

Lack of autonomy and self-control: Performance contingent rewards lead to greater depletion

Mark Muraven · Heather Rosman ·
Marylène Gagné

Published online: 20 November 2007
© Springer Science+Business Media, LLC 2007

Abstract Exerting self-control appears to deplete a needed resource, which leads to poorer self-control subsequently. However, the amount of depletion may vary, based on how controlling versus autonomy supportive the situation is. In particular, feeling compelled to exert self-control may deplete more strength than having more freedom when exerting self-control. In three experiments, participants who were given performance contingent rewards to exert self-control performed more poorly on a subsequent test of self-control than participants who were non-contingent rewards. There were no differences in mood, arousal, or anxiety between the groups; however, feelings of autonomy were related to self-control performance. The results have implications for understanding self-control depletion, as well as the impact of autonomous motivation on self-control performance.

Keywords Self-control · Depletion ·
Self-determination theory

In an ideal world, people would act for the simple pleasure of it. Unfortunately, in the real world, people often do things because they feel compelled or pressured. This may even be true for things that benefit the person, such as losing weight, studying, or overcoming frustration. The pressures to do these things, although needed, may have negative consequences for people. In particular, we will

present evidence that greater pressure to do something that takes self-control leads to poorer self-control subsequently.

Recent research has shown that exerting self-control appears to deplete or use up a limited resource, which results in a reduced ability to exert self-control (for a review, see Muraven and Baumeister 2000). Self-control is defined as any act that requires the individual to override, change, or inhibit a behavior, urge, thought, or emotion (Baumeister et al. 1994; Norman and Shallice 1986). Across many different studies, the more self-control individuals exert, the less able they are to control themselves later. For instance, after resisting the temptation of consuming alcohol, heavy drinkers (as compared to resisting the temptation of consuming water) had greater difficulty stopping a response and overcoming unpleasant feelings (Muraven and Shmueli 2006). The greater the temptation to drink, the greater the decline in self-control performance. These studies have found that the weakening in self-control performance is not related to mood, arousal, or other unpleasant states; only the amount of self-control exerted predicted the change in self-control ability (Muraven and Slessareva 2003; Muraven et al. 1998).

In these experiments, participants likely felt compelled to engage in self-control. That is, they likely exerted self-control to get some reward (e.g., the experimenter's approval) or avoid some punishment. Although this may be seen as a limitation, this probably reflects the fact that many self-control activities are not freely chosen, but instead done for some external reason. People quit smoking because the doctor ordered them, force themselves to study to get a good grade, and decide not to buy new clothes in order to pay down a credit card. In short, self-control is often imposed or externally compelled.

There may be times, however, when self-control is more freely chosen. People quit smoking because it matters to

M. Muraven (✉) · H. Rosman
Department of Psychology, University at Albany, Albany, NY
12222, USA
e-mail: muraven@csc.albany.edu

M. Gagné
Department of Management, John Molson School of Business,
Concordia University, Montreal, QC, Canada

them or start an exercise program out of a personal interest in feeling better. Even though these behaviors are probably not done for the pure intrinsic pleasure of the act (Deci and Ryan 1985), they represent more a autonomous or self-driven behavior. Hence, even extrinsically regulated behavior can be autonomously driven (Grolnick and Ryan 1987; Ryan and Deci 2000; Williams et al. 1996).

Significantly, research on self-determination theory (Deci et al. 1999; Deci and Ryan 1985) has found that some situations lead to greater feelings of being controlled than others. That is, how much a behavior feels autonomous versus controlled can depend on the situation surrounding that behavior. For instance, deadlines, surveillance, and contingent rewards all make people feel as if they have to do something (Amabile et al. 1976; Deci et al. 1999; Lepper and Greene 1975). These situations lead to feelings of being controlled. On the other hand, believing that one is supported, having choices, and rewards that are not linked to performance all reduce the external pressures of the situation. Such supportive situations help maintain feelings of freedom and personal motivation.

In particular, research on the effects of rewards on autonomous motivation has found that the contingencies surrounding a reward are more important than the reward itself (Ryan et al. 1983). More precisely, Deci et al. (1999) differentiated between task non-contingent rewards and task contingent rewards. Task non-contingent rewards are given for merely engaging in the task, for example, simply participating in an experiment. Non-contingent rewards are not perceived as controlling and therefore should not undermine feelings of autonomous motivation on a task. On the other hand, task contingent (especially performance contingent) rewards are based on completing a task, often to a specified level of performance. Performance contingent rewards tend to be much more controlling than task non-contingent rewards, particularly when they are not structured to highlight or affirm the person's feelings of competence. For those reason, performance contingent rewards should reduce feelings of autonomous motivation to a greater degree than non-contingent rewards. Researchers frequently use these reward contingencies to influence participants' feelings of autonomy (for a review and meta-analysis of the effects of reward contingency on feelings of autonomy, see Deci et al. 1999).

Based on self-determination theory and some previous research that has shown autonomously made decisions leads to less depletion than decisions that are compelled (Moller et al. 2006), one could predict that performance contingent rewards for exerting self-control should lead to greater depletion of self-control strength and hence poorer self-control performance subsequently. When the individual feels forced or controlled to do something, he or she is likely to have to overcome internal resistance. In other words, behaviors that are compelled should take greater

self-control than behaviors that feel more freely chosen. Thus, compelled self-control may deplete greater self-control resources as compared to the same self-control act that feel more freely chosen.

Such a prediction could be contrasted with a prediction from learned industriousness theory (Eisenberger and Cameron 1996), which would likely predict that a reward on the initial task should lead to increased motivated on the first task. This increased motivated should carry over to the second task, as the participant learns to work harder, thereby leading to better self-control among participants given performance contingent rewards.

Experiment 1

In Experiment 1, feelings of autonomy were manipulated through performance contingent rewards. Previous research has found that regulating one's mood, especially overriding the desire to laugh, requires the exertion of self-control. Consistent with the self-control strength model, individuals who were instructed not to laugh at a humorous video performed more poorly on subsequent tests of self-control as compared to individuals who did not have to control their mirth (Muraven and Slessareva 2003; Muraven et al. 1998). Participants in the present experiment were asked to not laugh while watching a funny video clip. They were offered a reward either based on their performance at controlling their emotions (performance contingent), or simply for participating (non-contingent).

After exerting self-control, participants were then asked to work on a second task that requires self-control of a different kind: a difficult and boring pattern recognition task. Previous research has found that participants lower in self-control strength exert less effort on tasks than participants who have greater self-control capacity (Muraven et al. 1998). Moreover, research has found that the intellectual performance of depleted individuals suffers relative to non-depleted individuals (Schmeichel et al. 2003). Thus, complex search patterns, which require a great deal of concentration and working memory, should be affected by the individuals' level of self-control strength. We predicted that participants whose payment was made contingent on their performance should be more depleted and therefore perform more poorly on this complex task as compared to participants whose payment was not contingent on their performance.

Method

Participants

Twenty-six (6 men and 20 women) undergraduate students recruited from an introductory organizational behavior

course participated in an experiment on “memory and monitoring performance” in return for extra credit. Participants were individually tested in one 30-min session, and were randomly assigned to one of two conditions described below.

Procedure

Participants were told that the purpose of the study was to examine how moods affect individuals’ ability to monitor their performance. Participants were not informed of the different conditions they could be assigned to, the effects of rewards on feelings of autonomy, and were unaware that self-control was the primary focus of the experiment.

After signing the consent form, participants watched a 10-min video clip of the movie “The Money Pit”, a clip that has been shown in pilot tests to be very funny. