

Action Versus State Orientation and Self-Control Performance After Depletion

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Abstract

Three studies investigated the role of action versus state orientation in how people deal with depletion of self-control resources. Action-oriented persons were expected to continue allocating resources and hence to perform better than state-oriented persons who were expected to conserve strength. Consistent with this, action-oriented persons performed better on the d2 test of attention than state-oriented persons after a strenuous physical exercise (Study 1), showed higher acuity on the critical fusion frequency test after a test of vigilance (Study 2), and performed better on the Stroop test after a depleting sensorimotor task (Study 3). No differences emerged between action- and state-oriented persons in their initial performance and in a non-depleting context. The impact of depletion on subsequent performance is thus not fixed, but moderated by personality.

Keywords

action orientation, self-regulation, self-control, ego depletion

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Self-control is the self's capacity to alter a person's behavior, which includes overriding and inhibiting desires, emotions, urges, or competing action tendencies that would otherwise interfere with goal-directed behavior (Barkley, 1997; Baumeister & Vohs, 2007; Muraven & Slessareva, 2003). The self-control strength model (Baumeister, Vohs, & Tice, 2007; Muraven, Tice, & Baumeister, 1998) proposes that self-control operates like a limited resource and hence becomes depleted after a prior exertion. Just as a muscle becomes fatigued after a period of sustained exertion, so self-control strength becomes depleted when used. This produces a state of *ego depletion*, a temporarily reduced capacity to exert self-control on subsequent tasks (Muraven & Baumeister, 2000). Consistent with this theory, studies have shown that individuals who exerted self-control performed more poorly on subsequent self-control tests than individuals who had not recently exerted self-control (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998; Muraven et al., 1998). These findings have been consistently replicated using a variety of self-control tasks (see Hagger, Wood, Stiff, & Chatzisarantis, 2010, for meta-analysis), which indicates that ego depletion is a stable and robust effect.

This article addresses personality differences in how people deal with depletion. What traits might enable some people to continue performing well despite preliminary depletion, when other people are withholding effort and failing? We connect the self-control strength model with Kuhl's

(1984) action control theory, another influential account that describes regulatory performance under high demands, and suggest that the effect of ego depletion on subsequent performance may depend on whether people are action- or state-oriented. In the following sections, we provide the rationale for this hypothesis and test it in a series of three empirical studies.

Ego Depletion and Changes in Resource Allocation

An important recent work by Beedie and Lane (2012) has argued that ego-depletion effects should be understood as changes in resource allocation rather than as simply the exhaustion of a limited resource. They noted that the brain has ample glucose resources for self-control but that these may be allocated selectively, in accordance with motivational priorities and situational demands. Consequently, the behavioral effects of ego depletion depend on whether people continue allocating resources once they start feeling

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depleted. On the one hand, they may tend to conserve resources and withhold effort. This may be the normal, automatic response. Just like a tired athlete who starts conserving energy for the moment when it counts the most, a depleted person may seek to conserve volitional resources in case important challenges arise. Consistent with that view, Muraven, Shmueli, and Burkley (2006) showed that depleted participants who anticipated exerting self-control in the future performed more poorly on an intervening self-control task than non-depleted participants, and more poorly than those who did not expect to exert self-control later on. Thus, they were apparently conserving their (already somewhat depleted) resources for the upcoming task.

On the other hand, even depleted people can find the resources to perform well when they are motivated. Muraven and Slessareva (2003) showed that leading people to believe that their persistence would be beneficial to others (by contributing to new therapies for patients with Alzheimer's disease) or to themselves (by improving their skills or earning money) could overcome the tendency for depleted persons to perform badly. If depletion indeed meant that the person's resources were so far gone as to remove all possibility of performing well, then the motivational incentives would have made no difference. The implication is that depleted people naturally conserve their energy but are willing to expend it when there is much at stake. Muraven and Slessareva (2003) concluded that "this is not necessarily a conscious, deliberative process but rather something individuals do continually with very little awareness" (p. 904).

Motivational and attentional concomitants of ego depletion have been outlined by Inzlicht and Schmeichel (2012). Even so, the depletion of some resource is implicit in their argument, such as by the assumption that people who have exerted themselves become motivated to avoid further exertion. Likewise, the notion of resource allocation emphasized by Beedie and Lane (2012) is highly compatible with resource depletion: People may allocate any valuable resource freely when they have it in abundance but conserve it when it has been depleted. Hence, our assumption is that resource depletion, motivational changes, and allocation of resources are all intertwined. The present research was carried out in the context of ego-depletion theory but is compatible with the various proposed refinements and extensions of that work. Distinguishing among competing theories about the ego-depletion phenomena was not the goal of this work.

The Moderating Role of Action Orientation

One factor that may influence how depleted people allocate their resources is the disposition toward action versus state orientation. According to action control theory, action/state orientation reflects how people adapt to increases in demands (Koole, Jostmann, & Baumann, 2012; Kuhl, 1984, 1994b). *Action orientation* entails responding to demanding

situations with decisiveness and initiative by activating the metastatic (change-promoting) mode of control, whereas *state orientation* is defined in terms of a catastatic (change-preventing) mode of control, which entails sustaining and preserving current mental and behavioral states. Individuals with a strong action orientation are more effective than state-oriented ones at self-motivation (Kuhl, 1994b) and at flexibly allocating their cognitive resources according to task demands (Diefendorff, Hall, Lord, & Streat, 2000). In contrast, state-oriented individuals are characterized by preoccupation and hesitation, which may result in behavioral passivity (Kuhl, 1994b). Consequently, action-oriented individuals are more likely than state-oriented individuals to perform at a high level under demanding situations (cf. Koole et al., 2012).

