Beyond limited resources: Self-control failure as the product of shifting priorities

Michael Inzlicht[1,2] & Brandon J. Schmeichel[3]

[1] University of Toronto, Department of Psychology

[2] Rotman School of Management, University of Toronto

[3]Texas A&M University, Department of Psychology

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Please send correspondence to:

Michael Inzlicht
University of Toronto
Department of Psychology
1265 Military Trail
Toronto, Ontario M1C 1A4, Canada
E-mail: michael.inzlicht@utoronto.ca
Telephone: 416-208-4862
Fax: 416-287-7642

For much of the history of psychology, psychologists have been trying to isolate that skill or ability that predicts important life outcomes such as academic achievement, job success, health, and criminality. For much of this time the pinpointed factor was general intelligence, which indeed predicts a large array of positive life outcomes (Gottfredson & Deary, 2004; Moffitt, Gabrielli, Mednick, & Schulsinger, 1981; Neisser et al., 1996). More recently, researchers have discovered that self-control also confers many personal and societal benefits, often contributing to positive outcomes as much as or more than intelligence (e.g., Duckworth & Seligman, 2005; Moffitt et al., 2011). For example, self-control fosters the ability to stay on-task when our minds would rather wander, it allows people to restrain momentary desires to reach cherished long-term goals, and it allows people to overcome selfish impulses and for groups of people to work together. In short, we have discovered that self-control sustains the better angels of our nature, allowing us to live the good life (Baumeister, Heatherton, & Tice, 1994; de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012).

Defining Self-Control

Self-control, known colloquially as willpower and related to executive function or cognitive control (Robinson, Schmeichel, & Inzlicht, 2010), refers to the mental processes that allow people to override thoughts, emotions, or behaviors that compete with their overarching goals (Baumeister, Vohs, & Tice, 2007). At its heart, self-control is instigated when a person faces a conflict between two competing desires or response tendencies—say, when an ex-smoker is conflicted by the desire to smoke; when a religious Jew is overpowered by the delightful smell of bacon; or even when a study participant is conflicted between naming the color of a word and reading that word in a Stroop task. Such conflict is subjectively aversive and can lead people to inhibit or suppress one set of responses and replace them with the second set (Inzlicht,

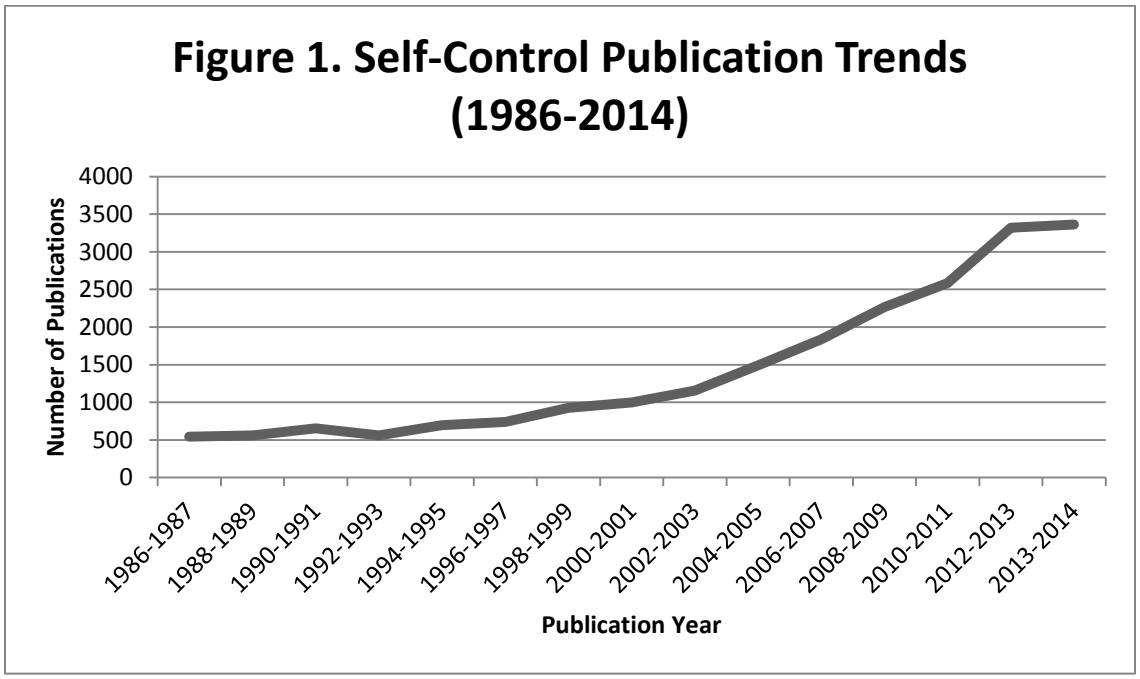
Bartholow, & Hirsh, 2015). Self-control is thought to be applied when a person chooses to inhibit their immediate desires (e.g., cigarette smoking, delightful bacon, word-reading) and to replace them with behavior that is in line with their longstanding goals. While some theorists have suggested that self-control can be effortless or automatic (de Ridder et al., 2012; Fujita, 2011; Gillebaart & De Ridder, 2015), in our view effort is the hallmark of self-control, with more effortless varieties of restraint falling under the broader concept of self-regulation (Carver & Scheier, 1998).

