

RUNNING HEAD: LAY THEORIES OF SELF-CONTROL

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Lay Theories of Self-Control

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Abstract

Why do people sometimes fail to regulate their behavior effectively to accomplish their goals? How can they do better? This chapter explores the role of prominent beliefs in society about the nature of willpower, and how these beliefs shape self-regulation. Social factors can convey, and people can believe, that self-control relies on a limited resource and, when this resource is drawn down, so too is the capacity to exert self-control (limited-resource theory). Or people can reject this idea, and believe instead that exerting self-control can become self-energizing and even boost later performance (nonlimited-resource theory). Longitudinal and experimental studies show that these beliefs or lay theories causally affect how people strive toward goals and ultimately their well-being. The belief that willpower relies on a limited resource undermines self-control in the laboratory and in everyday life, especially as demands accumulate. This theory sensitizes people to cues about the availability of mental resources, such as feelings of tiredness and the consumption of sugar long before any actual lack of resources, and facilitates the goal to rest following self-control efforts. By contrast, the belief that willpower is not so dependent helps people maintain their self-control and make progress on valued personal goals, and increases well-being.

Keywords: lay theories, self-control, self-regulation, ego depletion, goal-striving, well-being, rest goal, self-efficacy

People sometimes fail to behave as they intend. Children who participated in the famous marshmallow experiments wanted to wait and not to eat a tempting marshmallow placed on the plate before them. They knew that they would get a second marshmallow if they managed to wait until the experimenter came back. Still, many children ate the one marshmallow losing the chance to get a second one (Mischel, Shoda, & Rodriguez, 1989). Often people give in to temptations and immediate impulses at the cost of their long-term goals. Aggression and violence, over-eating, impulsive spending and sexual behavior, as well as drug addiction are examples of failures in self-control (Baumeister & Heatherton, 1996; Gottfredson & Hirschi, 1990; Vohs & Faber, 2007). They can have disastrous consequences for an individual and high costs for society as a whole. Therefore, considerable psychological research has aimed to understand self-control failures and investigate ways to improve self-control. The research reviewed in this chapter focused on people's beliefs about the availability of self-control capacity as an important predictor of their self-control.

During the last few decades, social-psychological research on self-control has been dominated by a model that uses a simple metaphor to explain self-control failures: the strength model of self-control (Baumeister, Bratslavsky, Muraven, & Tice 1998; Muraven, Tice, & Baumeister, 1998). This model suggests that self-control relies on a limited resource. Engaging in self-control draws down this resource, leaving the individual with reduced capacity to exert further self-control. In support for this theory, studies have found that after people have exerted self-control on one task subsequent self-control performance is impaired, even on a very different kind of task. This is termed the *ego depletion effect*. The strength model of self-control stimulated an impressive array of empirical research. Ego depletion effects were documented for outcomes as diverse as intellectual performance (Schmeichel, Vohs, & Baumeister, 2003), information processing (Fischer, Greitemeyer, & Frey, 2008), impression management (Vohs, Baumeister, & Ciarocco, 2005), and resisting violent responses to a

partner's provocation (Finkel, DeWall, Slotter, Oaten, & Foshee, 2009) (for meta-analytic summaries and controversies, see Carter, Kofler, Forster, McCullough, 2015; Hagger, Wood, Stiff, & Chatzisarantis, 2010). Indeed, ego depletion has been described as a universal phenomenon based in physiology (Gailliot & Baumeister, 2007).

However, increasing evidence questions this model. New research finds that the ego depletion effect is not inevitable but is affected by motivation (e.g., Inzlicht & Schmeichel, 2012; Inzlicht, Schmeichel, & Macrae, 2014; Molden et al., 2012) and other moderators (for overviews see Loschelder & Friese, in press; Masicampo, Martin, & Anderson, 2014). For instance, monetary incentives, autonomy, and positive mood can prevent ego depletion effects (Moller, Deci, & Ryan, 2006; Muraven & Slessareva, 2003; Tice, Baumeister, Shmueli, & Muraven, 2007). Further, people's expectancies about their ability to exert self-control following the exertion of self-control can moderate ego depletion. People were told that performing an effortful task (controlling their emotions) could either improve or harm performance on a subsequent task (Martijn, Tenbült, Merckelbach, Dreezens, & de Vries, 2002). Participants' subsequent self-control performance confirmed their expectations: Those who expected self-control depletion performed worse, while those who expected a self-control boost performed better.

We ask a more general question. Perhaps it is not just that motivation helps people overcome depletion. Perhaps lay theories about self-control in general give rise to ego depletion in the first place (see also Mukhopadhyay & Johar, 2005). People may draw from society's general theories about the nature of self-control capacity. These general theories are expressed, for example, in cultural products like movies or advertisements that echo and promulgate a specific belief ("You're not you when you're hungry"). Holding a global theory that difficult tasks deplete one, making it difficult to sustain self-control efforts, may make people feel depleted, exhausted, and in need of rest and replenishment when they face high demands. We

expected that people who do not endorse this limited theory on self-control—who instead believe that self-control efforts can even become self-energizing—may not experience depletion.

In this chapter we provide an overview of research on lay theories of self-control. Laboratory research shows that these theories, both measured as an individual difference and manipulated to examine causality, predict performance as people take on a series of self-control tasks. The theory that self-control does not rely on a limited resource helps people sustain self-control performance. Further, theories of self-control matter in everyday life settings. They predict self-regulatory success as well as well-being, specifically when people face high demands.