The advantages of action-oriented people in self-motivation and effective performance can be seen in health behaviors. For example, state-oriented persons suffer from higher discrepancies than action-oriented ones between intentions to exercise and actual exercise (Kendzierski, 1990). State-oriented people have higher rates of alcohol consumption (Palfai, McNally, & Roy, 2002) and unsuccessful dieting (Palfai, 2002). All of these suggest failures or deficits in self-control. In a more direct test, Jostmann and Koole (2007) experimentally compared self-regulatory performance under conditions of low versus high demand. That is, participants performed the Stroop color-word task, and in the high demand condition, the difficulty was increased by burdening participants with an extra working-memory task (Study 1A), by increasing the number and difficulty of trials (Study 2), or by providing performance-contingent rewards for an upcoming cognitive task (Study 3). State-oriented persons showed higher Stroop interference (indicative of failed self-control) than action-oriented ones in the high demand condition, but there were no differences in the low demand condition. The implication is that the baseline self-regulatory ability is the same regardless of action versus state orientation, but as demands escalate, differences emerge.

Insofar as the state of ego depletion reflects high demanding circumstances for subsequent performance, functional differences between action- and state-oriented people should emerge. Accordingly, we proposed that action-oriented individuals would perform better than state-oriented individuals when both are depleted. As noted above, action-oriented persons are better than state-oriented ones at self-motivation, such as by up-regulating positive affect in response to high task demands (Koole et al., 2012; Koole & Jostmann, 2004; Kuhl, 2000). Kruglanski et al. (2012) reasoned that increasing one's motivation may compensate for somewhat depleted resources to continue accomplishing goals. Indeed, Muraven and Slessareva (2003) showed that external incentives can improve performance despite depletion. Internal incentives (reflecting self-motivation) might have similar effects. In a similar vein, Inzlicht and Schmeichel (2012) argued that enhanced motivation would result in prolonged resource

allocation. Hence, action-oriented persons may find it relatively easy to summon up more resources so as to continue performing even when their resources are already somewhat depleted.

Meanwhile, because of their poor ability to regulate emotions and their tendency to persevere on their current state (Kuhl, 1994b), state-oriented persons should be more likely than action-oriented ones to functionally focus on the state of depletion and to behave accordingly. The most natural response to the state of depletion is the (possibly unconscious) impulse to conserve strength (cf. Muraven et al., 2006). Consequently, state-oriented persons should be more prone than action-oriented ones to avoid depleting their resources further. This impulse to conserve their remaining energy would then take precedence over optimizing performance on the immediate task. Hence, their performance should suffer more than that of action-oriented persons when both have already expended some effort.

The Present Research

Past work, thus, indicates that there are some differences in self-regulatory performance between action- and state-oriented persons—but also that these do not indicate that action-oriented persons are simply superior in general at self-control (see also Koole et al., 2012). Other evidence speaks against interpreting the differences as indicating that state-oriented persons are generally more sensitive to increases in task demands (Koole & Jostmann, 2004). Therefore, we proposed that the differences arise because action- and state-oriented persons differ as to how they allocate self-regulatory resources when they face demands despite having already depleted their resources. Action-oriented persons may remain motivated and continue to allocate their resources so as to perform well. Meanwhile, state-oriented persons may be guided by (unconscious) concern about their state of dwindling resources and seek to conserve what they have left, and so their subsequent performance would deteriorate faster than that of action-oriented persons.

We tested this proposition by the use of the dual-task design adopted from Baumeister et al. (1998). The dual-task design includes two main steps performed subsequently. Self-control resources are depleted in the first step and the depletion effect is measured in the second step using another (different) test of self-control. We assumed that action and state-oriented participants will differ in their performance at the second step (i.e., after depletion). Higher action orientation should predict less ego depletion. Three studies were designed. Self-control resources were depleted by mastering a difficult physical exercise (Study 1), performing a test of vigilance (Study 2), and overcoming frustration in an easy or a difficult sensorimotor task (Study 3). The d2 test of attention, the critical fusion frequency, and the Stroop task, respectively, were used to measure ego depletion.

Study 1 (Pilot)

Study 1 was a preliminary test of the hypothesis that action orientation moderates and mitigates ego depletion. It assessed differences in how performance on a mentally demanding test of attention control would deteriorate before versus after a strenuous, ego-depleting workout. We measured action orientation using the Demand-Related Action Orientation subscale of the Action Control Scale (ACS-90; Kuhl, 1994a).¹ It consists of 12 items, each of which describes a stressful situation and an action- versus state-oriented way of coping with the situation. For example, “When I have to take care of something important but which is also unpleasant: (a) It can take a while before I can bring myself to do it” (i.e., state orientation), “or (b) I do it and get it over with” (i.e., action orientation). Action-oriented choices were coded as 1 and state-oriented choices as 0, and these were summed for the entire subscale. The resulting score was analyzed as a continuous variable with higher score representing more action orientation. For descriptive reasons, however, we classified participants as either action-oriented or state-oriented based on the empirical median; participants who scored above the median were classified as action-oriented, whereas the remaining participants were classified as state-oriented. The ACS-90’s validity and reliability have been well established (Diefendorff et al., 2000; Kuhl, 1994a).

To deplete participants, we had 20 male semi-professional athletes perform strenuous physical exercises at their peak performance level for 15 min. Effortful physical exercise and stamina require self-control because they involve overcoming physical discomfort, resisting fatigue and overriding the urge to quit (Baumeister et al., 2007; Muraven et al., 1998). Therefore, it was reasonable to assume that requiring a workout would deplete participants’ self-regulatory resources.