Although the topic of self-control (and self-regulation) has been studied for quite some time—Walter Mischel's famous marshmallow studies, for example, were conducted in the 1960s and 1970s (Mischel, Ebbesen, & Raskoff Zeiss, 1972)—interest in self-control really began to take hold relatively recently. Figure 1 illustrates trends for academic publications on self-control from 1986 to 2014[1], and it clearly shows a spike of interest in the late 1990s and early 2000s. The timing of this spike was not haphazard—it coincided with (and was likely caused by) the arrival of a new and elegant theory by Roy Baumeister and his colleagues called the resource (or strength) model of self-control (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister et al., 1994; Baumeister & Heatherton, 1996; Muraven & Baumeister, 2000). The resource model captured the imagination of the field (and the lay public) and it should be credited with bringing to focus an important yet relatively neglected facet of mind.

One of the more striking things we have learned from the resource model is that self-control wanes over time, having an apparent refractory period (Baumeister & Heatherton, 1996; Hofmann, Vohs, & Baumeister, 2012; Muraven & Baumeister, 2000). According to the resource model, self-control is based on some finite resource or energy, such that effortful control has a

[1] Figure 1 is based on a PsychInfo search on March 6, 2015 for all publications using the term "self-control" or "self-regulation" in any search field.

natural limit, beyond which self-control can no longer be exerted as people find themselves in a state called "ego depletion" (Baumeister et al., 2007).



Despite the prominence of the resource model, a precise understanding of how and why self-control wanes over time has been slow to develop, and it is clear that more theoretical and empirical work is needed (Inzlicht & Schmeichel, 2012). Here, we review the resource model of self-control and explore a number of empirical findings that are hard to reconcile with it. In commenting on the resource model, we review an alternative model that has little to do with resources and more to do with shifting priorities and motivations (Inzlicht, Schmeichel, & Macrae, 2014). According to this alternative, self-control wanes over time not because people become *unable* to restrain themselves, but because they are *unwilling* to restrain themselves, choosing to indulge in more leisurely pursuits instead.

The Resource Model of Self-Control (Version 1.0)

The original resource model of self-control suggests that self-control is based on a kind of fuel that powers the will (Baumeister et al., 1998; Baumeister & Heatherton, 1996; Muraven & Baumeister, 2000). This model made two major claims. First, self-control is claimed to draw upon a shared, central resource that underlies a vast array of behaviors. Although on their surface many behaviors appear different—snacking on carrots instead of chips, staying calm when hearing bad news, or saving money instead of spending impulsively—deep down they all involve the inhibition of some pressing urge or impulse. Whereas the idea that self-control is domain-general has not been controversial among social psychologists (e.g., Cohen & Lieberman, 2010), this idea in not without detractors, with some theorists suggesting that control might be domain-specific (e.g., Egner, 2008). It is nonetheless fair to say that there is a fair degree of consensus concerning the centrality of self-control for numerous behaviors.

The second major claim of the original resource model is that self-control is based on a limited resource or fuel that is consumed by use. Engaging self-control is thought to consume and deplete this limited inner capacity, leaving further attempts at control underpowered. Just as a battery consumes energy to power your mobile phone, self-control relies on some energy to power your will. And just as using your phone throughout the day drains the battery until you are unable to further use it, the argument goes that controlling your behaviors throughout the day drains your self-control resources until you are unable to further restrain yourself. This model is thought to explain why people tend to eat junk food and sit on the couch after a long day—their self-control fuel is depleted and they simply cannot control themselves any more. To be clear, although more recent versions of the model have revised this claim (Baumeister, 2014; see

below), the original claim was that self-control wanes over time because self-control becomes depleted or has run out.