Measuring Lay Theories of Willpower

A first step to investigating people's lay theories on self-control was to develop a measure. Previous research showed that lay theories (e.g., of the malleability of personal attributes) are typically domain specific (Dweck, 1999). Since we expected the same for lay theories of self-control, we decided to begin by focusing on strenuous mental activities. We developed a scale containing six items that reflected the belief that self-control, for which we also use the colloquial term willpower, relies on a limited and easily depleted resource (*limited-resource theory*; e.g., “After a strenuous mental activity your energy is depleted and you must rest to get it refueled again”). Reverse-coded items (e.g., “After a strenuous mental activity, you feel energized for further challenging activities”) referred to the opposite belief: They reject the idea that willpower is highly constrained and, instead, suggest that exerting willpower can be energizing. We called this belief a *nonlimited* theory about willpower (Table 1). People with a nonlimited theory do not necessarily believe that self-control capacity is infinite or that they can exert self-control endlessly, never needing to rest or sleep. It is not an “unlimited” belief. However, they reject the view that willpower is readily depleted by acts of self-control.

Depending on the research question and the purpose of a study, we have developed additional scales assessing lay theories in other domains, like resistance to temptation, emotion control, and physical exertion (Bernecker & Job, 2015a, in press). The domain-specific scales represent distinct factors that best predict specific behavior when matched to the behavior in question. For example, in a study conducted with Type 2 diabetes patients, only willpower theories in the domain of resisting temptations predicted junk food eating and only willpower theories in the domain of strenuous physical activity predicted physical activity (Bernecker & Job, 2015a).

The willpower theories scales we have developed so far are certainly not exhaustive and future research may well develop measures in other self-control domains.

Do People Experience Ego-Depletion Only if They Believe that Willpower Relies on a Limited Resource?

Our first set of studies tested whether ego depletion is “all in your head,” that is, whether it occurs only if people *believe* that willpower relies on a limited resource (Job, Dweck, & Walton, 2010).

In a first study, we tested the hypothesis that peoples’ habitual lay theories about willpower, as assessed with the “strenuous mental activity” scale, would moderate the ego depletion effect. After filling out the scale, participants completed a difficult self-control task that has been used in previous research to induce a state of depletion, or an easier version of the task that does not require self-control. We then assessed a classic laboratory measure of self-control: Stroop performance. Color words (red, green, yellow, and blue) appeared on a computer screen in one of the four colors. Participants were instructed to indicate the color of the font, which either matched or did not match the meaning of the word. This task requires self-control because on incongruent trials (e.g., the word “red” displayed in green) people have to suppress the meaning of the word. Previous research has found ego depletion effects on

performance on these trials (Inzlicht, McKay, & Aronson, 2006; Webb & Sheeran, 2003). Participants who held a limited-resource theory showed the same pattern. After completing the difficult rather than easy initial task, they made more mistakes on incongruent trials on the Stroop task. But participants who held a non-limited theory performed equally well whether they had completed a difficult “depleting” or nondepleting task first. These results have been replicated several times; by us (Job, Walton, Bernecker, & Dweck, 2013) and independently (Chow, Hui, & Lau, 2015; Salmon, Adriaanse, De Vet, Fennis, & De Ridder, 2014).

Research also extends these findings to other self-control domains, including resistance to temptation (Bernecker & Job, in press). In one study, participants who had to resist a tempting food (freshly baked buns) (see Baumeister et al., 1998) later showed poor Stroop performance to the extent that they endorsed the theory that people have a limited capacity to resist temptations. Illustrating the domain-specificity of willpower theories, people’s theories about whether strenuous mental activities depend on a limited resource did not predict performance in this study (the two scales were only modestly correlated). Another study examined theories about emotion control (Bernecker & Job, in press, Study 2). We manipulated whether people had to suppress their emotions during a funny video (see Brown & McConnell, 2011). Lay theories about emotion control (but not strenuous mental activity) predicted how long people persisted on a subsequent frustrating task. People who thought that their capacity to control emotions depends on a limited resource persisted less long when they had had to suppress their emotions than when they had not. But people who thought the capacity to control emotions does not depend on a limited resource showed no decrement in persistence when they had had to suppress their emotions.

Taken together, these studies suggest that people who hold unlimited willpower theories do not experience ego depletion in a wide range of self-control domains. Moreover, they illustrate that theories of willpower are domain specific. If people think that strenuous

mental activity drains a limited resource, they become depleted after such a task and show impaired self-control even in other domains (e.g., Stroop). However, they do not necessarily feel depleted after resisting a temptation, since they do not necessarily believe the resistance to temptations depends on a limited and depletable resource. To matter, the implicit theory assessed in a research study has to match the initial, “depleting” task.

In the studies described so far, theories about willpower were only measured. They thus do not demonstrate their causal effect. Perhaps people who actually have greater self-control in a domain see this self-control as less limited, and this is why they can maintain their self-control performance as self-control demands accumulate. To address possibilities like this and test the causal effects of willpower theories, we manipulated theories about willpower using two biased questionnaires containing easy-to agree-with items that endorsed either a limited or a nonlimited resource theory (e.g., “Working on a strenuous mental task can make you feel tired such that you need a break before accomplishing a new task” vs. “Sometimes, working on a strenuous mental task can make you feel energized for further challenging activities”, see Table 2). This procedure evokes thoughts consistent with a specific theory. Manipulation checks consistently show that in each condition participants agreed with the suggested theory. As predicted, in the context of strenuous mental activity, participants led to endorse the limited resource theory showed ego depletion (Job et al., 2010). They performed worse after they had completed a “depleting” task as compared to the nondepleting control task. In contrast, participants led to endorse the nonlimited theory showed no drop in self-control performance following the initial “depleting” task as compared to an undemanding task. Thus, manipulated theories about willpower showed parallel effects on self-control performance as measured theories.

