

Self-Regulation and Personality: How Interventions Increase Regulatory Success, and How Depletion Moderates the Effects of Traits on Behavior

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ABSTRACT Self-regulation is a highly adaptive, distinctively human trait that enables people to override and alter their responses, including changing themselves so as to live up to social and other standards. Recent evidence indicates that self-regulation often consumes a limited resource, akin to energy or strength, thereby creating a temporary state of ego depletion. This article summarizes recent evidence indicating that regular exercises in self-regulation can produce broad improvements in self-regulation (like strengthening a muscle), making people less vulnerable to ego depletion. Furthermore, it shows that ego depletion moderates the effects of many traits on behavior, particularly such that wide differences in socially disapproved motivations produce greater differences in behavior when ego depletion weakens the customary inner restraints.

Self-regulation is an important personality process by which people seek to exert control over their thoughts, their feelings, their impulses and appetites, and their task performances. The human capacity for self-regulation appears to be much more extensive than what is found in other animals, which may suggest that the evolutionary pressures that guided the selection of traits that make up human nature, such as participation in cultural groups, found self-regulation to be especially adaptive and powerful (Baumeister, 2005). If so, then self-regulation may be one of the most distinctively human traits. Even if human beings are capable of more self-regulation than other animals, however, their capacity is far less than what many

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would regard as ideal, and self-regulation failures are central to the majority of personal and social problems that plague citizens in modern societies (Baumeister, Heatherton, & Tice, 1994).

How does self-regulation operate? At present, the evidence suggests that it relies on a limited resource, akin to energy or strength, which it uses to interrupt the stream of behavior and alter it (e.g., Muraven & Baumeister, 2000). When this limited strength has been used, the person falls into a state of ego depletion, during which further efforts at self-regulation are less than normally successful.

The purpose of this article is to articulate two sets of implications of the strength model of self-regulation for personality. The first involves the dispositional capacity for self-regulation itself. We have suggested that self-regulation operates on the basis of an energy or strength that can become depleted. This strength resource may be considered an important aspect of personality, not least because of its long-term power to promote positive, desirable outcomes. Although there is ample evidence of the stability of self-regulation, there is some evidence that individuals can increase their power, at least to the extent that their strength is less quickly depleted in responding to current demands. Hence, one major thrust of this article will review evidence on increasing self-regulatory strength so as to reduce vulnerability to ego depletion.

The second concerns individual differences (on variables other than trait self-control) that may interact with ego depletion. We shall review an assortment of findings indicating that some traits may manifest themselves more strongly among depleted people, which suggests that self-regulation may serve to suppress individual variation so that people can conform to external standards and that when self-regulation ceases to function at full capacity, these inner differences may emerge with a vengeance. In some cases, though, behavioral effects of various traits are more pronounced when people can self-regulate than when they are depleted.

There are stable individual differences in self-regulation, as measured most directly by scales designed to assess those differences (e.g., Tangney, Baumeister, & Boone, 2004), by behavioral measures such as delay of gratification (e.g., Mischel, 1974), or, more broadly, by scales aimed at assessing Conscientiousness as one dimension of the Big Five aspects of personality (Costa & McCrae, 1992; Gosling, Rentfrow, & Swann, 2003). People who have high levels of trait self-control appear to be more popular and successful in life, as indicated

by more positive outcomes in a broad range of human strivings (Mischel, Shoda, & Peake, 1988; Shoda, Mischel, & Peake, 1990; Tangney et al., 2004). The combination of stable individual differences and differentially successful long-term outcomes is consistent with the hypothesis that human evolution selected particularly in favor of self-regulation (because natural selection relies on trait variability contributing to differential adaptive success), though other interpretations are possible. Individual differences in self-regulation per se are, however, beyond the scope of this article.

SELF-REGULATION, STRENGTH, AND EGO DEPLETION

Self-regulation is a multifaceted process, as indicated by the different emphases of various theoretical models. Carver and Scheier (1981, 1982) emphasized the monitoring process involving self-awareness and the feedback loop based on comparing the self's current attainments against standards. Trope and Liberman (2000, 2003) have emphasized cognitive aspects, especially time span. Mischel (1996a) has explored the cognitive strategies by which people resist immediate temptations in order to pursue adaptive long-term goals. Higgins (1987, 1996) has focused on different kinds of standards against which one can compare the self and on the different types of emotion that may attend these respective comparisons.

Self-Regulation as Strength

Our own work has focused on how responses are actually changed. Accumulating findings suggest that self-regulation operates on the basis of a limited resource that resembles a form of strength or energy. An early pair of investigations by Muraven, Tice, and Baumeister (1998) and Baumeister, Bratslavsky, Muraven, and Tice (1998) pitted three models of self-regulatory change against each other, using competing predictions as to what would happen on a second self-regulatory task as the result of having already performed a first self-regulatory task. First, a cognitive schema model might have predicted improvement on the second task as a result of priming the self-regulatory schema. Second, a skill model would have predicted no change, insofar as skill remains essentially constant from one trial to the next (though long-term improvement through practice would be expected with a skill). Contrary to those, self-regulation on the

second task was consistently poorer as a result of the first. This pattern (dubbed *ego depletion*) suggested that some limited resource was consumed by the first act of self-regulation and was therefore unavailable for the second task. Clearly, this resembles a muscle becoming tired after exertion (the third model).