Self-regulatory performance was measured before and after the ego-depleting workout. For this, we used the d2 test (Brickenkamp, 2002). It is a test of attention control, as one must search a row of letters for instances of two particular patterns (a *d* with two dashes either above it or below it) and cross them out, while also refraining from responding to seductively similar stimuli (e.g., a *d* with three dashes, or a *p* with two dashes). The task is demanding and performance tends to get worse over continued trials. We counted errors of both omission and commission, and we assessed deterioration by subtracting the number of errors on the first half of the test from the number on the second half (cf. Brickenkamp, 2002). Participants performed a baseline version of this test, then went through a prescribed workout regimen consisting of sets of single-leg squats, sit-ups, press-ups, skipping, single-leg jumps, and side bridge-lats (i.e., lateral trunk extension and flexion). This took about 15 min (plus 5 min warm up) and was rated as quite strenuous, thus requiring self-control to complete. Then participants took the d2 test a second time. We again calculated performance deterioration by subtracting the first half

score from the second half. To furnish the crucial dependent measure, we subtracted the baseline deterioration score from the post-workout deterioration score.

The main finding was that action orientation interacted with depletion to determine self-regulatory performance. In general, both state- and action-oriented participants got somewhat worse over the course of each d2 test. However, action-oriented participants declined at about the same rate after the workout as before (increases in errors were 1.9 at baseline and 1.5 after the workout, thus no worse at all). State-oriented participants, in contrast, showed a steeper decline after the workout (increases were 2.7 at baseline but doubled to 5.5 after the workout). In other words, before the workout, everyone deteriorated at about the same rate, regardless of personality. After the workout, state-oriented participants deteriorated much faster than action-oriented ones. The correlation between action orientation and change performance decline was significant, $r(19) = -.48, p = .03$.

A hierarchical multiple regression analysis was conducted on post-workout vigilance deterioration scores. The baseline (before workout) deterioration score was entered as the first blocking variable, and action orientation was added on the second step. Both the first step with the baseline deterioration score, $\Delta R^2 = .28, \Delta F(1, 18) = 7.05, p = .02$, and the second step with action orientation showed a significant effect, $\Delta R^2 = .18, \Delta F(1, 17) = 5.79, p = .03$. Performance on the second task was strongly predicted by baseline score, $\beta = .53, p = .02$ on first step and $\beta = .49, p = .01$ on second step. That indicates merely that there were stable individual differences in performance. More important, action orientation contributed significantly, $\beta = -.43, p = .03$, indicating that action-oriented participants performed better than state-oriented ones, even after controlling for baseline performance.

The workout was rated as requiring considerable effort ($M = 8.75$ on the scale from 1 [*not at all*] to 10 [*extremely*]), but action orientation did not correlate with effort, $r(19) = -.07, p = .77$, so apparently, personality did not influence effort expenditure. However, action-oriented participants claimed to have more energy than state-oriented ones afterward ($M = 4.60$ vs. $M = 3.20$ on the scale from 1 to 10), $r(19) = .44, p = .05$, consistent with the view that they manage their emotions and motivations more effectively than state-oriented participants.

Study 1, thus, provided initial evidence that action orientation moderates performance level following ego depletion. Action orientation made no difference on baseline performance nor, as far as we can tell, on the workout performance. However, after a strenuous, depleting workout, state-oriented participants quickly lost their concentration on the mental task and their performance declined sharply, whereas action-oriented ones managed, despite their fatigue and depletion from the workout, to perform reasonably well.

Study 2

Study 2 was a conceptual replication of Study 1, using quite different procedures. To elicit self-regulatory effort and ego depletion, Study 2 participants performed a vigilance task (rather than the physical workout used in Study 1). Vigilance has been found to depend on self-control because it requires ignoring distractors in the environment, stopping task-irrelevant thoughts, and regulating emotions such as arousal and boredom (Muraven & Baumeister, 2000). We used the standardized vigilance test from the Vienna Test System software (Schuhfried, 2010).

The dependent measure this time was critical fusion frequency, which is a valid measure of central nervous system activation (Görtelmeyer & Wiemann, 1982; Schmidtke, 1951). Most people can see a flashing light as a series of on-and-off flashes, as long as there is a sufficient interval between the flashes. When flashes are close together, however, they tend to blur into seeming to be a steady, continuous light. We presented participants with flashes that were initially well spaced out and then began to appear ever closer together. The critical fusion is the point at which the person no longer sees discrete flashes and instead sees a steady light even though, technically, the stimulus is still flashing on and off. As people become mentally fatigued, this point comes earlier, which is to say with larger intervals between the flashes (e.g., Görtelmeyer & Wiemann, 1982; Grünberger, Saletu, Berner, & Stöhr, 1982; Schmidtke, 1951). We reasoned that ego depletion would produce the same effect as mental fatigue.

Our hypothesis was that action-oriented persons allocate more resources to the task at hand than state-oriented ones, so the effects of ego depletion would be muted among action-oriented people. Therefore, the prediction was that from before to after the ego-depleting vigilance task, state-oriented individuals would show a bigger change (decrease) in critical fusion frequency than action-oriented individuals. Put more plainly, state-oriented persons would find that the flashes blur together into a seemingly continuous light much sooner than action-oriented people, when depleted.

Method

Participants. Forty-seven athletes (23 women) participated in exchange for detailed feedback on their individual concentration and self-control skills. Their mean age was 27.8 years ($SD = 9.37$). Participants were tested in individual sessions of approximately 50 min.

Procedure. After being briefed on the study and signing informed consent, participants' action orientation was measured with the same scale used in Study 1. Next, participants' critical fusion frequency was obtained as a baseline level of central nervous activation. We used the standardized apparatus

and software in the Vienna Test System (Schuhfried, 2010). Participants looked into a tube with a steady white basic illumination. A flickering red light, centered on the bottom of the tube, was steadily increased from 20 to 80 Hz at a speed of 1.5 Hz/s. Participants were asked to press a button at that moment when the ever-faster flickering light seemed to change into a steady light. For each participant, the software calculated the median fusion frequency value after the participant completed eight measurements. The test took about 5 min, including 2 min for instruction and practice.