An artificial aspect of most laboratory research on self-control including the above-mentioned studies is that they assess performance on a single self-control task rather than

sustained effort and success over time. A further study tested whether willpower theories might predict people's sustained efforts over the course of a challenging learning task (Miller, Walton, Dweck, Job, Trzesniewski, & McClure, 2012). Participants completed the biased questionnaire that manipulated their theory about willpower. They then engaged for 20 minutes with a demanding task widely used to improve working memory. Although all participants learned effectively at the beginning of the task, improving their performance over the first half of the task, participants led to think of willpower as a limited resource stalled over the second half of the task, whereas those in the nonlimited theory condition sustained their learning and improvements in performance over the full task.

These laboratory experiments indicate that reduced performance after previous self-control exertion (i.e., "ego depletion") results not from a true lack of resources but from people's beliefs about their self-control capacity. They raise important questions. First, many goals in the real world demand sustained self-control. Can implicit theories about willpower affect the extent to which people accomplish their goals and flourish in their daily lives? And second, what mechanisms underlie the effects of willpower theories on sustained self-control?

Effects of Lay Theories About Willpower in Everyday Life

The strength model of self-control suggests that understanding the limits of self-control capacity should help people use their limited resources wisely and therefore predict better self-regulation and well-being. People with a nonlimited theory, by contrast, may overuse their resources and suffer from severe depletion when high demands accumulate (Vohs, Baumeister, & Schmeichel, 2012). However, in contrast to this view, we hypothesized that a limited resource theory leads people to let up on self-control efforts long before they have reached any actual limit. If so, they may reduce their effort on everyday tasks and fail to accomplish their goals, especially when they face high demands. But people with a nonlimited theory might better sustain their efforts, improving their everyday self-regulation.

Everyday self-regulation

In a first longitudinal study (Job et al., 2010, Study 4), we tracked college students across three time points over an academic term, the last of which was during final exams. The results showed that only students who endorsed a limited-resource theory (assessed with the strenuous mental activity and the resisting temptations scale) self-regulated less effectively at the stressful final time point, for instance reporting procrastinating more and eating more junk food controlling for baseline self-regulation.

This study simply assumed that self-regulatory demands were high for all students as final exams approached. A second study examined the level of self-regulatory demands each student reported on a week-by-week basis so as to distinguish students who faced high demands from those who faced lower demands (Job, Walton, Bernecker, & Dweck, 2015). As predicted, although students with limited and nonlimited willpower theories faced similar levels of self-regulatory demands, only those with a limited theory showed increasing self-regulation failures (e.g., procrastination, junk food eating, bad time management) as demands increased. In addition, this study assessed students' end-of-term grade point average (GPA). Among students who took a heavy course load, students with the nonlimited theory earned higher grades than students with the limited theory.

A recent study extended these findings to people with diabetes, who face particularly high and significant self-control challenges (Bernecker & Job, 2015a). To control their blood sugar levels, people with diabetes have to adhere to a complex regimen involving regular blood sugar testing, medication, a low-glycemic diet, and exercise throughout their entire life (Boule, Haddad, Kenny, Wells, & Sigal, 2001; Brand-Miller, Petocz, Hayne, & Colagiuri, 2003). Would lay theories about willpower predict how well patients adhere to their therapy? In a correlational study, type 2 diabetes patients completed three theories about willpower scales (resisting temptations, physical activity, strenuous mental activity) and measures assessing

therapy adherence (i.e., blood glucose monitoring, diet, exercise) and psychological adjustment (i.e., emotional distress, well-being, life quality). As predicted, participants with a limited theory reported fewer self-care activities (full scale), a less healthy diet (resisting temptations scale), and less physical activity (physical activity scale) than people with a nonlimited theory. They also reported more emotional distress from the disease and experienced less subjective well-being and reported a worse life quality. The belief that willpower is nonlimited seems to be more adaptive for coping with the demands that arise from managing diabetes than the belief that willpower is limited.

Personal goal-striving and well-being

Another important context of self-regulation involves the personal goals people set for themselves, and their success in accomplishing them. For instance, a person may have the goal to be admitted to a specific college or to lose ten pounds of weight. Personal goals are conscious representations of anticipated end-states. They represent what people strive for and want to achieve in life (Emmons, 1986; Klinger, 1977; Little, 1983). Several theorists propose that having goals and striving for and achieving them is crucial for the development and maintenance of well-being, because goals provide meaning, structure, and direction to a person's life as well as, when completed, a sense of accomplishment (Brunstein, 1993; Diener, Suh, Lucas, & Smith, 1999; Emmons, 1986; Maier & Brunstein, 2001).