The pattern of ego depletion has been replicated in a variety of settings (see also review by Muraven & Baumeister, 2000). For example, when people have exerted some of their self-regulatory strength on an initial task, they subsequently are less successful at difficult reasoning and thinking problems (Schmeichel, Vohs, & Baumeister, 2003), more prone to spend money impulsively (Vohs & Faber, 2004), show higher levels of aggressive responding (Stucke & Baumeister, 2006), drink more alcohol even when anticipating a driving test (Muraven, Collins, & Nienhaus, 2002), perform inappropriate or undercontrolled sexual behaviors (Gailliot & Baumeister, 2005), rely on simplistic strategies for making judgments and decisions (Amir, Dhar, Pocheptsova, & Baumeister, 2005), and present themselves in ways less likely to make a good impression (Vohs, Baumeister, & Ciarocco, 2005). Likewise, dieters are more prone to break their diets and eat fattening foods when depleted (Vohs & Heatherton, 2000).

Researchers have also begun to explore a variety of behaviors that consume strength, thereby leading to poorer self-regulation afterward. These include making choices and decisions (Vohs et al., 2004), interacting with people about whom one holds derogatory racial preferences (Richeson & Shelton, 2003), and presenting themselves in unfamiliar, effortful ways contrary to their habitual style (Vohs et al., 2005).

Thus, self-regulation appears to depend on a limited resource that resembles a strength. It becomes depleted when the person engages in self-regulation. The same resource appears to be used for a broad assortment of behaviors that have little in common other than that the self is overriding or altering its initial responses in some way.

Validating the Construct of Ego Depletion

Right from the start, research on ego depletion has had to contend with alternative explanations, which is why most investigations have used multiple methods to provide converging evidence and reduce the danger of method artifact. Here, we review several of the most commonly cited alternative explanations and the relevant evidence.

In particular, the effects of ego depletion do not appear to be the result of simply completing a difficult or effortful task. Performing a difficult task that does not require self-control (e.g., solving math problems, memorizing words) does not impair later attempts at self-control, and ratings of task difficulty do not appear to account for the effects of depletion (e.g., Muraven & Slessareva, 2003). Likewise, after exerting self-control, participants perform worse only on tasks that require self-control (Muraven & Slessareva, 2003) or executive functioning (Schmeichel et al., 2003). The effects of ego depletion, therefore, seem particular to self-regulatory tasks and not to difficult or effortful tasks in general.

Another alternative explanation holds that ego depletion is part of a state of general mental fatigue. Fatigue does not seem to be a viable explanation for all the findings, however. First, fatigue causes people to apply less effort toward unimportant tasks and goals but not more to important tasks and goals (Van den Berg, 1985). Self-regulatory goals are perhaps among the most important goals (Baumeister et al., 1994), and one might expect that self-regulation should be the last (and probably not the first) capacity to become impaired during a state of fatigue. Second, when people are fatigued after performing a task, they often perform better (rather than worse) on a second task as a result of the extra stimulation of doing something different (Broadbent, 1979), whereas depletion effects almost invariably show decrements on the second, unrelated task. Likewise, fatigue seems to impair performance on simple but not complex tasks (Hancock & Desmond, 2000) (perhaps because simple tasks offer little stimulation), which is the opposite effect of depletion effects. Third, fatigue seems to be domain specific such that performing one task impairs performance on the same task but not on other, unrelated tasks (Van den Berg, 1985). Self-control, however, appears to be domain general (Muraven et al., 1998). Fourth, researchers have repeatedly failed to find any evidence that depletion is attributable to mood or arousal (e.g., Schmeichel et al., 2003). One might expect that depletion would worsen mood or reduce arousal if it were related to fatigue. In sum, ego depletion does not appear to stem from general fatigue.

Further, depletion is probably not the result of diminished self-efficacy. In one direct test, participants performed a self-regulatory task or control task and then received positive or negative performance feedback (Wallace & Baumeister, 2002). They then completed a second self-regulatory task. Regardless of the performance feedback,

participants who initially performed the self-regulatory task performed worse on the second self-regulatory task as compared to those who initially performed the control task. Receiving positive performance feedback presumably increased self-efficacy, yet it did not reduce the effect of depletion. Likewise, studies that have assessed perceptions of self-efficacy have found no evidence that self-efficacy is related to depletion (e.g., Gailliot & Baumeister, 2005).

Another explanation might be that completing a self-regulatory task causes participants to think they have fulfilled their experimental obligation or satisfied some implicit contract with the experimenter, and so they perform worse on later tasks. Several studies have presented the two self-regulatory tasks as two different experiments and have nonetheless found that participants perform worse on the second task as a result of having done the first (e.g., Baumeister et al., 1998). In addition, the effect of depletion has been found even when the demand of the initial self-control task comes from someone other than the experimenter (e.g., during an interracial vs. same-race interaction; Richeson & Trawalter, 2005). If depletion arises because participants believe that they have fulfilled a contract with the experimenter, then one might expect that an initial self-control task should be depleting only if the demands of the task come from the same experimenter. Third, the implicit contract or obligation explanation does not seem to account for many of the effects of depletion. For instance, depleted participants have been shown to overspend with their own money (Vohs & Faber, 2004) and to prefer to disclose more or less personal information with an interaction partner (Vohs et al., 2005). It is unclear as to why participants would choose to spend their own money or change their level of personal disclosure because they feel that they have fulfilled an experimental contract. In a study of passive (default) options, depleted participants sat longer than nondepleted ones watching a boring movie, whereas if they had felt their obligation had already been fulfilled, they would presumably have left earlier (Baumeister et al., 1998). Last, the effects of depletion are evident outside of the laboratory in people's day-to-day lives (Baumeister et al., 1994). For instance, self-regulatory demands during the day undermine drinking restraint later on (Muraven, Collins, Shiffman, & Paty, 2005). An implicit contract or obligation explanation clearly cannot account for these data.

