p. 77) and therefore that people must have weighed the value of competing response options with data from many different sources, including identity. That is, the IVM accounts for a *mechanism by which* a person decides whether and to what extent she or he will self-regulate but is silent with respect to *why* the person must decide. Cost-benefit or valuation analyses entail that there is some inherent cost to potential responses, so one must calculate which response is most worth the cost. One inherent cost is the limited energy of the self, with conservation tendencies driving valuation calculations. We think this is an important factor to add to the IVM: Decisions about whether to engage in self-regulatory inhibition of a prepotent response may be affected by whether the self can afford the effort expenditure required for such inhibition.

According to the IVM, ego depletion reflects a decrease in the subjective value of continued self-regulation, or a

diminishing marginal value of effort: The value of completing the initial task is high enough to warrant working hard on it, but then the value of completing subsequent tasks is reduced because further effort does not produce sufficient additional gains. (p. 83)

This interpretation of depletion effects is consistent with other motivational accounts and suffers from the same conceptual shortcoming just discussed—*why* do people weigh values of response options if not because the very act of self-regulating is costly? Berkman et al. go on to suggest that the salience of the self can increase the value of employing self-control, and we concur.

Of course the self's identity guides allocation of self-regulatory resources. Identity is conceptualized by Berkman et al. (this issue) as the relatively stable schema of the self that includes values, beliefs, social identities, goals, and important past experiences (cf. Baumeister, 1986, 1987). Those aspects of the self are also instances of standards that guide self-regulation. So we agree that the self's values and standards direct both motivation (e.g., subjective valuations) and cognition (e.g., information processing) during a self-regulatory dilemma.

An important aspect of selfhood that is often overlooked is that the human self functions as a cultural animal, that is, the

self is an interface between the animal body and the social system with culture. We have two points about how the IVM would benefit from consideration of the cultural context in which a person self-regulates. First, the self develops with extensive input from culture: Culture shapes values, beliefs, social identities, goals, and important past experiences. Hence, acts of self-regulation not only affirm aspects of the self, as Berkman and colleagues suggest, but also aspects of identity as a group member. Further, the self appears to be defined by its role as an information agent (Baumeister, Maranges, & Vohs, *in press*). That is, humans have evolved motivations and cognitive abilities to seek out and share information with group members to improve the group's collective store of knowledge, which benefits survival of the group members (Baumeister et al., *in press*). Accordingly, people may value acts of regulation that benefit the group's information stores more highly than other acts.

Second, when the regulating self's identity is not salient in a particular domain, cultural input can combat potentially adverse effects of self-regulatory depletion. Those adverse effects include depleted persons becoming less fair (e.g., Mead et al., 2009), less prosocial (DeWall, Baumeister, Gailliot, & Maner, 2008), and more aggressive (DeWall, Baumeister, Stillman, & Gailliot, 2007). Some of our recent work suggests that one safeguard against the depleted person's misbehavior is the depleted self's vulnerability to external or social cues. Banker, Ainsworth, Baumeister, Ariely, and Vohs (*in press*) found that depleted people relied on situational cues in a dictator game to decide how much to take from or give to other people. One such cue from the group was the starting amount of money given or taken, which people could use as an anchor for their decision. When situational cues encouraged prosocial generosity and fairness, depleted people gave more and took less. Other work has shown that people in a depleted state make healthy and generous decisions when they think that group members are healthy and generous (Fennis, Janssen, & Vohs, 2009; Salmon, Fennis, de Ridder, Adriaanse, & de Vet, 2014). Having evolved as cultural animals, human selves rely on information about group norms and standards when their own capacity for effortful self-regulation is impaired. Berkman and colleagues seem amenable to this sort of thinking, suggesting that people's self-regulation can be benefitted by groups because of social influence or the motivation to live up to one's social identity. Yet the IVM may benefit from more heavily weighting the valuation of parts of the self's identity that are reinforced by its culture and acknowledging that the *self* is ultimately a *group member*. Indeed, one line of argument is that the human self evolved for the sake of group membership, much beyond what other primates exhibit (Baumeister, Ainsworth, & Vohs, 2016).

Integrative Future Directions

An integrative theoretical framework that takes into account the tenets of the strength model and the IVM suggests priorities for further empirical work on self-regulation. One important question is whether increased subjective value of a behavior in an identity-relevant domain is enough to overcome *severe* depletion. The strength model holds that the body treats

self-regulatory resources as limited, such that depletion corresponds to how much energy has been expended. Of course, one can be motivated to continue expending the precious resource when circumstances are sufficiently urgent, even if one has already depleted the resource to some degree. Consistent with that view, recent work has begun to delineate differing degrees of depletion. The traditional dual task paradigm, in which participants perform one self-control task for a few minutes, tends to tap into mild depletion evidenced by performance deficits on the second self-control task. New procedures distinguish between that mild depletion and more severe depletion, which can be brought about with a longer series of multiple depleting tasks. Vohs et al. (2008) first demonstrated this distinction: Depletion could be counteracted by the pleasantness of the task's choices if the task lasted for only 4 min; however, depletion effects emerged when choices had to be made for 12 min, regardless of their pleasantness (see also Choi & Fishbach, 2011; Graham et al., 2014; Muraven et al., 2008; Vohs, Baumeister, & Schmeichel, 2013). Other research has begun to shed light on the benefits that autonomy might confer to varying degrees of depletion. For example, when people were told that their participation on tasks that required self-control was important and that the level of effort they put forth was up to them, they performed better on subsequent tasks than people who were told to put forth their best effort (Graham et al., 2014; see also Moller, Deci, & Ryan, 2006). Again, when people performed many more tasks that required self-control, the benefits of autonomy no longer counteracted depletion (Graham et al., 2014). This work suggests that identity salience, insofar as it parallels autonomy, may help the person overcome mild but not severe depletion. Situations in which one is given autonomy over energy expenditures are different from facing a self-regulatory dilemma in a domain in which one's identity is salient, though. Understanding the role of identity in cases of severe depletion is therefore a rich challenge for future empirical work.