In early research on personal goal-striving, Mukhopadhyay and Johar (2005) showed that measured and manipulated beliefs about self-control as depending on a limited or a nonlimited resource and as either malleable versus fixed affected the number of New Years' resolutions people set. People who thought that self-control is not limited set more New Years' resolutions. Moreover, a second study showed that manipulating lay theories about willpower affected people's success in the keeping of their resolutions. Participants led to view willpower as dependent on a limited resource were less likely to succeed four months later, especially if

they had set difficult goals. It seems that they were more likely to give up in the face of difficulties or setbacks.

To examine more directly whether lay theories of self-control predict goal attainment most when demands accumulate, one of the above-mentioned longitudinal studies (Job et al., 2010, Study 4) assessed self-regulation with respect to a personal achievement goal. At the first assessment period, students listed a personal goal that involved challenge and achievement. People were asked at each subsequent time point over the term how well they had regulated themselves in pursuing this goal (e.g., “I was often not in the mood to do something for this goal”). As predicted, during the demanding final exam week, students who had a limited theory about willpower reported worse goal-related self-regulation than students with a nonlimited theory. Another study found that with a limited resource theory even demands experienced on a day-to-day basis can undermine self-regulatory efforts toward personal goals (Bernecker & Job, 2015b).

If people with a nonlimited theory make more progress toward to their personal goals, do they experience greater well-being? In another set of studies, we first found a strong relationship between theories about willpower and life-satisfaction as well as affective well-being (Bernecker, Herrmann, Brandstätter, & Job, 2015). The more people endorsed a nonlimited theory about willpower the greater was their subjective well-being. Next, a longitudinal study tested whether willpower theories predicted change in subjective well-being over students’ first year in college. As expected, a limited theory about willpower predicted a decline in subjective well-being from a period with low demands (i.e., the beginning of the first year) to a period with high demands (i.e., final exams at the end of the first year). Another longitudinal study replicated this finding using a daily diary method and, moreover, showed that the gains in well-being for people with a nonlimited theory of willpower were mediated by more effective goal striving and more progress toward personal goals over the course of the

term (Bernecker et al., 2015, Study 3). These findings show that a nonlimited theory of willpower does not just help people accomplish tasks in the face of demands. It does not just make people better workers. It helps people accomplish goals—people’s own priorities for their lives—and this improves their well-being.

Mechanisms

How does a limited theory about willpower undermine people’s efforts at self-control, especially as demands accumulate? So far, several potential mechanisms have been explored: perceived exhaustion, sensitivity to cues about the availability of resources, activation of the goal to rest, and self-efficacy.

Perceived exhaustion

The first evidence that perceived exhaustion may play an important factor came from a series of experiments conducted by Clarkson and colleagues, which found that a manipulation of the exhaustion people perceived in a previous task affected subsequent self-control performance, whereas actual self-control exertion did not (Clarkson, Hirt, Jia, & Alexander, 2010). Does a limited theory about willpower make people experience self-control exertion as more exhausting, and is this what reduces subsequent performance? To test this question, we assessed perceived exhaustion (“How exhausting was the task?”) in a study manipulating implicit theories about willpower (Job et al., 2010, Study 3). Even though the manipulation affected subsequent self-control performance, it had no effect on the degree to which people perceived the “depleting” task as exhausting (see also Job, Bernecker, Miketta, & Friese, 2015). Instead, willpower theories affected how people responded to the experience of exhaustion. People in the limited willpower theory condition responded to feelings of exhaustion with decrements in their subsequent self-control performance. The more exhausting they found the first task, the worse they performed on the second task. This was not the case for people in the nonlimited theory condition. Although they found the “depleting” task just as exhausting, for

them, feelings of exhaustion were not a reason to let up on their self-control efforts. A limited-resource theory seems to attune people to experiences of exhaustion, and to take this as a sign to let up.

Sensitivity to cues about the availability of resources

If people with a limited-resource theory are sensitive to perceived exhaustion, are they sensitive to cues about the availability of mental resources more generally? This resource sensitivity hypothesis is supported by another set of studies, which link theories about willpower to the finding that ingested glucose, too, buffers the ego depletion effect (Job et al., 2013).

Previous research showed that ingesting glucose can improve self-control performance and buffer ego depletion (DeWall, Baumeister, Gailliot, & Maner, 2008; Gailliot et al., 2007). Research suggests, however, that ingested glucose does not simply restore depleted energy resources and directly fuel performance (Kurzban, 2010). In contrast, peripheral sensory receptors in the mouth and digestive system, which are sensitive to glucose, can activate reward regions in the brain and increase motivation (Chambers, Bridge, & Jones, 2009; Kringelbach, 2004; Kurzban, 2010). Merely rinsing the mouth with glucose, as compared to a sugar-substitute, improves physical performance and mitigates ego depletion (Hagger & Chatzisarantis, 2013; Molden et al., 2012; Sanders, Shirk, Burgin, & Martin, 2012). Thus, people who have ingested glucose may perform better because these peripheral cues signal the availability of energy, motivating them to sustain effort on difficult tasks. If a limited resource theory sensitizes people to cues about the availability of resources, then theories about willpower may moderate the effect of glucose on subsequent self-control performance.