One last alternative explanation is that people seek to reward themselves for performing a self-regulatory task by performing worse

on later self-regulatory tasks. First, self-regulatory goals are highly important to many individuals (Baumeister et al., 1994), and it is therefore questionable that people would relinquish such important goals so as to reward themselves. Secondly, depleted individuals often relinquish self-control in ways that do not seem rewarding, such as yelling at one's romantic partner (Finkel & Campbell, 2001), or seem to be an inappropriate reward, such as preferring to engage in extra-dyadic sex (Gailliot & Baumeister, 2005). The most comprehensive and parsimonious conclusion for the data is thus that self-control operates akin to a muscle or strength.

INCREASING STRENGTH VIA EXERCISE

In the previous section we said self-regulation resembles a muscle in that it seems to become tired after exertion, resulting in temporarily diminished power or capacity. There is arguably a second aspect to the muscle analogy, however. Muscles briefly become tired after exercise, but, in the long run, exercise strengthens them. Can self-regulation be improved by exercise or practice? In this section we review longitudinal studies seeking to strengthen self-regulation by repeated exercise.

To be sure, multiple theoretical perspectives would predict improvement in self-regulation as a result of practice. People ought simply to get better at almost anything they do over and over as a result of habit formation, increased knowledge and understanding, increased liking from familiarity, automatization, and other processes. The pattern that would be most distinctively consistent with the strength model would involve broad-based improvement, extending even to spheres or aspects of self-regulation unrelated to the practice. For example, according to the strength model, keeping a diet ought to improve the person's ability to suppress unwanted thoughts, or adhering to a rigorous exercise program should result in better discipline in managing one's money.

If it could be rigorously and consistently shown that self-regulation improves via exercise, there could be far-reaching implications. The possibility of long-term change in personality has been debated for decades, and any finding of lasting change would contribute to the small body of evidence indicating that systematic change is possible (see Heatherton & Weinberger, 1994). Clinical psychologists

and addiction counselors often deal with clients who are struggling to change themselves so as to escape from destructive, pathological patterns of responses, and anything that could improve self-regulation might give them a powerfully helpful tool to improve therapeutic outcomes. Positive psychologists seek to enhance normal human functioning, and, given the broad range of positive outcomes associated with self-regulation, they might well find that enhancing self-regulatory strength would be a useful and valuable way to promote health, happiness, and other positive outcomes.

Posture, Affect Regulation, and Dietary Monitoring

Initial evidence for increasing self-regulatory strength was provided by Muraven, Baumeister, and Tice (1999). Participants first attended a lab session involving a standard assessment of ego depletion. Specifically, they furnished a baseline measure of handgrip stamina, then participated in a thought suppression task of not thinking about a white bear (first used by Wegner, Schneider, Carter, & White, 1987), and then performed the handgrip task again. Most participants showed reduced stamina on a handgrip as a result of having performed the thought suppression task. They then engaged in one of three self-regulatory exercises (tracking food eaten, improving mood, or improving posture) for 2 weeks, after which they returned to the lab and again performed the thought suppression and handgrip tasks. A control group completed the two lab sessions without doing any intervening exercises.

Consistent with the strength model, there was overall improvement in self-regulation (as indicated by holding the handgrip for a longer duration) among the participants who had performed the exercises, relative to the no-exercise control group. In that sense, the results suggested that self-regulation can be strengthened by regular exercise. The evidence was however mitigated by several problems. First, the increase in self-regulation was not absolute but only relative to the control group, and the control group showed a substantial decline in self-regulatory performance from their first laboratory session. (As it happens, deterioration in a variety of psychological functioning measures has been a somewhat common observation in longitudinal studies that follow college students through the semester, so the deterioration in the control group was not unique; cf. Lyubomirsky, Sheldon, & Schkade, 2005).

Moreover, the different exercises were not uniformly effective at improving self-regulation. Best results were obtained among participants who were assigned to improve their posture whenever they thought of it. Other participants kept track of what they ate, and these showed some improvement. The group that was assigned to try to improve their mood state whenever they felt bad did not show any benefit from this exercise.

Still, the Muraven et al. (1999) study provided initial evidence that self-regulation can be improved by regular exercise. An encouraging aspect of the results was that within each condition, participants who followed the instructions to exercise self-control most consistently (as indicated by daily diaries) showed the best improvement on the laboratory tests of self-regulation and depletion. Nonetheless, the ambiguities in this evidence made it imperative to conduct further studies.

Physical Exercise as Self-Regulation Exercise

Stronger evidence was provided in a series of investigations by Oaten and Cheng. Their first project (Oaten & Cheng, 2004a) enrolled participants in physical exercise programs for 2 months. The exercise programs included weightlifting, resistance training, and aerobics, and each participant received a program designed by a gym staff member specifically suited for him or her. A staggered waiting list control group design was used so that all participants eventually received the exercise program. The hypothesis was that adhering to an exercise program requires self-regulation, and so 2 months of such regular effort would improve the capacity for self-regulation in general.

Self-regulation was assessed in the laboratory in several ways. A visual tracking task (VTT) required people to keep their attention on visual targets despite a humorous distractor (Pylyshyn & Storm, 1988; Scholl, Pylyshyn, & Feldman, 2001). The VTT presents the participant with six identical black boxes and then highlights three of them to be followed, whereupon the six move independently according to random trajectories. If the participant looks away even briefly, he or she will get them mixed up. A comedy video on another nearby screen provides the distracter. Therefore, participants must ignore the distracter video completely in order to be successful at tracking the VTT targets. The VTT was administered twice at each session to

furnish baseline and dependent measures of self-regulation (attention control).