Then, participants performed a 25-min vigilance task on a computer. We used the standardized vigilance test, also using the Vienna Test System software. Five triangles appeared in a row on the screen, each one pointing either up or down. Participants were asked to press a key whenever three of the triangles pointed downwards. The software calculated the sum of and the mean time for correct and incorrect reactions. Immediately after completing the vigilance test, participants' critical fusion frequency was measured for the second time, thereby furnishing the main dependent measure. Participants were then debriefed, thanked, and dismissed.

Results

Preliminary measures. There were no significant differences between men and women in the study variables. Moreover, controlling for gender did not significantly affect any of the results. Therefore, we will not discuss gender any further.

Action orientation did not predict participants' performance on the vigilance task. That is, action- versus state-orientation scores did not correlate significantly with either the sum of correct responses, $r(46) = .06, p = .71$, or the mean reaction time, $r(46) = -.06, p = .68$. These data suggest that action- and state-oriented individuals performed about the same (and presumably exerted about the same amount of self-regulatory effort) on the depleting vigilance task.

In addition, action orientation did not correlate with the pre-test fusion frequency, $r(46) = -.06, p = .69$, indicating that action- and state-oriented individuals did not differ in their central nervous activation before the vigilance task.

Decline in critical fusion. The main dependent measure was the decrease in critical fusion frequency from before to after the ego-depleting vigilance task. To reduce error variance caused by individual differences in central nervous system activation, we controlled for baseline performance.

Action orientation significantly predicted the post-test fusion frequency (see Table 1). Specifically, action-oriented persons showed less decline than state-oriented ones. In fact, again, action-oriented individuals seemed relatively immune to the effects of ego depletion from the vigilance task, as their critical fusion frequency actually showed an improvement from the baseline pre-test to the post-test ($M = 34.91$ on pre-test and 35.25 on the post-test, thus indicating an improvement of 0.34 Hz). State-oriented individuals, on the

Table 1. Multiple Regressions Analysis of Action Orientation on Fusion Frequency (Time 2).

Condition	β	R^2	ΔR^2
Step 1		.83***	.83***
Time 1	.91***		
Step 2		.89***	.06***
Time 1	.93***		
Action orientation	.24***		

*** $p < .001$.

other hand, became worse after the vigilance task ($M = 35.20$ on pre-test and 34.56 on the post-test, thus indicating a deterioration of 0.64 Hz).

Discussion

Study 2 provided further evidence that action orientation moderates the effects of ego depletion. Performing the vigilance task produced the standard mental fatigue effect on state-oriented persons, as indicated by a drop in critical fusion frequency. Thus, at the level of central nervous system functioning, their acuity deteriorated after an exertion of self-control and effort on the vigilance task.

Action-oriented persons showed no sign of fatigue and in fact improved on the post-test relative to the pre-test. The improvement may seem surprising, but it fits the view that action-oriented individuals automatically allocate more resources to the task at hand. Prior work has shown signs of increased physiological activation associated with exerting self-control (Muraven et al., 1998). We assume that everyone experienced this during the vigilance task, which requires substantial effort to regulate attention. Afterward, therefore, everyone's resources should have been depleted. Action-oriented persons, however, managed to find and allocate additional resources so as to continue performing well (and perhaps sustained the heightened activation that the vigilance task caused). State-oriented persons apparently did not.

The difference cannot be attributed to any baseline differences in critical fusion frequency or, by extension, in central nervous system efficiency. Action-oriented individuals did not differ from state-oriented ones on the baseline pre-test. Only after depletion did the differences emerge.

Study 3

Study 3 aimed to provide further converging evidence that action/state orientation moderates self-control exertion using quite different procedures and an enhanced research design. The changes were as follows. First, we added a no-depletion control condition, which was lacking in the first two studies. In those, everyone underwent a depleting task. Our theory focused on how action/state orientation moderates the effects of depletion, and the results of the first two studies found

differences between state- and action-oriented persons after preliminary exertion of self-control—but they did not provide evidence that the deterioration of performance among state-oriented individuals was indeed caused by depletion. We predicted that after performing a non-depleting task, action- and state-oriented individuals would perform at the same level (as on the pre-test baseline).

To increase generalizability and rule out concerns that results might be specific to particular methods, Study 3 used yet another set of tasks. Ego depletion was manipulated by having participants perform one or the other version of a sensorimotor task. Both tasks were challenging and approximately of the same time duration, but they differed in their demands for self-control. The depleting task required considerable self-regulation, because it required the person to deal with spontaneous, unpredictable changes that repeatedly disrupted the performer's efforts. In contrast, the non-depleting version was relatively easy to master and did not require the person to deal with random, frustrating shifts in the stimulus that he or she sought to guide.

Ego depletion was measured with the familiar Stroop color-word test. That is a classic test of self-control. It requires the person to override an automatic response (thinking the meaning of a printed word) to give the correct response (naming the color of the font). Many studies have used it to measure self-regulation and have often found that performance on the Stroop task deteriorates when people are in the state of ego depletion (e.g., Gailliot et al., 2007; Job, Dweck, & Walton, 2010; Webb & Sheeran, 2003). The prediction was that action-oriented persons should outperform state-oriented ones after the difficult, frustrating (and depleting) version of the sensorimotor task, but not after performing the easy task.

Method

Participants. Participants² were 72 college students (49 women), who participated for payment of €10. Their mean age was 23.5 years ($SD = 3.62$). Participants were tested in individual sessions of approximately 45 min.

Procedure. After being briefed on the study and signing informed consent, participants' action orientation was measured with the same method as in Study 1. Thereafter, participants were randomly assigned either to the frustrating or to the simple task condition. In the *frustrating task condition*, participants performed the standardized Sensorimotor Coordination Test, which is a part of the Vienna Test System software (Schuhfried, 2010). This test assesses eye-hand coordination by maneuvering a circular segment that moves on its own about a three-dimensional room. Participants' task was to maneuver an element (i.e., yellow circular segment) to a specific pre-set goal (i.e., green bars forming an upside-down "T") and to react adequately to the element's spontaneous, unpredictable changes of direction and size. Because of

these frequent and unpredictable changes, the task demanded considerable self-regulation: The performer had to sustain the effort to maneuver the yellow circle despite these changes (something akin to flying a kite in high, gusty winds) and had to overcome the feelings of frustration as the yellow circle kept escaping from its target position. The task was performed on a computer with a special joystick and took about 20 min, including 5-min instruction and practice phase.

Participants in the *simple task condition* performed the standardized Motor Performance Series, which is another sensorimotor test also included in the Vienna Test System. Using a special work panel, participants' task was to track lines, insert pins into small holes, aim a stylus into different grooves, and perform tapping using the right and then the left hand. The task was rather easy to master, and in particular, there were no random changes or complications to disrupt the performer's efforts. It too took about 20 min, including 5 min for instructions and practice.

After the sensorimotor task, all participants completed a manipulation check by rating how frustrating and strenuous the task was on a 10-point scale (1 *not at all* to 10 *extremely*), as well as the Brunstein's (1993) mood adjective checklist. The checklist consisted of four positive mood items (e.g., happy or joyful) and four negative mood items (e.g., sad or dissatisfied) that are rated on a 7-point scale from 1 (*not at all*) to 7 (*extremely*). Then came the main dependent measure in the form of the Stroop color-word task. Color words (*red*, *green*, *yellow*, and *blue*) appeared on a computer screen in a font color that was either congruent or incongruent with their meaning. Only incongruent trials require self-regulation in the sense of having to override the meaning of the word to give the correct answer. Participants' task was to press the correct color button the word was written in as fast as possible. Performance was measured in terms of interference, operationalized as the difference in median reaction times between the congruent and incongruent trials. High interference indicates poor self-regulation and thus ego depletion should produce high interference scores. The Stroop task took about 8 min, including 2 min for instructions and practice.

After the Stroop test was completed, the experimenter debriefed, paid, and dismissed the participants.

Results

Preliminary measures. There were no significant differences between men and women in the study variables. Moreover, controlling for gender did not significantly affect any of the results. Therefore, we will not discuss gender any further.

Manipulation check. Participants in the frustrating task condition rated the task as being more frustrating ($M = 5.31$) than participants in the simple task condition ($M = 3.78$), $F(1, 70) = 9.28$, $p < .01$, $f = .36$.³ Similarly, the frustrating task was perceived as requiring much more effort ($M = 7.31$) than the

simple task ($M = 4.54$), $F(1, 70) = 41.62$, $p < .001$, $f = .72$. Moreover, participants in the frustrating task condition showed significantly higher Stroop interference (i.e., more ego depletion; $M = .062$) than participants in the simple task condition ($M = .039$), $F(1, 70) = 5.56$, $p = .02$, $f = .28$, which is in line with the strength model of self-control (Baumeister et al., 2007; Muraven et al., 1998). Hence, mastering the frustrating task required significantly more self-control than mastering the simple task. This manipulation check was also reported by Gröpel and Kehr (2013, Experiment 2), who focused on the moderating effect of achievement motivation on ego depletion.⁴

Sensorimotor task performance. Participants completed either the Sensorimotor Coordination Test or the Motor Performance Series as the manipulation of self-regulatory depletion. In both conditions, standardized T -score was calculated by the software for each participant as his or her individual performance score. Action/state orientation did not have any effect on performance of the manipulation task. That is, scores on the action orientation measure did not correlate with performance on either the frustrating task, $r(34) = -.11$, $p = .52$, or on the simple task, $r(36) = .27$, $p = .11$. In addition, action and state-oriented persons did not differ in their responses to how effortful and how frustrating the manipulation task was. Action orientation scores did not correlate with self-reported effort on either the frustrating task, $r(34) = .01$, $p = .98$, or on the simple task, $r(36) = .10$, $p = .58$. Similarly, action/state orientation was not related to perceived frustration on either the frustrating task, $r(34) = .01$, $p = .99$, or on the simple task, $r(36) = -.11$, $p = .52$. These results suggest that both action and state-oriented persons worked hard and performed about equally well on the depleting task. Thus, any differences on the dependent measure (the Stroop task) cannot be attributed to differential effort, frustration, or performance on the depleting task.

Stroop performance. The main dependent variable was Stroop interference. We predicted that action/state orientation would moderate self-control exertion on the frustrating task, resulting in lower Stroop interference (i.e., less ego depletion) by action-oriented participants. A hierarchical regression analysis was conducted on the Stroop interference, with action orientation and dummy-coded study conditions (the frustrating task condition = 1, the simple task condition = 0) entered as the first block, and their interaction term entered as the second. In all analyses, predictor variables were standardized before their interaction term was calculated. The main effect of depleting task turned out to be significant, $\beta = .27$, $t(69) = 2.42$, $p < .02$, indicating that overall, participants performed worse on the Stroop after the depleting task than after the simple one. The main effect of action orientation was marginal, $\beta = -.21$, $t(69) = -1.89$, $p = .06$. Both effects were qualified by a significant interaction, $\beta = -.29$, $t(68) = -2.60$, $p < .02$. It seems that the relatively poor performance among