The main evidence in support of the limited resource model of self-control comes from studies using a sequential task paradigm, whereby exerting effortful control at Time 1 impairs self-control performance on a different task at Time 2. A meta-analysis of studies published between 1998 and April 2009 revealed that nearly 200 separate studies had used the sequential task paradigm (Hagger, Wood, Stiff, & Chatzisarantis, 2010). Many more sequential task studies have been conducted since then. All of these studies have suggested that self-control wanes over time. For example, writing an essay while restricting one's use of certain common letters makes it more difficult to maintain items in working memory, tell the truth, act ethically, and learn simple categorization rules (Gino, Schweitzer, Mead, & Ariely, 2011a; Mead, Baumeister, Gino, Schweitzer, & Ariely, 2009; Minda & Rabi, 2015; Schmeichel, 2007).

The sequential task paradigm has been used not only to demonstrate that self-control wanes over time, but also to persuade researchers that self-control is limited and relies on a finite resource. That is, despite the fact that the sequential task paradigm remains silent about the precise processes that underlie self-control's refractory period—after all, self-control could wane at Time 2 after effortful control at Time 1 for a whole host of reasons (Hagger et al., 2010)—researchers have nonetheless concluded from it that self-control is based on a limited resource. To date, however, studies scrutinizing the precise processes via which self-control failure in the sequential task paradigm comes about have been lacking (Inzlicht & Schmeichel, 2012). It is possible that self-control wanes after initial exertion, but for reasons that have little to do with depleted resources.

The primary exception to the paucity of process evidence is research on glucose. In a highly influential paper Gailliot and colleagues (2007) found evidence to suggest that the resource powering the will was not some metaphorical entity, but was in fact the simple carbohydrate circulating in the blood stream that supplies energy to the body and brain, namely glucose. The studies reported by Gailliot and colleagues (2007) supported three important ideas: (1) self-control exertion leads to measurable drops in circulating blood glucose, (2) blood glucose covaries with and predicts self-control performance, and (3) ingestion of glucose-laden beverages can boost self-control. In combination, these three ideas provided powerful support for the resource model. The reason that self-control wanes after initial bouts of effort is that glucose-levels have been depleted. In other words, effortful control literally depletes an essential physical resource that is finite in nature.

The resource model was a real advance in understanding the psychology of self-control. It taught us a number of new things about self-control: Appreciating self-control as a central skill, critical for many life domains, was a real innovation, and recognizing that self-control has a refractory period, waning slowly over time, was a legitimate breakthrough. It is no wonder, then, that the resource model crossed disciplinary boundaries, being discussed not just in social psychology but also in cognitive psychology and human neuroscience (Heatherton & Wagner, 2011; Persson, Larsson, & Reuter-Lorenz, 2013; Shamosh & Gray, 2007), behavioral economics (Gino, Schweitzer, Mead, & Ariely, 2011b), and organizational/consumer behavior (Fennis, Janssen, & Vohs, 2009; Vohs & Faber, 2007). In brief, the resource model captured the imagination of more than a few fields and can be credited with changing the way we think of important societal issues, including, to name only one, intergroup interactions (Apfelbaum & Sommers, 2009; Richeson & Shelton, 2003).

The Resource Model of Self-Control (Version 2.0)

Despite the smashing success of the original resource model, it became clear that the model needed to be updated and revised. A few studies, in particular, led resource theorists to revise the model by suggesting that complete resource depletion or exhaustion is rare, with most instances of ego depletion reflecting only partial and temporary depletion (Baumeister & Vohs, 2007; Baumeister, 2014). The revised resource model (version 2.0) suggests that effortful self-control does not fully drain self-control resources until they are utterly gone; rather, effortful control is now thought to deplete the resource only partially and only slightly (Baumeister, 2014).

The first studies that led to this revision found evidence that motivational incentives could overturn the typical ego depletion effect. For example, people who were depleted by exertion on an initial task were able to control themselves effectively on a subsequent task if they were offered cash or interpersonal incentives for doing so (Muraven & Slessareva, 2003; see also Moller, Deci, & Ryan, 2006). If self-control resources are completely depleted, it is difficult to understand how motivations (or any other sort of psychological stimulants) could possibly have an effect. After all, if the battery on your mobile phone is drained, the phone will not work no matter how urgently or desperately you need to make a call. Hence, a model based on the complete depletion of a resource is implausible, justifying the need for resource model 2.0, whereby resources are only partly diminished. With this modification, people in a state of ego depletion can still control themselves if they are sufficiently motivated, such as when an important situation arises (Baumeister, 2014).

One powerful motive that is thought to drive how people behave after effortful control is the motive to conserve energy (Baumeister & Vohs, 2007). To return to our mobile phone

example, when battery-life reaches some critical low level, people refrain from using their phones unnecessarily and opt instead to preserve battery life for essential phone operations, like receiving phone calls or texts from loved ones. Just like their use of mobile phones, then, people are thought to withdraw effort in order to save their energy for some pressing need or opportunity. Support for conservation of effort comes from evidence that whereas exertion at Time 1 can lead to poor self-control at Time 2, it leads to even poorer self-control when people expect to perform an additional important task at Time 3 (Muraven, Shmueli, & Burkley, 2006). The anticipation of further effort leads people to restrain their current effort (and performance), presumably so that they have enough energy left over to perform the anticipated third task. In short, resource model 2.0 suggests that effortful control leads to ego depletion because people desire to conserve their limited energy stores.