Three experiments found evidence for this hypothesis (Job et al., 2013). Replicating past research, people who reported holding a limited resource theory, or who were induced to hold this theory, showed improved self-control performance following an initial demanding

task when they had consumed glucose (lemonade with sugar) rather than a substitute (lemonade with a sugar substitute). Yet, people with a nonlimited theory showed no such benefit. They performed well regardless of whether they consumed the sugar or the nonsugar drink. This was the case even though participants could not reliably distinguish the sugar from the nonsugar drink in their self-reports. The results provide further evidence that self-control does not rely on a limited physiological resource that is depleted by even brief acts of self-control and is restored by glucose consumption (Gailliot & Baumeister, 2007; Gailliot et al., 2007; see Kurzban, 2010; Molden et al., 2012). Instead, a limited-resource theory attunes people to cues about the availability of resources, including cues below conscious awareness. They further document how top down beliefs interact with bottom-up physiological information to influence people's self-regulatory success.

Activation of a rest goal

If a limited resource theory attunes people to cues to their internal states (perceived exhaustion) and the availability of self-control resources (glucose), does it also activate the goal to rest following self-control exertion? This hypothesis is consistent with the process model of self-control (Inzlicht & Schmeichel, 2012; Inzlicht et al., 2014), which proposes that after people exert self-control, they are no longer motivated to exert themselves and this is why people perform worse on subsequent self-control tasks.

Because it is well documented that people possess limited introspective abilities that often lead to invalid self-reports about inner motivational states (e.g., Silvia & Gendolla, 2001; Wilson & Dunn, 2004) a series of studies assessed motivational shifts after “depletion” using indirect implicit and behavioral indicators, including reaction times (RTs), object evaluations, and actual resting (Job et al., 2015).

In one study, we tested whether people with a limited-resource theory would value means to reach the goal to rest more strongly once they were “depleted.” We assumed that after

engaging in a self-control task they would evaluate objects that are helpful for resting (bed, sofa, hammock, cup of tea, bathtub, TV screen) more positively (see Ferguson & Bargh, 2004; Fishbach, Shah, & Kruglanski, 2004). After reporting their theories about willpower and completing the depletion manipulation, participants were asked how much they liked both objects relevant to rest and objects relevant to physical or mental exertion (barbell, racing bicycle, punching bag, treadmill, sneakers, Sudoku puzzles). As predicted, in the high-“depletion” condition, the more people endorsed the limited-resource theory the more highly they evaluated rest-conducive objects, and the more they devalued objects conducive to physical and mental exertion. Willpower theories were not related to evaluations in the low depletion condition. After self-control exertion, a limited-resource theory both inclines people to value rest and recovery and disinclines activities that involve effort and exertion. A second study found the same result after manipulating theories about willpower, confirming their causal effect (Job et al., 2015, Study 3).

If people with a limited resource theory want to rest, do they rest more if given the chance? In additional studies, a limited-resource theory—both measured and manipulated—led people to rest longer following a “depleting” experience before continuing with another task. In one study, only participants randomly assigned to a limited-theory condition and to a high depletion condition took an excessively long time to complete an ostensible “product-tasting” task in which they could lounge in comfortable chairs following the depletion task (Job et al., 2015, Study 5).

These data show that the belief that willpower depends on a limited resource causes a motivational shift toward rest following the exertion of self-control. The findings are consistent with the process model of self-control, which denies the existence of a specialized self-control resource and explains ego depletion effects through shifts in motivation and attention (Inzlicht & Schmeichel, 2012; Inzlicht et al., 2014). That model postulates that after having expended

effort in a strenuous task, people are less motivated to expend further effort. Our research adds an important specification: Only people who think, or are led to think, that self-control relies on a limited resource show the motivational shift toward rest.

Changes in self-efficacy

A recent line of research suggests changes in self-efficacy as a further mechanism underpinning the effects of lay theories of willpower on self-control. Self-efficacy is the “judgment of how well one can execute courses of action required to deal with prospective situations” (Bandura, 1982, p. 122). People tend to prefer to engage effort in tasks that they perceive themselves to be good at and to withdraw from tasks that seem difficult to them. Chow and colleagues (2015) proposed that when people exert self-control their self-efficacy for upcoming tasks is temporarily reduced, which impairs further performance. Moreover, they suggest, this reduction in self-efficacy occurs only in people with a limited-resource theory. People with a nonlimited theory about willpower should not react to self-control exertion with reduced self-efficacy because for them exerting self-control does not imply a lack of available resources (Chow, Hui, & Lau, 2015).

Three experiments supported this theorizing. First, they showed that people depleted by an initial challenging self-control task reported reduced self-efficacy to exert further self-control. A second study confirmed that this reduction in self-efficacy mediated the effect of depletion on subsequent self-control performance. Finally, a third experiment confirmed that only people with a limited theory about willpower showed this drop in self-efficacy following self-control exertion. Moreover, the drop in self-efficacy mediated the moderating effect of a limited willpower theory on subsequent self-control performance (Chow et al., 2015).

Relations among mechanisms

So far different research lines explored three different mechanisms explaining why a limited theory about willpower leads to reduced self-control when demands accumulate. It is

likely that these processes interact. For instance, the inference that cues (e.g., feelings of exhaustion, lack of sleep, time since last snack) signal a lack of needed resources sets off two motivational shifts: 1) a feeling of reduced self-efficacy (“I can’t do more”) and the activation of a rest goal (“I want to rest”). Thus there may be a reciprocal relationship between these processes dragging down people’s willingness and perceived ability to exert self-control. It is a task for future research to examine these concurring processes and to integrate them into a comprehensive model.

Boundaries and Possible Negative Consequences

The findings we have presented thus far suggest that a nonlimited theory about willpower is more beneficial than a limited theory about willpower, both in laboratory self-control tasks and in everyday self-regulation, goal-striving, and well-being. Could a nonlimited theory be counterproductive in some circumstances?