In between the two testings (at each session), participants were administered a 5-minute depletion task, namely the thought suppression (white bear; see above) task. Insofar as the thought suppression exercise depleted self-control resources, participants would perform worse on the second VTT than on the first. At the initial session, most participants showed the depletion effect quite clearly and strongly, but after 2 months of adhering to the exercise regimen, the effect was substantially diminished.

Crucially, adherence to the exercise program was also beneficial to self-control in other spheres. Relative to controls, people who performed the exercise routines became more successful at reducing their cigarette smoking, alcohol use, and caffeine consumption. They ate less junk food and ate more healthy food. They reported improvements in emotional control and a reduction in impulsive spending. They reported studying more and watching less television. Even some domestic habits (e.g., washing dishes instead of leaving them in the sink) also improved across the exercise program. These changes suggest an across-the-board improvement in self-control, consistent with the strength model.

It is important to note that only some of these behaviors could plausibly be directly linked to the exercise itself. For example, it is plausible that people ate less junk food and more healthy food because their physically active bodies craved better nutrition. In contrast, it is hard to see why exercise should make people want to study rather than watch television, or why physical workouts should motivate them to wash the dishes more regularly. Hence, a wide-ranging improvement in self-regulatory strength is the most parsimonious interpretation.

Money Management

Another investigation by Oaten and Cheng (2004b) focused on one of the areas in which self-control failures are most troublesome and costly to people, namely money. Participants signed up for a 4-month program on financial monitoring. Each participant met with the experimenter, individually, at the start, and together they reviewed the participant's bills and spending habits and devised a personal money management plan. Each participant was issued a

spending diary and other logs to improve record keeping, both in order to improve adherence to the money self-regulation plan and to enable the researchers to keep track of behavior and performance. Most participants improved substantially in regulating their use of money. Though their incomes did not increase, they spent less and saved more. On average they improved each month and ended up more than quadrupling their savings rate (from 8% to 38% of income).

That money management training can improve how people manage their money is hardly surprising (though many participants seemed quite happy about it!). More relevant to our theory is evidence of self-regulatory improvement in other spheres unrelated to money. As people progressed through the money management training, they also got progressively better on laboratory tests of self-regulation, including the visual tracking task described above. That is, after participants had done the financial monitoring exercises for 1 or more months, visual tracking performance was less adversely affected by the thought suppression exercise. Thus, the exercise of managing one's money made one less susceptible to depletion from thought suppression.

As in the physical exercise study, the self-regulation training in the money management study had a variety of positive side effects indicative of a central improvement in self-regulatory strength. Participants reported significant decreases in psychoactive substance use, including smoking, caffeine, and alcohol consumption. These reductions were not just significant but also substantial (mean reductions of 15 cigarettes, 2 cups of coffee, and 2 alcohol drinks per day!). Participants also reported significant improvements in healthy eating, emotional control, maintenance of household chores, attendance to commitments, and study habits. The shift toward healthier food is revealing, in part because, by and large, healthy food is more expensive than fatty junk food, and if the overriding effect of the money management training were to save every penny, one would have expected participants to eat more cheaply—thus less healthy foods. Measures of perceived stress (PSS: Cohen, Kamarck, & Mermelstein, 1983), emotional distress (GHQ: Goldberg, 1972), and self-efficacy (GSES: Jerusalem & Schwarzer, 1992) showed no change. Taken together, these results indicate that the long-term effects of regular regulatory exercise may be a thoroughgoing, multifaceted improvement in self-control.

Study Habits and Exam Stress

A third study (Oaten & Cheng, in press) designed individual study programs for students as a form of self-regulatory exercise. Again not surprisingly, participants who adhered to these programs studied better. Compared to waiting list controls, students who completed the study program reported less emotional distress and perceived stress during their next examination period (see Oaten & Cheng, 2005, on self-regulatory failure during exam periods).

Once again, though, the central improvements in self-regulation brought about by the training program were accompanied by self-regulatory improvements in other, seemingly unrelated, spheres. After completing the study program, students smoked fewer cigarettes, drank less alcohol and caffeine, exercised more, watched less television, kept up more with household chores, and ate a more healthy diet. They managed their money better. They also reported improvements in emotional control and stability. Laboratory measurements confirmed that the self-regulatory task of thought suppression caused less ego depletion (as measured by the VTT) after the study skills program, as compared with beforehand.

Interpreting the Findings

The Oaten and Cheng studies ruled out a variety of alternative explanations. As already noted, the Muraven et al. (1999) study was complicated by the fact that the control group changed for the worse, thereby making the effect of self-regulation training relative rather than absolute. The Oaten and Cheng studies have avoided this problem, however, and confirmed improvement in absolute terms, including relative to participants' own personal baseline (prior to the training). In plain terms, participants improved significantly at self-regulation from before to after the training program.

One might suggest that the primary impact of improved financial monitoring or physical exercise is a rise in global self-efficacy, but measurements of self-efficacy detected no such changes. In a similar way, perceived stress and emotional distress went down in some studies but not in others, and so it cannot account for all the findings. Hence, improvement in self-regulation seems the most appropriate and parsimonious interpretation of these findings. Self-control

may seem a core, stable feature of personality, but it can apparently be changed (and for the better) by studious exercise.

Switching Hands, Verbal Regulation, and Stereotyping

The idea that self-regulatory strength can be increased was tested in a different way by Gailliot, Plant, Butz, and Baumeister (2004). They built on evidence that suppressing stereotypes is depleting (Gordijn, Hindriks, Koomen, Dijksterhuis, & Van Knippenberg, 2004), as well as previous evidence that interacting with someone from a different race can cause ego depletion among prejudiced people (Richeson & Shelton, 2003), presumably because prejudiced people have to exert themselves to control their behavior so as not to reveal their attitudes and possibly thereby provoke a hostile confrontation. Gailliot et al. (2004) undertook to show that improvements in self-regulatory strength would make people less negatively affected by such interactions.

To do this, the researchers made use of a trait measure recently developed by Plant and Devine (1998) to assess individual differences in the motivation to respond without prejudice. The trait construct assumes that some people are not particularly concerned with avoiding the expression or appearance of prejudice, whereas others are highly motivated to do so. Although the scale was originally designed to assess racial prejudice, it was modified for this investigation to be used with prejudice against homosexuals and obese people.

The laboratory sessions in the Gailliot et al. (2004) study instructed participants to write or speak about a typical day in the life of a hypothetical obese or homosexual person—without using any stereotypes. Afterward, self-regulation was measured by performance on anagrams. (Anagrams are regarded as an executive function task, insofar as one must start to combine letters in one way and then override it to try another way. There is no simple algorithm for solving an anagram; instead, one must create novel combinations and then disassemble them to try something else.) In the first session, the predicted pattern of ego depletion was observed. The worst performance on anagrams was shown by the people who were low in trait motivation to avoid prejudice. Presumably, these people normally do not exert themselves to curb prejudicial thoughts about gays or obese people, and so making the effort to do so in the laboratory setting (as per instructions) was depleting. In contrast, people with a high motivation to avoid prejudice of that sort

probably have automatized the suppression of stereotypes, and, for them, the exercise of writing without such stereotypes would not require self-regulatory effort.

To increase self-regulatory strength, participants were asked to perform some tasks for 2 weeks that involved self-regulation but had no direct relationship to prejudice or anagram solving. One assignment was to use the participant's nonpreferred hand for a list of activities that included brushing teeth, stirring drinks, using a computer mouse, carrying items, eating, and opening doors. Another assignment involved verbal self-regulation in a series of prescribed ways: avoid curse words, speak in complete sentences, say only "yes" and "no" instead of using colloquial substitutes such as "yeah" and "nope," and refrain from starting sentences with "I." A control group performed no exercises. The laboratory sessions were conducted before and after the 2-week program.

Once again, the self-control exercises made people subsequently less vulnerable to ego depletion, as indicated by improvement in their performance on solving anagrams. The only improvements were found among the participants who were low in motivation to respond without prejudice and who followed the exercises for 2 weeks. For them, the (presumably novel and unfamiliar) task of suppressing stereotypes was effortful and depleting, so, afterward, they had less resources available to help them perform well on the anagrams task. After the 2 weeks of self-control exercises, however, suppressing stereotypes did not deplete them to the same extent, and, as a result, their anagram performance was unimpaired.

Conclusion

From these studies it does appear possible to improve self-regulation via regular exercise. Moreover, these improvements fit the strength model in an important sense: They suggest that improving self-regulation operates by increasing a general core capacity. That is, as the person performs exercises to improve self-regulation in one sphere, he or she becomes better at self-regulating in other spheres.

DEPLETION AND INDIVIDUAL DIFFERENCES

A major purpose of self-regulation is to enable individuals to bring their behavior into line with socially desirable standards. In many

circumstances, there is a single standard for proper or desired behavior whereas people may feel a plethora of impulses and inclinations to act in other ways. In such situations, the net effect of self-regulation will be to suppress variability in behavior and the individual differences behind them. In blunt and simplistic terms, instead of doing all the different things they may feel like doing, people will do the one thing that society prescribes. Therefore, at least some links between personality traits and behavior will be stifled by self-regulation, and those links will emerge more strongly when people are depleted.

The reverse pattern is at least conceivable. In particular, people may share basic and common impulsive tendencies, but some may be more motivated than others to suppress these tendencies so as to conform to various standards and ideals. Etiquette provides one example: Some people may try harder than others to conform to various standards of proper, socially prescribed behavior, and so under normal circumstances (when people are fully capable of self-regulation) there will be significant variation in behavior. When people are depleted, however, those who normally regulate may become less able to do so and the variation in behavior will diminish. Ego depletion could thus reduce the link between traits and behavior when the traits refer to motivation to regulate one's behavior.

In this section we review an assortment of findings showing interactions between trait measures (other than trait self-control) and the state of ego depletion. These are intended to establish the fact that traits can moderate the effects of ego depletion and vice versa. Of greater theoretical interest, however, is the broader question of why some individual differences will become stronger under ego depletion whereas others may become weaker or disappear. Although, given the present state of knowledge, we can only support some tentative and preliminary speculations with regard to the latter, we think it is important to begin formulating these questions because of their potential importance for personality theory, including the fundamental issue of when do personality differences matter most versus least.

Dieters

One approach to individual differences in the effects of depletion is based on the assumption that since self-regulation is used to restrain

particular behaviors, depletion will mainly affect people who chronically strive to restrain that particular behavior. As a striking example, some people (dieters) who constantly seek to control and restrain their eating should find themselves eating more when depleted. In contrast, other people comfortably and freely eat whatever they want, and so depletion should not affect their eating. Several studies have found that restrained eaters (dieters) ate more after engaging in a self-regulation exercise, whereas nondieters ate the same amount whether depleted or not (Kahan, Polivy, & Herman, 2003; Vohs & Heatherton, 2000).

With restrained eating, presumably, the desire to eat is the same in both groups, and the individual differences are on the dimension of chronic restraint. Because depletion undermines the capacity to self-regulate, dieters cease to restrain their eating. In this case, then, ego depletion suppresses the effect of the trait (of restrained eating) on behavior. When able to self-regulate, dieters eat less than nondieters, but when both groups have been depleted by prior self-regulation, they eat the same amount.