Theoretical Problems with the Resource Model

The revised resource model (version 2.0) was an important acknowledgment of some of the shortcomings of the original perspective on limited resources for self-control. The major advance, in our view, was the recognition that the ego depletion effect does not reflect an inability to exercise self-control, but rather reveals a motivated decision not to exercise further self-control without good reason. In this section we take a more in-depth look at three intractable issues for a resource model of self-control before reviewing our process-based model of ego depletion.

What is the Resource? The first problem with the resource model is the inability to specify a *plausible* resource that fuels the will. Although there was much excitement about glucose as the physical resource that powers self-control (Gailliot et al., 2007), the glucose

findings have proven to be controversial and have been challenged on multiple grounds (Kurzban, 2010; Schimmack, 2012).

First, the idea that self-control can consume inordinate amounts of brain glucose is biologically implausible (Kurzban, 2010). Studies using positron emission tomography (PET), which directly measures localized changes in brain glucose metabolism, suggest that specific mental activities cause a local increase in glucose utilization of no more than one percent above resting levels (Raichle & Mintun, 2006). Mental effort, in other words, consumes very little brain glucose, and the little that it does use is readily circulating in the brain (Hockey, 2013). Confirming this implausibility, a series of experiments assessing carbohydrate metabolization with highly precise measurements repeatedly failed to replicate the finding that exerting self-control reduces levels of blood glucose (Molden et al., 2012).

In short, if exerting self-control does not reliably reduce blood glucose levels, then the idea that glucose is the physical manifestation of the metaphorical resource is in doubt. Revisions of the resource model have adapted to these facts, with new recognition that self-control failure is unlikely to be caused by shortages of blood glucose (Baumeister, 2014). Self-control may nevertheless operate based on some limited inner resource, but the resource must be something other than glucose. The identity of the resource remains unknown, and we suspect that it will remain unknown precisely because there is no literal resource that powers self-control.

Resource-Incompatible Findings. The second intractable problem with the resource perspective concerns findings that are incompatible with a resource account. These findings strain the necessity of a resource concept to explain self-control's refractory period (Inzlicht et al., 2014; Navon, 1984). The growing numbers of incompatible findings are of three varieties. The first variety reveals that self-control can be improved—not diminished—when other self-

control tasks are performed in tandem, the second indicates that depletion can be moderated by subjective perceptions and construals, and the third shows that depletion effects can be overcome when some sort of rewarding activity is performed between the two tasks of the sequential task paradigm.

The first variety of resource-incompatible findings comes from provocative new work on the propagation of self-control, which indicates that self-control can be improved when performing multiple self-control tasks at the same time (Tuk, Zhang, & Sweldens, 2015; see also Tuk, Trampe, & Warlop, 2011). In one study, for example, participants performed better on a Stroop task, a canonical measure of attentional control, if at the same time they were asked to inhibit their desire to eat tasty potato chips; when they were free to eat as many chips as they liked, in contrast, their Stroop performance suffered (Tuk et al., 2015, Study 5). In another study, participants were successful at curbing their desire to eat potato chips when at the same time they were asked to avoid looking at words popping up on a video of a women being interviewed; yet, they were less successful at curbing their appetites and ate more chips when their attention was free to roam on the salient words in the video (Tuk et al., 2015, Study 4). In short, self-control begets more self-control, at least when engaged concurrently. These findings are also broadly consistent with work on learned industriousness (Converse & Deshon, 2009) and conflict adaptation (Gratton, Coles, & Donchin, 1992; Kleiman, Hassin, & Trope, 2014) whereby short bouts of control have been found to induce mindsets that are conducive to further self-control success.

These sorts of studies are hard to reconcile with a resource account. If self-control truly relies on some limited, slowly replenishing resource that becomes depleted (even partially) after use, then it is difficult to understand how simultaneous acts of self-control can be successful. If

people run out of self-control fuel after use, or even if they are conserving their limited fuel for some pressing need, then how can concurrent control be so successful? Increasing the demands on a limited resource should make self-control less likely to succeed, not more. That is why when you use multiple applications on a mobile phone, such as listening to streaming music while typing an email, you drain more (not less) battery life than when you use only one application. One solution is to conceive of self-control as not being bound to resources, but instead as being based on preferences for and willingness to exert effort (Inzlicht et al., 2014), which might wax and wane based on factors like habituation (Converse & Deshon, 2009) and labor-leisure tradeoffs (Kool & Botvinick, 2014).

The second variety of resource-incompatible findings comes from research showing that changing perceptions and construals can counteract ego depletion. For example, when people perceive themselves as being depleted despite not having engaged in previous cognitive work, they exhibit poor self-control; conversely, when people perceive themselves as having lots of energy and stamina despite having previously worked hard, they show fully intact self-control (Clarkson, Hirt, Jia, & Alexander, 2010). Perceptions of depletion and vitality, then, appear to trump actual depletion. Similarly, lay theories about how self-control works and beliefs about whether it is based on a limited resource shape self-control (Job, Dweck, & Walton, 2010). When people believe that self-control wanes over time, they show typical depletion effects; however, when they believe that self-control is renewable, they show no noticeable drops in self-control over time. Further, research suggests that the construal of effort itself can determine whether effort leads to depletion. When people construe an effortful activity as work, they tend to show subsequent failures in control; when they construe the same task as fun and enjoyable,

they tend not to show these deficits (Laran & Janiszewski, 2011; Werle, Wansink, & Payne, 2014).

As with the research on the propagation of control, it is difficult to reconcile these studies with the resource model. If self-control fails because people have depleted some real physical resource, then how can subjective perceptions and construals make a difference? After all, a mobile phone will not work when the battery is drained, no matter how the battery-meter is perceived. According to the revised resource model, people drain some of their self-control resources as they exert themselves, after which they withhold subsequent effort to conserve these real, biologically-based resources. Presumably, actual effort consumes actual resources, thereby limiting the further willingness to control. But the research above makes clear that even the illusion of effort can limit self-control (Clarkson et al., 2010), which strongly suggests that the consumption of some physical resource is not needed to explain ego depletion and that models based on easily shifting priorities and choices can suffice (Inzlicht et al., 2014; Kurzban, Duckworth, Kable, & Myers, 2013).

The third variety of resource-incompatible findings comes from work showing that self-control can be overturned by motivational incentives. We have already discussed how incentivizing self-control can knock out ego depletion (Moller et al., 2006; Muraven & Slessareva, 2003). Whereas this pattern is problematic for the original resource model (version 1.0), it is less problematic for the updated resource model (version 2.0), which makes clear that resources are typically only slightly depleted, allowing for people to draw on their reserves and control themselves effectively when they are motivated to do so (Baumeister, 2014).

More problematic, however, is the increasing number of studies showing that the depleting effects of initial bouts of effortful control are undone by additional inputs and

incentives (Masicampo, Martin, & Anderson, 2014). For example, one remarkable study found that if depleted smokers smoked one cigarette in the minutes after their initial round of effortful control, they showed no measurable downstream effects on subsequent control; smokers who were not given the opportunity to smoke between the Time 1 and Time 2 tasks showed the typical self-control decrements characteristic of ego depletion (Heckman, Ditre, & Brandon, 2012). Smoking, in other words, undermines depletion (at least for smokers). Nearly 40 studies in total have documented similar effects (Masicampo et al., 2014). Thus, watching a favorite television program (Derrick, 2012), receiving a surprise gift (Tice, Baumeister, Shmueli, & Muraven, 2007), affirming a core personal value (Schmeichel & Vohs, 2009), gargling with sugar (Hagger & Chatzisarantis, 2013; Molden et al., 2012), briefly meditating (Yusainy & Lawrence, 2015), and even praying (Friese & Wänke, 2014) have all been found to counteract the typical ego depletion effect.

These sorts of studies are hard to reconcile with the resource model, even with resource model version 2.0. If depletion is due to people withholding effort in a bid to conserve their limited energies, applying effort only when an important situation arises (Baumeister, 2014), then it is hard to understand how bouts of pleasure and gratification can reverse this depletion. After all, smoking a cigarette does not make some mundane mirror tracing task any more meaningful or enjoyable (Heckman et al., 2012), and praying does not transform a Stroop task into something more pressing and important (Friese & Wänke, 2014). When a mobile phone battery is critically low, people limit their mobile phone use to important activities; we suspect that affirming core values or meditating will not change people's willingness to squander their limited battery life on unimportant things. What these additional inputs do accomplish, however,

is to offset initial mental effort and cognitive work, thereby increasing people's willingness to engage in further work (Kool & Botvinick, 2014).

In our view, self-control failure has little to do with resources being fully or partially depleted. Instead, we suggest that it has to do with willingness and motivation to apply effort, with willingness declining over time (Inzlicht et al., 2014; Inzlicht & Schmeichel, 2012). Willingness to apply effort does not always decline, however, and can wax and wane depending on countervailing incentives (Kool, McGuire, Rosen, & Botvinick, 2010), construal of effort (Laran & Janiszewski, 2011), and adaptation to effort (Dang, Dewitte, Mao, Xiao, & Shi, 2013; Dewitte, Bruyneel, & Geyskens, 2009).

The Process Model: Depletion as Shifting Priorities

The process model of self-control failure—which may be more descriptively called the shifting priorities model—integrates research from multiple areas, including work on the aversiveness of control (Botvinick, 2007; Kool et al., 2010), the opportunity cost model of effort (Kurzban et al., 2013), and the psychology of fatigue (Hockey, 2013). In our view, self-control is not that special; it is not based on some exceptional ability to power through adversity. Instead, we agree with others who liken self-control to a decision to engage in one course of action over another (Hare, Camerer, & Rangel, 2009; Kurzban et al., 2013; Sullivan, Hutcherson, Harris, & Rangel, 2014). Crucially, decisions about which action or goal to pursue, like many other decisions, are based on factors like the perceived effort of the action (Kool et al., 2010), opportunity-costs for committing to the action (Kurzban et al., 2013), and the dynamically changing value of the action (Kool & Botvinick, 2014).

The model first attempts to address *why* self-control wanes over time. We propose that this temporal dynamic was evolutionarily selected to solve a recurrent problem in animal life

(Tooby & Cosmides, 1992): the problem of balancing the needs for exploitation versus exploration, whereby the value of exploiting established sources of reward is pitted against the utility of exploring the environment for other opportunities (Cohen, McClure, & Yu, 2007; Tooby & Cosmides, 2005). Balancing this trade-off involves regulating the extent to which one favors task engagement (exploitation) versus task disengagement (exploration). Knowing when to persevere and when to change course is a balancing act—if the appropriate balance is not maintained, people may expend too much effort for too little reward or prematurely give-up on an endeavor before some large payoff. The point here is that natural selection would have favored adaptations that minimize opportunity costs caused by a poor decision about whether to engage or to disengage from a task (Kurzban et al., 2013). One such adaptation is making effortful control aversive, having inherent disutility (Kool et al., 2010).

Because effortful control is aversive, not only do people tend to avoid it, their desire to avoid it increases the more time they spend engaged in effortful control (Kool & Botvinick, 2014). In other words, the inherent disutility of working to control one's responses accumulates the more one has already engaged in work. This is another way of saying that people increasingly prefer rest and leisure after engaging in effortful control and labor.

From this perspective, self-control's refractory period may be the motivated switching of task priorities, wherein all forms of mental effort become increasingly aversive, making mental leisure increasingly attractive (Job, Bernecker, Miketta, & Friese, in press). What this means is that depletion may not be about some finite resource being exhausted, but about people's preferences and priorities changing. Specifically, initial bouts of effort may lead people to subsequently prefer engaging in "want-to" goals as opposed to "have-to" goals (Inzlicht et al., 2014). That is, people may experience a shift in motivation away from "have-to" or "ought-to"

goals, which are carried out through a sense of obligation and duty, and instead come to prefer "want-to" goals, which are fun, personally enjoyable, and meaningful (Ryan & Deci, 2000; see also Milkman, Rogers, & Bazerman, 2008) . Although this motivational shift was originally conceived as primarily influencing subsequent attention (Inzlicht & Schmeichel, 2012), or subsequent attention and emotion (Inzlicht et al., 2014), it likely affects all information processing modalities (e.g., perception, memory, attention, emotion, etc.) given motivation's far reach. Thus, depletion may affect not only effortful control, but also what people pay attention to in their environment, as well as how they perceive, remember, and emotionally react to it.

Without some countervailing reward to offset the increasing aversiveness of work, people will prefer to engage in activities they find more pleasurable (Inzlicht et al., 2014). Thus, self-control can be seen as the product of multiple inputs that either increase or decrease the value of engaging effortful control. Effort appears to have inherent disutility—that is, effort itself is aversive—but this disutility can be countered by additional sources of value that may lead someone to decide to engage effortful control, including being self-affirmed (Schmeichel & Vohs, 2009), gargling with sugar (Molden et al., 2012), smoking a cigarette (Heckman et al., 2012), or getting the opportunity to meditate (Yusainy & Lawrence, 2015). The disutility of effortful control can also be countered by framing it as a means toward some inherently fun and enjoyable end, thereby changing the value of effort itself, like when walking is framed as sight-seeing instead of as exercise (Werle et al., 2014). In this light, expectations about how self-control works (Job et al., 2010) and perceptions of fatigue and vitality (Clarkson et al., 2010; Draganich & Erdal, 2014) act as additional inputs that add or subtract value from the decision about whether to apply effort.