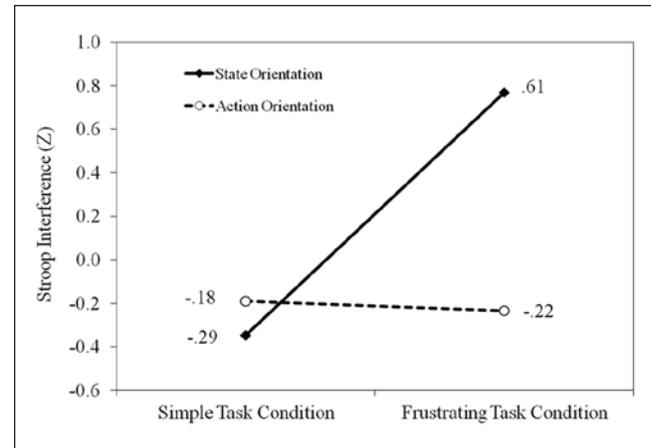


Figure 1. Stroop interference as a function of action orientation and study conditions in Study 3.

the state-oriented persons after the frustrating task accounted for both main effects. Unstandardized regression weights conducted with a range of ± 1 SD for action orientation were used to illustrate this interaction effect (see Figure 1). The impact of prior self-control on Stroop interference varied as a function of action/state orientation. State-oriented participants who suffered through the frustrating task showed higher Stroop interference than action-oriented participants who had done the same task and also more interference than the participants in the simple task condition.

Simple slope analyses (O'Connor, 1998) revealed that among state-oriented participants, performing the frustrating task led to significantly higher Stroop interference than performing the simple task, $t(68) = 3.64$, $p < .001$. Action-oriented participants who had performed the frustrating task did not differ in the Stroop interference from those in the simple task condition, $t(68) = -.08$, $p = .94$.

In addition, we computed separate correlations between action orientation and Stroop interference for the two study conditions. As expected, action orientation was negatively correlated with the Stroop interference in the frustrating task condition, $r(34) = -.41$, $p < .02$. In other words, doing the frustrating task caused subsequent declines in self-regulatory performance among state-oriented persons but not among action-oriented ones. In the simple task condition, there was no correlation between action/state orientation and Stroop performance, $r(36) = .16$, $p = .34$ —indeed, the trend was in the opposite direction from what was found with the frustrating task. Thus, the impairment of state-oriented persons after performing the frustrating task cannot be attributed to poorer Stroop capabilities overall or to any general tendency to perform poorly after any initial task.

Mood. Action orientation did not correlate with either positive mood, $r(71) = .15$, $p = .23$, or negative mood, $r(71) = -.08$, $p = .50$. Controlling for positive and negative mood in the above regression analyses did not significantly affect any

of the results. Emotional state appears to have been irrelevant to the main findings.

Discussion

Study 3 provided further evidence that action orientation moderates the depleting effects of self-control exertion. Overall, participants who completed the frustrating task were more depleted than those who performed the simple task, as indicated by higher Stroop interference (the main effect of depleting vs. non-depleting task). However, the level of their depletion varied as a function of action orientation. The more action-oriented they were, the less their performance suffered from ego depletion. This result was consistent with Studies 1 and 2.

Study 3 also contained a non-depleting task condition, with a relatively simple, non-frustrating task. As predicted, participants performed better after that task than after the frustrating one—and, more important, there was no effect for action orientation on Stroop performance. State-oriented individuals apparently show deterioration in self-control performance only when their resources have been expended on an earlier task. The null result in the simple task condition rules out alternative interpretations that would suggest that state-oriented persons perform worse on the Stroop task generally or that they show depletion and impairments after doing any sort of task.

This study also measured performance on the manipulation task, and there were no differences as a function of action orientation. Thus, the relatively poor Stroop performance of state-oriented individuals cannot plausibly be attributed to having exerted more effort to perform well on the frustrating task (because performance was the same across the action/state orientation spectrum).

General Discussion

Three studies investigated the role of personality in how people deal with depletion of volitional resources. We found that individual differences in action/state orientation systematically predicted self-control performance—but only when the performers were depleted. Our pilot study found that action-oriented persons performed better on the d2 test of attention than state-oriented ones after a strenuous workout (but not before it). In Study 2, action-oriented persons showed higher acuity on the critical fusion frequency test than their state-oriented counterparts after (and not before) they had performed a demanding vigilance task. Study 3 manipulated self-control exertion using either a depleting or non-depleting sensorimotor task. Following the depleting task, action-oriented persons showed less Stroop interference than state-oriented persons. No differences emerged after the simple, non-depleting task. Taken together, these results indicate that the state of ego depletion caused by prior exertion of self-control impairs the subsequent self-control of state-oriented persons more than of action-oriented persons.

Our findings appear quite robust. We found the same pattern three times despite substantial changes in performance type, measure, and manipulation. Thus, the three studies measured self-regulatory performance with a vigilance task, a visual acuity judgment (relatively new to self-regulation research), and the Stroop color-word test (a familiar paradigm that has been standard for decades of research). We depleted persons with a physical exercise workout, with a cognitive judgment and vigilance task, and with a frustrating motor coordination task. We used both student and non-student samples. Each time, the action-oriented persons performed better than state-oriented ones, but only after becoming depleted.