Overuse of resources

Vohs and colleagues (2012) hypothesized that a nonlimited theory may lead people to “overuse” resources, temporarily compensating for depleted resources, and thus improve self-control performance in the face of mild or moderate self-control demands but not in the face of high demands. In a laboratory experiment, they compared a “no depletion” condition (no initial self-control tasks), a “mild depletion” condition (two initial self-control tasks), and a “severe depletion” condition (four initial self-control tasks). Theories about willpower were manipulated with the biased questionnaire. First, the study replicated our previous findings: In the “mild depletion” condition participants led to think of willpower as a nonlimited resource sustained a high level of performance. But in the “severe depletion” condition, there was no positive effect of a nonlimited theory. Moreover, on one of two measures of self-control performance the effect reversed. Participants in the severe depletion condition performed worse when they had been led to think of willpower as nonlimited. Vohs and colleagues concluded

that a nonlimited theory can be counterproductive. Thinking that willpower is nonlimited, they suggest, “might undermine the normal tendency to conserve resources so that people find themselves severely depleted after multiple tasks” (Muraven, Shmueli, & Burkley, 2006, p. 186).

As a laboratory session wears on, however, many factors beyond people’s self-control capacity may affect their willingness to exert further effort on tasks of little personal relevance. People in the severe depletion condition may simply have been unwilling to exert further effort on such tasks, regardless of their willpower theory. Indeed, a nonlimited theory about willpower would not be functional if it led people to engage on a high level with every task that came along regardless of its value or purpose. Future research may distinguish the capacity to exert self-control from the value or meaning of a task to the self, for instance by comparing tasks of personal relevance to those without. However, from our perspective the critical test of the functionality of willpower theories comes from field studies examining people’s efforts to accomplish their own goals in their daily lives. As discussed earlier, examining students’ self-regulatory success in a demanding academic environment was predicted by a non-limited theory, especially when they faced the greatest demands (Job et al., 2015). Further, among people with type 2 diabetes who face high and significant self-regulatory demands, the non-limited theory predicted greater therapy adherence (Bernecker & Job, 2015a).

Of course, it is possible that alternative processes may arise when people face extreme physical or psychological circumstances (e.g., torture). As we have emphasized, a non-limited theory is not an unlimited theory. The belief that willpower is not limited does not imply that people think they can continue to control themselves and exert effort indefinitely without needing to rest, sleep, or eat. What research on implicit theories shows is that, as compared to the belief that willpower relies on a limited resource, the belief that willpower does not rely on a limited resource simply helps people stay engaged for longer during the normal range of

challenges they face in their daily lives. Put the other way: the limited-resource theory undermines people's self-control success by leading people to reduce effort and conserve their "resources" long before they reach any true limits.

Interpersonal consequences

Most research on theories of willpower has examined people's efforts to accomplish their own goals. But if a person believes that willpower does not rely on a limited resource, do they expect more not only from themselves but also from others? If other people fail to meet these expectations, are nonlimited theorists less understanding and harsher in their judgments? Although not examining limited-resource beliefs, one line of research found that peoples' beliefs about willpower as either malleable or a fixed trait (measured and manipulated) predicted harsher judgments of people with salient self-regulatory failures (e.g., to quit smoking, to lose weight; Freeman, Shmueli, & Muraven, 2013). However, high expectations can also be helpful in promoting people's performance—when these expectations are communicated in positive, growth-oriented ways (e.g., Cohen, Steele, & Ross, 1999; Lepper, Woolverton, Mumme, & Gurtner, 1993). Future research can examine how individuals can communicate a nonlimited theory about willpower in ways that support and improve other people's self-control.

Consequences for parenting

Mukhopadhyay and Yeung (2010) examined how lay theories about self-control affect parenting. They theorized that parents who think of willpower as not reliant on a limited resource would not sufficiently prioritize the development of self-control skills in their children. They reasoned that "the belief that reserves of self-control are already large may lessen the value of further developing these reserves" (p. 242). Accordingly, they expected that parents with a limited theory about willpower, who in addition believe that the limited capacity can be enlarged (limited, but malleable theorists), would engage more in behaviors that help

develop children's self-control as compared to parents with a nonlimited theory. Indeed, a series of studies showed that parents who believed that willpower relies on a limited resource but is malleable were more likely to restrict unhealthy snacking and fast-food consumption in their children as compared to nonlimited-malleable theorists. They were further more likely to choose educational television programs for their children. A manipulation of theories about self-control (nonlimited vs. limited/fixed vs. limited/malleable) further confirmed their causal effect. Adults led to believe that self-control does not rely on a limited resource were more likely to choose gifts for a child that provided instant pleasure. But adults led to believe that self-control is limited but malleable chose gifts that were more educational. They were further convinced that their choice would have a positive effect on the child's development. People with a nonlimited theory did not emphasize the development of children's self-control in their choice. Apparently, they did not think it necessary to foster the development of self-control.

An important question concerns whether these behaviors, which were showed by parents with a limited-malleable theory, are effective in promoting improved self-control in children. Specifically, it is not clear whether restricting children's food and toy related choices, promotes the development of self-control. Could restricting a child's freedom give the child fewer opportunities to learn to restrain him or herself and, hence, rather undermine the development of self-control?