Strengths and Weaknesses of the Process Model

The process model is consistent with the view of self-control as a decision about whether or not to exert effort. It allows multiple inputs to influence this decision, including information about effortfulness, task importance, opportunity costs, countervailing rewards, and task framing. And, because it recognizes that the inputs into decision change over time, including the dynamically changing valuation of labor versus leisure, it is not only consistent with the major discovery of the resource model, that self-control wanes over time, it can also accommodate findings that are difficult to account for with a resource model (e.g., Clarkson et al., 2010; Dang et al., 2013; Heckman et al., 2012).

The process model has the benefit of accounting for the existing literature without reference to the problematic resource concept (Navon, 1984). The resource concept is of little use in explaining why one minute of mental effort (Halali, Bereby-Meyer, & Meiran, 2014)—which should have no noticeable impact on a resource—can still have measurable downstream consequences. The process model also makes predictions unanticipated by the resource model, such as effects related to the basic perception of stimuli that have nothing to do with self-control (e.g., Schmeichel, Harmon-Jones, & Harmon-Jones, 2010). Finally, the process model is consistent with, and is indeed based on, modern theories of fatigue that make no reference to energy or resources, but instead are based on motivation (Hockey & Earle, 2006; Hockey, 1997, 2013).

Despite the positives of the process model, the model also has shortcomings. First, there is little direct evidence that depletion is mediated by changes in motivation, priorities, or goals (Baumeister, 2014). That is, the process model makes strong claims about self-control failure being the product of changing motivational priorities (and not depleted resources), yet there is

little direct evidence in support of this view. We note that few researchers have bothered to examine this important issue (Inzlicht & Schmeichel, 2012), so the absence of evidence should not be confused with evidence of absence. And a few recent studies are very much consistent with the process model. For example, people in a state of depletion appraise their goals as less important and worthwhile, as being less of a priority (vanDellen, Shea, Davisson, Koval, & Fitzsimons, 2014). Similarly, people in a state of depletion report lower levels of commitment to their self-control goals, an effect that can be overcome by reminders of their goal commitment (Walsh, 2014). Thus, more research is accruing to suggest that depletion does indeed change people's appraisal of the importance of their self-control goals, including their commitment to these goals. Given the clear relationship between goals and motivation (e.g., Kruglanski et al., 2002), we take these recent findings as evidence in favor of the process model. But, more work is needed.

A second drawback of the process model—and one that we think confounds some people—is that self-control *feels* limited. The process model suggests that self-control is limitless if motivation and desire is high, but this seems to collide with common sense. After all, people do indeed get fatigued to the point of exhaustion when working on effortful tasks for extended periods, even the ones they enjoy. It is hard for people to sustain effort for long durations, giving credence to the idea that they have run low on energy. For example, air traffic controllers need to expend inordinate amounts of effort to stay vigilant to prevent tragedies, and there is no doubt that they are highly motivated to not make errors. Nevertheless, air traffic controllers do indeed become fatigued, with flagging attention a consequence and mandatory leisure breaks, a remedy.

The process model suggests that this flagging of effort is due to changes in motivation and priorities, and not due to some internal limit on how long effort can be sustained. This seems

to fly against conventional wisdom and subjective experience. Yet, modern theories of fatigue suggest that this is precisely what happens (Hockey, 2013). Even when people work on important tasks, tasks that they are highly motivated to complete, people can only sustain their effort for so long—this is the exploitation mode we referred to earlier. The reason for this is that over time, people become habituated to a task, finding it less interesting or important as they consider other possible tasks and activities that might come to seem more pressing (Kurzban et al., 2013)—this is the exploration mode. An ambitious student studying for a final can sustain her efforts to study in the library for only so long before her desire to eat, check email, socialize with friends, or sleep come to dominate her attention. When she decides to take a break or to stop studying for the day, it is not because her energies are depleted, but because other goals become more important. Despite self-control really seeming to be limited, we know of no evidence that directly corroborates this view (Hagger et al., 2010).

Is the Resource Model (version 2.0) a Motivational Model?

The idea that depletion is typically a slight diminishment of a resource (Baumeister, 2014) is an important turn for the resource model. Unlike the original model, the revised resource model (version 2.0) suggests that ego depletion reflects a slight (but not complete) diminishment of a central resource. That is, self-control failures are now recast as efforts to preserve a resource that is only somewhat diminished. If depletion is mostly mild, however, with people having "ample reserves of energy" (Baumeister, 2014, p. 314), why would it lead to self-control failure at all? That is, if people have the resources needed to engage effortful control, what holds them back?