Another key question is how one's identity interacts with emotions during times of self-control depletion. Work in our lab suggests that depletion plays out on an emotional level as well as a behavioral level. Depletion increases vulnerability to negative feelings, presumably because protective top-down processes are impaired. For example, thoughts of death, which people usually can keep out of conscious awareness, intrude more than normally when people are depleted (Gailliot, Schmeichel, & Baumeister, 2006). More recently, Maranges, Schmeichel, and Baumeister (2016) compared the effects of ego depletion and cognitive load on emotions. We found that depleted people experienced increases in negative emotions, whereas people under a cognitive load did not, contrary to the oversimplified assumption that cognitive load and depletion reflect the same psychological state. Negative feelings evoked by unpleasant photos increased among depleted people but not among cognitively loaded ones. In another study, depletion, but not cognitive load, increased the tendency to match words based on negative, but not positive, emotional associations. Even the negative physical feeling (pain) of holding one's hand in ice water was felt more strongly by depleted people relative to loaded people, who were able to submerge their hands for longer times than depleted or neutral control participants.

Thus, self-control depletion leaves the self vulnerable to the experience of negative emotions, presumably by weakening defenses. If depletion is unavoidable, perhaps salience of a relevant facet of one's identity may encourage a shoring up of resources to defend against and regulate the negative effects of depletion. The literature provides clear-cut instructions for improving self-control behaviors in the long run (i.e., practice or exercise), but self-control could benefit from interventions that help manage emotions when people become depleted. Examining whether identity salience counteracts the negative *emotional* repercussions of depletion constitutes a profitable research agenda for future work with the IVM.

Empirical work has continued to build support for the idea that people higher in self-control do not necessarily have *more* willpower but rather are just better at using it. For example, people higher in trait self-control are faster in perceiving and resolving self-regulatory dilemmas relative to people lower in trait self-control (Gillebaart, Schneider, & De Ridder, 2016). Berkman and colleagues cite work demonstrating that increasing the salience of self-regulation itself increases self-regulatory success, presumably because people value willpower as a trait (Magen & Gross, 2007; Study 2). People higher in trait self-control may value self-regulatory skills and have built them into their self-concept more extensively than people lower in trait self-control. Bringing to mind a relevant aspect of the self may be another strategy people higher in trait self-control use when facing a self-regulatory dilemma. Exploring links between identity salience and trait self-control seems a promising way to gain insights.

Last, it is important to highlight that the self-regulatory resource appears to be used for other processes than those at play when facing a self-regulatory dilemma per se, including decision making (e.g., Pocheptsova, Amir, Dhar, & Baumeister, 2009; Wang, Novemsky, Dhar, & Baumeister, 2010), taking initiative versus remaining passive (e.g., Vohs et al., 2008; Vonasch, Vohs, Ghosh, & Baumeister, in press), planning (e.g., Webb & Sheeran, 2003), and coping with uncertainty (Alquist, Baumeister, & Tice, 2016). Future research should test to what extent having the self's identity in mind benefits people in those contexts. For example, recent work by Alquist et al. (2016) demonstrated that experiencing uncertainty in an ambiguous situation depletes the self-regulatory resource. That is, after a person encountered an uncertain situation, self-regulation performance suffered on a subsequent task. In one study, participants were instructed to solve problems for which it was unclear whether the participant should follow one set of instructions or another. Other studies in that investigation included manipulations that made participants uncertain as to whether they would later have to give a speech, and those uncertain participants subsequently showed signs of depletion, even relative to people who were certain they would give a speech (an anxiety-inducing task). Perhaps uncertainty undermines the self insofar as it is unclear which aspects of one's identity should be salient, and affirming specific facets one's identity in ambiguous or uncertain situations might defend against depletion. This could be a promising avenue for future research.

Conclusion

We find much to be admired in Berkman et al.'s (this issue) IVM of self-regulation. The central assertion that people will

self-regulate more vigorously and successfully in connection with issues pertinent to their cherished values and identity than other issues is a powerful insight.

The IVM is highly compatible with the strength model that has guided our own work (e.g., Baumeister & Vohs, 2016; Baumeister, Vohs, & Tice, 2007). The self tends to conserve its regulatory resources but will allocate them to acts that align with or promote its values and goals. In this comment, we elaborated on the current strength-model of self-regulation, noting how its key assumption, that people seek to conserve energy resources used for self-control, especially after prior exertion, strengthens the IVM. We also argued that an acknowledgment of the self as a cultural animal can benefit the identity-value framework. An integrative model underscores promising avenues for future research on the self and its regulatory processes. Self-control can be thought of as a muscle, but more specifically, one that works hard for goals associated with one's identity.

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