An additional question involves the transmission of beliefs about willpower from parents to children, and whether specific kinds of acts or ways of talking about willpower in parents foster harmful beliefs in children about willpower (see Gunderson et al., 2013; Haimovitz & Dweck, 2016). It is also important to keep in mind that the nonlimited willpower theory helps people exert self-control especially in the face of challenge, and this predicts better interpersonal outcomes (e.g., Moffitt et al., 2011; Tangney, Baumeister, & Boone, 2004). Indeed, being able to control one's impulses and regulate one's emotions in the face of high

demands may be particularly crucial in challenging parenting situations and therefore contribute to relationship quality and functional parenting (Deater-Deckard, 2014; Valiente, Lemery-Chalfant, & Reiser, 2007).

Future Directions: Exploring the Antecedents of Willpower Theories

So far, most research on implicit theories about willpower has focused on their behavioral consequences in the laboratory and the field and mechanisms that explain these effects. Yet little is known about their cultural, social, and developmental antecedents. Where do willpower theories come from?

Social learning

Previous theoretical and empirical work suggests that one factor that shapes children's motivational beliefs, expectations, and values are their parent's beliefs (Eccles, 1993; Haimovitz & Dweck, 2016; Simpkins, Fredricks, & Eccles, 2012). For example, Simpkins and colleagues (2012) showed that when parents value a certain domain, like sports or literature, their children are more likely to develop an interest in that domain, too. How do parents' beliefs about willpower affect their children's beliefs?

According to social learning theory (Bandura, 1971; Bandura & Walters, 1963; Olson & Dweck, 2008), learning is a cognitive process that is tied to the social context of a person. One crucial element of this process is the observation of other people's behavior. Accordingly, children acquire knowledge about social norms by observing what their parents and other adults do, when they do it, and what consequences arise from this behavior. With regard to children's beliefs about willpower, we would assume that being raised by a person with a limited theory about willpower exposes a child to numerous adult behaviors implying that the capacity to exert effort is limited and that periods of hard work have to be followed by rest and recovery. As described above, we have found that people with a limited-resource theory strive for rest and recovery once they have exerted self-control (Job et al., 2015). Do parents with a

limited theory rest more after they have exerted themselves as compared to parents with a nonlimited theory? Do they talk more about the need to rest after they have worked hard?

Previous research further shows that parents communicate their theories of intelligence in what they say to a child and by praise and feedback they provide to a child's performance (Gunderson et al., 2013; Haimovitz & Dweck, 2016; Mueller & Dweck, 1998). Do parents with a limited theory communicate to their child, explicitly or implicitly, that their child needs to rest after having worked hard ("You deserve a break!")? If so, do children of parents who have a limited theory infer that one has to rest after (demanding) work before being able to function well again?

Cultural background

A recent series of studies (Savani & Job, 2017) explored cross-cultural differences in willpower theories, which might inform their cultural roots. We found that in the United States, people tend to endorse a limited theory about willpower. Interestingly, in India, a country with a strong self-control tradition, we found the opposite—people tended to believe that completing strenuous mental tasks is energizing. Moreover, Indians exhibit a reversed ego-depletion effect. They performed better after an initial demanding task, especially if they endorsed a nonlimited theory of willpower—that is, who believed that exerting self-control is energizing.

These cultural differences could have their roots in philosophical traditions. Numerous religious traditions originating in India, including Hinduism, Jainism, and Buddhism, advocate the frequent exertion of self-control not just for monks and nuns but for lay people in their daily lives (Bronkhorst, 1993; Mosher, 2005; Walsh & Shapiro, 2006). Characteristics of the Indian schooling system as compared to the US might further contribute to the cross-cultural differences in theories about willpower. The workload of students in India is considerably higher than in the US putting less emphasis on breaks and times for recovery (Larson & Verma,

1999; Verma, Sharma, & Larson, 2002). Such a practice communicates to students that sustained mental effort is possible.

Future research should systematically investigate cultural differences in willpower beliefs and the socio-cultural mechanisms that perpetuate them. An interdisciplinary approach, including sociological and/or historical perspectives may generate knowledge of both theoretical and practical relevance. Indeed, research on the origins of willpower beliefs could inform, for instance, educational reforms and social policies on how to promote the development of nonlimited willpower theories in children and adults.

Interventions

Although a limited-resource theory might be functional in some situations, the accumulated evidence documents its costs. When people face high self-control demands those with a limited theory show impaired self-regulation, goal-attainment, and well-being. An important direction for future research is to develop interventions that can help people adopt a nonlimited theory about willpower and self-regulate more effectively when they face high demands, such as in challenging academic programs or when a chronic disease requires a careful lifestyle change). Indeed, how to improve people's self-regulatory outcomes is a pressing issue (Diamond, 2012; Duckworth, Grant, Loew, Oettingen, & Gollwitzer, 2011).

Previous field-experiments show that it is possible to change people's implicit theories about intelligence and personality in field settings, with beneficial consequences including for academic performance (Aronson, Fried, & Good, 2002; Blackwell, Trzesniewski, & Dweck, 2007; Paunesku et al., 2015; Yeager, Romero, et al., 2016) and social outcomes (e.g., Yeager, Trzesniewski, & Dweck, 2013). Such interventions give people information (e.g., scientific reports) about the nature of human qualities and help them internalize this information using powerful persuasive techniques, such as "saying-is-believing" exercises in which people

advocate for the intervention message to others (see Aronson, 1999; Yeager & Walton, 2011).