These findings extend the strength model of self-control, which proposes that exerting self-control expends energy (strength) and therefore leaves less available for subsequent challenges (Baumeister et al., 2007; Muraven et al., 1998). Researchers have informally observed that not all participants show ego-depletion effects to the same degree, but evidence about which personality traits moderate those effects has been very sparse, and at least, the Baumeister laboratory has included trait measures in various studies but rarely found them to moderate ego depletion. (Even the majority of studies using trait self-control have simply found main effects for trait and depletion, with no interaction; e.g., Gailliot & Baumeister, 2007). It is therefore an important advance to have found at last a replicable moderation by an important personality trait, namely, differences in action/state orientation. These differences seem to depend on how people continue to allocate self-control resources after they had been partially depleted rather than on how much initial effort they expended. Both action and state-oriented persons exerted themselves and performed equally well on the initial task in the present studies, but they differed in their subsequent performance. Action-oriented persons presumably continued to allocate further resources to the task at hand, whereas state-oriented ones withdrew from further effort.

The behavior of action- and state-oriented persons is consistent with Kuhl's (1984) action control theory that implies differences in how people adapt to demanding situations. Action-oriented persons motivate themselves effectively, and they allocate their resources flexibly. These skills enable them to initiate and continue actions despite increases in demands (and depletion of their own resources). In contrast, state-oriented persons are relatively poor at self-motivation, which results in hesitation and behavioral disengagement. We reasoned that depleting one's resources by a strenuous task would make the subsequent task more daunting and difficult. Past work has shown that action-oriented persons outperform state-oriented ones when facing high external demands (Jostmann & Koole, 2007; Koole et al., 2012; Kuhl & Beckmann, 1994). Our work extends this by showing that action-oriented persons outperformed state-oriented ones when the problem was internal rather than external: The difficulty of the second task was compounded by one's own fatigue and depletion.

The decline in performance among state-oriented persons is also consistent with the view that many depleted persons seek to conserve their diminished energy for subsequent demands and challenges. Muraven et al. (2006) showed that performance during the depleted state was affected by expectations of subsequent demands for further self-control. State-oriented persons are, by definition, functionally prone to focus on their current state (Kuhl, 1994b), and so the awareness of having depleted some of their energy may be more salient to them than to action-oriented persons. Hence, on our main dependent measure, state-oriented persons might have skimmed on effort to conserve their already reduced resources, resulting in relatively poor performance, while action-oriented persons continued to put forth higher effort and performed well.

Furthermore, the present findings are in line with the most recent understanding of ego depletion as changes in resource allocation rather than as the exhaustion of some limited resource (Beedie & Lane, 2012; Inzlicht & Schmeichel, 2012). Although energy may be expended in physical and self-regulatory exertions, people do not reach a point of having none left. On the contrary, whether they continue to expend energy depends on attention and motivation. The impulse to conserve energy when tired may be natural to all humans, but this can be overcome with self-motivation and self-regulation. Because action-oriented persons are more efficient than state-oriented ones at self-motivation, such as by up-regulating positive affect and self-generating rewarding incentives under demanding conditions (Koole & Jostmann, 2004; Kuhl, 2000), they are better able to manage themselves so as to continue performing well on subsequent tasks. In contrast, state-oriented persons disengage so as to reduce further effort and save energy.

Thus, we are not suggesting that action-oriented persons are immune to ego depletion. On the contrary, we assume that the basic facts of putting mental and/or physical energy into challenging tasks are similar for both kinds of persons, and that both action- and state-oriented persons become depleted. However, they respond differently to the depleted state. State-oriented persons emphasize conserving their remaining energy, whereas action-oriented persons emphasize doing their best on the task at hand.

Limitations and Alternative Explanations

Our theory has been that action- and state-oriented persons become equally depleted, but action-oriented persons continue to allocate resources whereas state-oriented ones withhold effort to conserve. An alternative explanation might hold that state-oriented persons became somehow more depleted than action-oriented ones by the initial task. As there is no gold standard measure of depleted state, an unassailable resolution of this question is beyond currently available empirical methods. Still, we have some relevant evidence. The main likely cause of differential depletion

would be differential effort on the initial task. We found both subjective and objective evidence contrary to the alternative hypothesis. Specifically, participants rated their effort on the depleting task as equal regardless of action orientation, and objective measures of performance were likewise equal. Insofar as they exerted the same amount of effort, they should be equally depleted.

The only other possibility would seem to be that some extra depletion occurred among state-oriented persons because of poor affect regulation. Koole and Jostmann (2004) found that under high task demand, intuitive skills for regulating affect were activated more readily in action-oriented than state-oriented persons. Intuitive regulation tends to make behavior more automatic and therefore less reliant on self-control resources. This idea could be stretched to explain why our action-oriented participants suffered less ego depletion than state-oriented ones. Without the benefit of intuitive affect regulation, state-oriented persons might have needed to continue drawing down their energy resources to manage their moods and emotions while performing, so that they might become more extensively depleted, and their performance would suffer, as it did in all our studies.

Affect regulation may have played a role in the present findings, but we did not find evidence of it. If state-oriented persons became more depleted than action-oriented ones, they should have felt frustration and other emotions more strongly when performing the frustrating tasks. Indeed, recent work has indicated that the depleted state is characterized by stronger, more intense feeling of a wide range of evaluative responses, including desires and emotions (Vohs et al., 2013). Study 3 found no difference as a function of action orientation on multiple such measures, including frustration (the primary manipulation check), general positive mood, and general negative mood. Thus, one highly relevant (to emotion) sign of depletion suggested no difference as a function of action orientation. However, these results are limited to self-reports. As the effects of intuitive affect regulation may be best captured by implicit rather than explicit measures (Koole & Jostmann, 2004), future research should include implicit affective measures to examine the role of affect regulation during the initial task more deeply.