Stereotype Suppression

Just as people differ on the trait of restraining their eating, they differ on the trait of restraining their tendency to think in prejudiced or stereotypical terms (as noted above; Plant & Devine, 1998). Depletion should therefore reduce those differences insofar as people who ordinarily seek to suppress their stereotypes would lose the ability to do so. Early evidence that depletion increases stereotype use was provided by Gordijn and colleagues (2004). In their study, participants were first asked to write about a typical day in the life of a skinhead, and half were instructed to avoid using stereotypes in their essay. Later, all participants were asked to describe an elderly person. One might have expected that people who had suppressed stereotypes when writing about the skinhead would be sensitized to the importance of avoiding stereotyping in general and would therefore eschew stereotypes of the elderly, but the opposite finding obtained: Participants who had suppressed stereotypes about skinheads later used more stereotypes about the elderly. This fits the ego depletion interpretation. Apparently, suppressing the stereotype of the skinhead depleted the person's self-regulatory strength, thereby

making the person more willing to use stereotypes when discussing the new (elderly) target.

More relevant, these results were moderated by individual differences in motivation to respond without prejudice (Plant & Devine, 1998). Specifically, only participants who were low in motivation to respond without prejudice appeared to be depleted after suppressing stereotypes, such that they mentioned more stereotypes about the elderly. People who were highly motivated to suppress stereotypes did not use stereotypes of the elderly in either (depleted or nondepleted) condition. Thus, the effect of trait motivation to suppress stereotypes only emerged after depletion, presumably because depletion weakened those restraints.

Temptation to Drink

With eating, we considered individual differences in restraint, and the findings suggested that depletion can have the strongest effects on the people who chronically expend the most effort at restraint. A complementary hypothesis would be that the strongest impulses are the hardest to restrain, and depletion should release the behavior most strongly among people who have the strongest impulses. Therefore, links between trait and behavior should become stronger, and behavior should become more variable among depleted as opposed to nondepleted people.

Research on alcohol has provided some evidence in support of the hypothesis that ego depletion selectively releases the strongest impulses. Muraven and colleagues (2002) showed that the amount of alcohol consumed prior to a simulated driving test was a function of self-control strength and individual differences in temptation to drink alcoholic beverages. In their study, some participants completed a thought suppression task (avoiding thinking about a white bear), whereas other participants completed a series of arithmetic problems. Participants were then given a pitcher of Budweiser beer and a pitcher of Beck's beer as part of an ostensible taste-testing study. The experimenter told participants to read a series of adjectives (e.g., sweet, bitter), sip as much or as little of the beers as they desired, and rate the degree to which each type of beer possessed the taste characteristic. To increase participants' motivation to refrain from consuming large quantities of the beer, the experimenter reminded participants that they would later have to complete a

simulated driving test in which good driving could earn a cash prize. The driving task was chosen because it invoked widespread norms against drinking alcohol before driving.

Consistent with a standard depletion effect, participants who had exerted self-control by suppressing thoughts of a white bear consumed more alcohol than participants who completed a task that did not require self-control. More relevant to the present discussion, however, this effect was moderated by individual differences in temptation to drink alcohol, as measured by the Temptation and Restraint Inventory (TRI; Collins & Lapp, 1992). Participants who scored high in trait temptation to drink consumed more alcohol than those low in temptation—but only after the thought suppression task. Perhaps surprisingly, temptation to drink did not lead to different levels of alcohol consumption when people were fully capable of self-regulation (i.e., in the no-depletion control condition). The implication is that most people seek to restrain their drinking of alcohol, especially before an upcoming driving test; when they are in full possession of their self-regulatory strength, they can do so successfully regardless of their desire to drink. However, when self-regulatory strength has been depleted by a prior, seemingly irrelevant, task, then the stronger desire to drink emerges to cause increased drinking.

Gender, Sociosexual Orientation, and Sexual Infidelity

Another approach to the study of individual differences and ego depletion involves the link between gender, sociosexuality, and sexual infidelity. People with an unrestricted sociosexual orientation are generally inclined to engage in sexual relationships without a strong need for emotional commitment, whereas people with a restricted sociosexual orientation require a greater degree of emotional closeness and commitment to another person before engaging in sexual intercourse (Simpson & Gangestad, 1991). In simpler terms, an unrestricted orientation indicates an interest in having many partners without being choosy, whereas a restricted orientation entails restricting sex to special, intimate-relationship partners. People with an unrestricted orientation should therefore be more open, if not downright eager, to having sexual relations outside a committed relationship, including extramarital and extradyadic intercourse.

One study found that ego depletion interacted with sociosexuality to predict sexual infidelity (Gailliot & Baumeister, 2005). Specifically, participants either completed an initial task requiring self-control (i.e., overriding a previously learned routine of crossing out letters) or did a simpler task that did not require self-regulation. Then, they all responded to hypothetical scenarios offering a temptation to engage in sex with someone other than their primary relationship partner. Both gender and sociosexual orientation interacted with the self-regulation (depletion) manipulation to predict willingness to engage in illicit sex, and the interactions showed that depletion enabled individual differences to emerge. Among nondepleted participants, gender had no effect on infidelity intentions, and sociosexual orientation had only a small effect, but among depleted participants, males and sexually unrestricted individuals were much more likely to express a willingness to participate in extradyadic sex.

Presumably, ego depletion increased participants' willingness to engage in sexual infidelity because refraining from doing so requires self-control. Most people normally refrain from committing sexual infidelities, but some people have to exert more self-control than others. When self-control strength is depleted, people are less able to resist the temptation to engage in sexual infidelity. Men and sexually unrestricted individuals possess stronger desires to engage in sexual infidelity than do women and restricted individuals, respectively (e.g., Allgeier & Allgeier, 1995; Baumeister, Catanese, & Vohs, 2001; Goettch, 1994; Kinsey, Pomeroy, & Martin, 1948; Kinsey, Pomeroy, Martin, & Gebhard, 1953; Seal, Agostinelli, & Hannett, 1994; Simpson & Gangestad, 1991; Thompson, 1983). As a consequence, depletion unleashes the desire to engage in sexual infidelity primarily among men and unrestricted individuals.