Could this approach change people's beliefs about willpower?

An important caution is that it would not be fruitful for people to infer that self-control is easy—that they have ample resources to resist temptation, say, and thus need not take normal steps to make self-regulation easier (e.g., putting the cookies on a high shelf). Ironically, simply learning that willpower is stronger than one might have supposed could backfire. People could feel encouraged to put themselves in situations they are ill-equipped to deal with (e.g., keeping temptations close at hand in the belief that they will be able to resist them indefinitely).

In a currently ongoing project, we have started to develop such an intervention. In a first study, participants did not learn that willpower is ample. Instead, materials emphasized that how you think about willpower matters, and you can choose how you think about it. They then thought of a person who struggles with willpower, and wrote a letter of advice to this person describing these ideas. In a first randomized field experiment with students enrolled in their first year at the university, we found that, for students who faced high academic demands, the intervention improved their academic self-regulation (i.e., time spent on academic tasks) and semester grades (Job, Flückiger, Bernecker, Lieb, & Mata, 2017). This gain was found relative to a control group exposed to parallel but psychologically neutral (in terms of theories about willpower) material that addressed time-management. Thus, when confronted with high demands, students in the nonlimited willpower theory condition were able to scale up their academic effort to achieve greater success. Although these results are promising, many questions remain. Can such an intervention produce long-term change in people's willpower theories and self-regulatory success? If so, what recursive processes contribute to lasting change? Can such an intervention be scaled-up to benefit a wide population? Can it be adapted to help non-student populations that face specific challenges, such as people trying to make lifestyle changes to manage a chronic disease?

Conclusion

Research on lay theories on self-control suggests that one reason people may fail to control themselves or have trouble reaching their personal goals involves their beliefs about self-control resources, not a true lack of resources. This approach does not deny that a person is in part an energy-based system. Obviously, people need food to function well, they get tired, and they need sleep. But in the normal range of self-regulatory demands people face in everyday life there is not a narrow energy-based constraint on self-control capacity. However, in a social and cultural context that promulgates the belief that willpower depends on a highly limited resource—including in the strength model of self-control itself—people can easily believe in such a constraint, and thus attend and respond to minor fluctuations in their available resources. This belief then itself limits people's willpower.

Although research on willpower theories began as an alternative view of self-control, it extends beyond a mere critique of the strength model. Not only does it suggest that ego depletion is not an inevitable state determined by basic physiological processes. It further informs our understanding of processes, including self-efficacy and rest-goal activation, which contribute to self-regulatory performance, personal goal striving, and well-being when self-regulatory demands arise. Thus, it brings top-down processes back into focus in self-regulation research, and shows that seemingly fixed, physiological principles can, at least in part, be created and modulated by people's beliefs and expectations.

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Table 1. Items to measure implicit theories about willpower for strenuous mental activity (Job et al., 2010)

Strenuous mental activity	
1. Strenuous mental activity exhausts your resources, which you need to refuel afterwards (e.g. through taking breaks, doing nothing, watching television, eating snacks).	R
2. After a strenuous mental activity, your energy is depleted and you must rest to get it refuelled again.	R
3. When you have been working on a strenuous mental task, you feel energized and you are able to immediately start with another demanding activity.	
4. Your mental stamina fuels itself. Even after strenuous mental exertion, you can continue doing more of it.	
5. When you have completed a strenuous mental activity, you cannot start another activity immediately with the same concentration because you have to recover your mental energy again.	R
6. After a strenuous mental activity, you feel energized for further challenging activities.	

Note. R = reversed items

Table 2. Biased questionnaires to manipulate implicit theories about willpower (Job et al., 2010)

Induction of limited-resource theory

1. When you think over a matter with great concentration, it can be sometimes tiring.
 2. Working on a strenuous mental task can make you feel tired much so that you need a break before accomplishing a new task.
 3. When you have to do many demanding activities for a while, you eventually get exhausted and less productive.
 4. Sometimes, when you completely focus your attention on a demanding mental activity, you feel tired and you need a break sooner or later since your resources have to be refilled.
 5. After you have been working on a strenuous mental task for several hours you can get fatigued so that you need to rest before taking on the next challenging activity.
 6. Strenuous mental activity sometimes exhausts your resources, which you need to refuel afterwards (e.g. through breaks, doing nothing, watching television, eating....).
 7. After a strenuous mental activity your energy can be depleted and you sometimes must rest to get it refuelled again.
 8. Sometimes, when you have completed a very exhausting mental activity, you have to recover your mental energy again before starting with the same concentration on a new difficult task.
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Resisting temptations

1. Sometimes, it can be very inspiring to think over a matter with great concentration.
 2. When situations accumulate that challenge you with temptations, it gets more and more difficult to resist the temptations.
 3. It can be energizing to be completely focused on a demanding mental activity, so that you are able to remain concentrated for a while.
 4. Sometimes, it is energizing to be fully absorbed with a demanding mental task.
 5. It can be energizing to be completely focused on a demanding mental activity, so that you can remain concentrated for a long time.
 6. Sometimes, your mental stamina fuels itself. After a strenuous mental exertion you can continue doing more of it.
 7. It is possible to be in such a productive work mode that you don't need much recreation between different mentally strenuous tasks.
 8. Working on a strenuous mental task can activate your mental resources and you become even better at accomplishing subsequent demanding tasks.
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