In addition, our notion that state-oriented persons withhold effort when they are depleted seems to contradict Heckhausen and Strang's (1988) findings that state-oriented persons tend to overexert under high demands. Heckhausen and Strang found somewhat higher level of lactate concentration, a physiological index of bodily exertion, among state-oriented than action-oriented athletes after the participants were pressured to perform at their best. This seeming contradiction may be resolved by considering Beckmann and Kazén's (1994) results. They found that state orientation was beneficial to athletes in sports that emphasize brief, intense performances, such as sprinting and jumping, whereas action orientation was beneficial to athletes in sports requiring sustained exertion, such as distance running. This pattern

suggests that state-oriented individuals put forth high initial effort and expend their resources quickly, whereas action-oriented people allocate their resources more evenly over longer time periods. Applied to the present findings, this suggests that state-oriented persons expended plenty of energy early in task, thus becoming depleted, and then they began to withhold effort to conserve their remaining energy. In contrast, action-oriented persons managed to sustain effort over a longer period, including during the main measure of performance that followed the initial, depleting task.

Depletion and Action Orientation, and Future Directions

Our results should not be misinterpreted as suggesting that action-oriented persons are generally superior to state-oriented ones at self-control. State-oriented persons usually display equal or even better self-control than action-oriented ones in low demanding contexts (Koole et al., 2012). Consistent with that pattern, in our studies, action- and state-oriented persons worked equally hard and showed about the same level of performance on the initial self-control tasks. Moreover, as Study 3 demonstrated, they differed after the depleting task but not after the simple, non-depleting task. These results suggest that the trait of action versus state orientation is not relevant to baseline self-control capability and motivation, nor simply to having already performed other activities. Rather, its effects are specific to how people perform when already depleted by prior exertion of self-control.

In addition, the difference between action and state-oriented persons might disappear under severe depletion. Vohs, Baumeister, and Schmeichel (2012) found that motivational incentives erased the ego-depletion effect among persons who had done one initial task only—but failed to moderate the depletion effect among severely depleted persons who had done multiple self-control tasks. The implication was that situational and motivational factors can influence performance when people are only slightly depleted and still have much energy to allocate. When depletion becomes severe and extensive, such factors make less difference. The analogy to physical strength is apt: Slightly tired athletes can still perform at peak levels when sufficiently motivated, but extremely tired muscles cannot be coaxed to perform at peak levels until they have rested. The same might be expected for personality. Action-oriented people are able continue exerting effort and postpone conserving strength up to a point. Thereafter, the impact of personality would disappear. Future research may profitably examine the effect of personality under severe demands.

Concluding Remarks

In sum, we found that the personality disposition of action/state orientation moderated the ego-depletion effect. When both action- and state-oriented persons are depleted, the

former continue allocating self-control resources whereas the latter tend to disengage and to conserve strength. Hence, action- and state-oriented people adapt differently to enhanced demands on self-control. There is no a priori reason that one strategy would be superior to the other: Sometimes, it may be optimal to conserve resources, but at other times it may be best to push oneself to continue to perform at a high level. Our findings that people differ as to which strategy they favor may be useful for managers, coaches, teachers, and others seeking to help their charges achieve maximum performance over the long run. When resources have already been depleted, it may be helpful to provide additional motivations and incentives to sustain the performance of state-oriented persons to overcome their tendency to withdraw and conserve. Meanwhile, action-oriented persons in the same state may need to be encouraged to take some rests and breaks so as to sustain their level of energy for longer periods. By understanding the interplay between personality, self-regulatory resources, and task demands, it may be possible to enable more people to perform up to their potential.

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Notes

1. The label Demand-Related Action Orientation was suggested by Koole and Jostmann (2004) as alternative to Kuhl's (1994a) original label, the Hesitation subscale. Following recommendations by Kuhl (1994b), we also included the Preoccupation subscale (i.e., the threat-related action/state orientation; cf. Koole & Jostmann, 2004) in Studies 1 to 3 (see Jostmann & Koole, 2007, for similar procedure). According to Kuhl's (2001) theory, demand and threat represent qualitatively different types of aversive states that each relate to specific regulatory systems. Consistent with this, we found no effects of threat-related action/state orientation on self-control performance after depletion.
2. The data were collected as part of a broader research project on ego depletion, and the data set used in Study 3 was also used by Gröpel and Kehr (2013, Experiment 2), except one person who did not complete the Thematic Apperception Test and was therefore not included in Gröpel and Kehr's sample.
3. By convention, *f* effect sizes of 0.10, 0.25, and 0.40 are small, medium, and large, respectively (Cohen, 1988).
4. Gröpel and Kehr (2013, Experiment 2) tested whether implicit achievement motive moderates the ego-depletion effect and

found that, after performing the frustrating sensorimotor task (which provides achievement incentives such as challenge and time-pressure), participants low on the implicit achievement motive showed substantially higher Stroop interference on the subsequent Stroop task than participants high on the implicit achievement motive and those in the simple task control condition. Gröpel and Kehr concluded that the aroused achievement motive made the frustrating task intrinsically motivating and hence less depleting. Therefore, before conducting analyses in Study 3, we examined the relationship between implicit achievement motive and action orientation. Action orientation did not correlate with implicit achievement motive either in the total sample, $r(70) = -.06$, $p = .63$, or in the frustrating task condition, $r(34) = .08$, $p = .66$, or in the simple task condition, $r(35) = -.18$, $p = .30$. Moreover, the effects of action orientation reported in Study 3 remained significant and stable when controlling for implicit achievement motive. In addition, the effect of implicit achievement motive reported by Gröpel and Kehr remained significant and stable after we controlled for action orientation. Conducting a three-way interaction analysis with task condition, action/state orientation, and implicit achievement motive did not reveal a significant interaction, $\beta = .17$, $t(66) = 1.44$, $p = .16$. Hence, the effect of action/state orientation on self-control performance in the present study was independent of individual differences in achievement motivation. Both action orientation and implicit achievement motive contributed significantly and independently of each other to the ego-depletion effect in this data set.

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