Sexual History and Sexual Restraint

The extent of sexual activity that a couple engages in may depend on multiple factors, and these change over time. Most people regard it as inappropriate to begin having intense, intimate sexual activity right away, even though some people may feel sexual desire very early in a relationship (e.g., Baumeister & Bratslavsky, 1999; Cohen & Shotland, 1996). Hence, early in a relationship, couples may be restraining their impulses and desires, whereas after they have come to trust each other and establish some degree of intimacy, they may

engage in more sexual expression without conflict. If this is correct, depletion would have a greater effect on the sexual activity of young and inexperienced than on advanced couples because only the former would be still regulating their desires to a substantial degree, and ego depletion would reduce these inner restraints.

Consistent with that reasoning, a laboratory study by Gailliot and Baumeister (2005) assessed sexual history, manipulated depletion by means of having some couples engage in an attention control task (ignoring peripheral stimuli while watching a video), and then invited them to express any degree of physical affection (e.g., hugging, holding hands) for each other in a private laboratory room. Sexual history interacted with depletion to predict the level of physical intimacy achieved by the couples in the laboratory. Not surprisingly, there was a trend for the more advanced couples to engage in more extensive physical intimacy—but only among the control (nondepleted) couples. When self-regulatory resources had been depleted by the prior exercise of attention control, the inexperienced couples actually engaged in more extensive intimacies. Looked at another way, the results showed that depletion had a strong and significant effect on the inexperienced couples but a negligible effect on the more advanced ones. The implication is that ego depletion removed the relatively inexperienced couples' inner barriers against going too far sexually, resulting in a surge of unrestricted desire and physical affection.

Social Anxiety and Social Interactions

Another investigation examined whether ego depletion would cause certain participants to become more passive in social interactions (Gailliot, Vohs, & Baumeister, in preparation). Passivity is difficult to assess in the laboratory but is of central interest to our research program because, on an a priori basis, it indicates lack of exertion by the self's executive function (Baumeister, 1998). In several studies, depleted participants were perceived by others as being more passive (e.g., less active, friendly, talkative, hostile) than were nondepleted participants during a short conversation and while instructing others on how to perform a task (e.g., how to putt in golf).

For present purposes, the relevant findings involved social anxiety. Gailliot et al. (in preparation) repeatedly found significant interactions between social anxiety and depletion. In this case,

depletion eliminated the link between trait and behavior. That is, social anxiety did not correlate with passivity among depleted participants, but there was a significant correlation among nondepleted participants such that low-anxious people were highly active in social situations, whereas highly anxious individuals were still somewhat withdrawn and passive.

The implication is that some social interactions involve processes that require self-regulatory effort, such as impression management (Vohs et al., 2005). These findings suggest that ego depletion causes people to become less able or willing to exert such effort and consequently to become more passive. People low in social anxiety are typically able to expend such effort, but when they are depleted, they appear to withdraw from social interactions in the same way people high in social anxiety do.

Attachment Style and Optimal Self-Presentation

Yet another approach to individual differences in the effects of ego depletion concerns how people respond when they know, or at least suspect, that the way they want to act may not make the best impression. They may self-regulate in order to behave in the optimal or appropriate fashion under normal circumstances (and contrary to their inclinations). When in a state of ego depletion, however, that self-regulation may be less effective, and so their behavior may revert to their less attractive forms. This was tested in a pair of studies by Vohs and colleagues (2005).

The behavioral focus of this procedure was people's choice as to level of intimacy of self-disclosure. Abundant research has established that when people meet someone new, medium levels of self-disclosure elicit the most favorable reactions (Altman & Taylor, 1973; Jones & Wortman, 1973). Low-intimacy disclosures convey an impression of aloofness that can imply hostility, arrogance, or disliking. Meanwhile, high-intimacy disclosures can convey insecurity, neuroticism, or manipulative intent. Most adults have presumably learned to some extent that it is best to discuss issues of intermediate intimacy when meeting someone for the first time.

Individual differences in attachment style may, however, conflict with the optimal choice of medium disclosures. Hence, there is a tension between inner, latent motivation and situational demands. Participants in this particular study completed Hazan and Shaver's

(1987) measure of attachment style. Although securely attached individuals may be comfortable with intermediate intimacy, other styles are less compatible. Avoidant individuals seek to minimize intimacy, and so they would be naturally inclined to disclose as little about themselves as possible (thereby creating a preference for low-intimacy disclosures). In contrast, anxious/ambivalent individuals seek to maximize intimacy with others, and so they might well be inclined to move quickly into talking about highly personal matters.

In one study by Vohs et al. (2005), ego depletion was manipulated by having some participants regulate their emotional response (i.e., to suppress or exaggerate emotional reactions) to a comedic video clip, whereas other participants watched the same video without any instructions to regulate their responses. In a replication, the Stroop task was used to manipulate ego depletion. Participants were then told that they would have a brief conversation with another participant, and they were told to choose topics to discuss with the other person. The topics were to be taken from a list that had been pre-tested to include topics requiring low, medium, and high levels of intimate disclosure (adapted from Sedikides, Campbell, Reeder, & Elliot, 1998). Thus, the research was able to assess whether participants chose to talk about topics of high, low, or medium intimacy.