In our view, the revised resource model (version 2.0) is hardly different than a model based on changing motivations and priorities (Inzlicht et al., 2014). If people indeed have ample

energy (Baumeister, 2014), then the reason that self-control wanes over time is because people decide that some tasks are not sufficiently interesting, important, or worthwhile and choose not to apply effort. That is, depletion seems to have turned from a question of inability to a question of unwillingness. If the resource is still ample, then one cannot blame resource unavailability for subsequent self-control failure, at least at the proximal level. For example, if restraining one's emotions leads people to overeat (Vohs & Heatherton, 2000), yet leaves the resources that power the will mostly intact, can we blame overeating on the unavailability of resources? We believe not.

We do not mean to imply that the resource concept is irrelevant; we simply think it plays no pivotal role as the proximal mediator of ego depletion. The process model—and it seems the revised resource model (version 2.0) as well—suggest that the reason people do not control themselves at Time 2 is that they do not deem the Time 2 worthy of their efforts. But why do people generally deem the Time 2 task unworthy? The resource model suggests it's because people are motivated to save their dwindling supplies of self-control energy; in this view, resources are central. People have an idea, be that a lay theory (Job et al., 2010) or one based on actual fact, that their energies are finite and because of this idea, they may ration it, selectively using it on tasks that they think are worthwhile. So while the revised resource model (version 2.0) admits that people selectively use their self-control energies (based on preferences, choices, etc.), it also suggests an ultimate reason for this selectivity: because self-control is limited and eventually runs out. In short, the ultimate cause of depletion is limited resources, which then leads to changes in willingness to use that resource. The process model, in contrast, dispenses of the resource concept altogether.

Like the revised resource model (version 2.0), the process model suggests that the proximal cause of depletion is lack of willingness, but unlike the resource model it suggests that this unwillingness stems from the desire to balance competing goals and motives (Inzlicht et al., 2014). At any one time, people have a number of goals that they desire to enact (Kruglanski et al., 2002). The problem is that sometimes these goals conflict and sometimes choosing one goal precludes choosing another goal. One solution to competing goals is to have a mechanism in place that prevents people from perseverating on any one goal so that they can sample other goals, which is to say that evolution needed to build a mechanism that allowed for a switching between task engagement and disengagement or between exploitation and exploration (Cohen et al., 2007; Tooby & Cosmides, 2005). By preventing the accumulation of opportunity costs (Kurzban et al., 2013), such a mechanism would foster intelligent decisions and goal commitments.

The point of all this is to say that the process model and revised resource model (version 2.0) are in apparent agreement about the proximal cause of ego depletion: people's lack of willingness to exert more effort. The key difference between the models is in the ultimate causes of this change in willingness: The resource model claims that this derives from a motivation to conserve limited resources, whereas the process model claims that it derives from a motivation to balance competing goals. The problem here is that it is often difficult to test between different ultimate causes, given the distance between the effect and the ultimate cause (e.g., Conway & Schaller, 2002). Nonetheless, there is evidence that is consistent with the conservation of energy account (Giacomantonio, Jordan, Fennis, & Panno, 2014; Muraven et al., 2006), and evidence that is consistent with an account based on switching motivational preferences (Job et al., in

press; Schmeichel et al., 2010), but more research examining these competing ultimate causes are needed.

Conclusion

The resource model of self-control should be celebrated. Not only did it bring much needed attention to a neglected area of psychology, it also revealed that self-control has a refractory period. This finding was a legitimate breakthrough, being influential in a number of subfields of psychology and beyond. Despite its influence and importance, basic questions about how and why ego depletion operate remain, with the original resource model unable to account for quite a few discrepant findings (Masicampo et al., 2014). These discrepancies have forced researchers to rethink core assumptions and have led to a revision of the original model (Baumeister, 2014) and spawned a number of competing models as well (Dang et al., 2013; Inzlicht et al., 2014; Kurzban et al., 2013). We believe that the revised resource model can successfully accommodate some of the discrepant findings, for example findings on how motivation can counteract depletion (e.g., Muraven & Slessareva, 2003), but the model has difficulty with others. The resource model (both version 1.0 and 2.0) has real trouble with recent findings showing that concurrent demands can increase control (Tuk et al., 2015) and with findings showing that the subjective perceptions, expectations, and mindsets trump depletion (Clarkson et al., 2010; Werle et al., 2014). In contrast, modeling self-control as a decision about whether or not to engage effort allows for self-control to be more flexible and to change based on the various inputs that go into any decision making process.

The goal of this chapter was to examine the theoretical underpinnings of the resource model and to focus on areas where it appears lacking. Such a focus should not detract from our legitimate view that the resource model has been a boon to the field. Finding that self-control

wanes over time was a real advance. We suspect it will continue to inspire researchers for years to come.

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