The results showed that depletion allowed individual differences to dictate departures from the norm of intermediate disclosure. Among nondepleted participants (i.e., those who had not engaged in emotion regulation while watching the video or who had performed the easy version of the Stroop task), attachment style made no difference because nearly everyone succeeded at choosing topics of intermediate intimacy. The picture was, however, quite different among participants whose strength had been depleted by the emotion control exercise or the difficult Stroop task. In that condition, avoidant participants chose low-intimacy topics, and anxious/ambivalent participants favored highly intimate ones. The link between trait and behavior only appeared among depleted participants.

Thus, under normal circumstances, most people can override their personal inclinations and present themselves in the optimal fashion, which is to say they can choose to disclose information of intermediate intimacy about themselves. Variance in behavior is minimal, and the trait of attachment style makes little difference. When their resources are depleted, however, they are less able to regulate their self-presentations in that optimal manner. Instead, people who

distrust intimacy prefer to talk about trivial or nonpersonal things when they are depleted, whereas people who crave closeness choose to talk about highly personal and intimate matters. The implication is that the less-attractive or less socially desirable aspects of the self can sometimes emerge under ego depletion, even if people normally succeed at keeping them under wraps.

Conclusion

Multiple studies have thus found interactions between ego depletion and traits. Most of the currently available findings fit one pattern. Some people are habitually, dispositionally motivated to act in a certain way, such as to eat or drink too much, misbehave sexually, or interact in intimacy-seeking or intimacy-avoiding ways. They know these behaviors are not optimal, and so they ordinarily manage to refrain from them. Ego depletion appears to reduce their effort to alter their behavior toward the socially or personally desirable ideal. Put another way, when people's self-regulatory resources have been depleted, the nonoptimal inner motivations exert a greater influence on behavior. The stronger the desire, the greater the releasing effect of ego depletion. In this case, therefore, individual differences in desire produce bigger behavioral differences in the depleted state than when people are fully able to self-regulate. To the many personality psychologists who study correlations between traits and behavior, we can offer a suggestion that may have both methodological and theoretical value, which is to include measurements of behavior taken when participants' resources are depleted so they are not fully able to bring their behavior into line with external norms. The data we have reviewed make clear that some inner tendencies and motives emerge all the more strongly when people are depleted.

Two other patterns are, however, suggested by some findings. In one, some people habitually exert control while others do not. For example, dieters routinely seek to control their eating, whereas non-dieters do not. Not surprisingly, ego depletion mainly affects the people who are ordinarily exerting control. (Thus, dieters eat more when depleted, but the eating of nondieters remains unchanged.) In these cases, the individual difference is in the quest to control the behavior rather than in the motivation to perform the behavior. When the relevant individual difference is in control rather than

desire, ego depletion tends to eliminate rather than amplify individual differences.

The other pattern, less well supported than the other two—but just as interesting theoretically—is the increase in passivity. In the studies reviewed here, social anxiety moderated this pattern, but depletion eliminated, rather than increased, the differences in behavior. Apparently, highly anxious people are passive in many social situations regardless of the condition of their self-regulatory resources, whereas people with low anxiety feel free to interact with others in an energetic and proactive manner. Such proactive, energetic interaction is perhaps what consumes energy, however, and when low-anxious people are depleted, they become as passive as the highly anxious ones.

CONCLUDING REMARKS

The ability to alter one's responses so as to bring them into line with ideals, moral values, social norms, laws, and other standards is an important key to success in life and one of the most important and distinctively human traits. The capacity for self-regulation is thus one of the most important elements of personality. One could go so far as to say it is the single most important aspect because, given sufficient powers of self-regulation, any other personality trait can be overcome. In other words, if your self-regulation is powerful enough, then regardless of your inclinations, past experiences, or neuroses, you can always do the adaptive or right thing. Self-regulation can be the trump card of personality.

This article has worked from a strength model of self-regulation and sought to develop two main sets of implications for personality theory. The first is that the capacity for self-regulation can be improved through exercise. In multiple studies, research has shown that regular exertions of self-regulation lead to steady reductions in susceptibility to ego depletion. Moreover, consistent with the view that self-regulation depends on a single, common resource that is used for all manner of self-regulatory activities, exercises in one sphere of self-regulation bring improvements in many other spheres. Therapists, coaches, teachers, and even simply ambitious persons may take heart from this finding, provided that further work continues to bear it out. It is possible to make the self stronger and thereby increase its ability to rise above situational demands to guide behavior.

The second theme of this article is that the links between traits and behavior can be moderated by ego depletion. In particular, ego depletion appears to reduce inhibitions, thereby affecting people who have strong inhibitory controls over particular behaviors (ranging from eating to sex to prejudice) and releasing socially undesirable behaviors that may ordinarily be subject to strict control. Although much more research is needed, our preliminary survey suggests two conclusions: Individual differences in motivation are amplified by ego depletion. Individual differences in control are suppressed and diminished by ego depletion.

For decades, personality psychologists have struggled to reconcile the common finding that, in the laboratory, the correlations between trait scale measurements and behavioral observations are often rather weak (e.g., Mischel, 1996b). Meanwhile, social psychologists and others are often struck—and sometimes dismayed—to see that laypersons believe personality traits to be powerful predictors of behavior. We may suggest a small contribution to this seeming contradiction by noting that laboratory participants are often on their (sort of) best behavior and, largely, in full possession of their self-regulatory resources. The present findings indicate that many trait effects emerge more strongly when people's self-regulatory resources have been depleted—as they often may be in everyday life. Personality traits may therefore be more powerful at guiding behavior than the laboratory studies would indicate. Then again, if we can strengthen self-regulation via exercise, people may be more able to act as they would ideally prefer, and even as society might prescribe, rather than as their less appealing impulses may dictate.

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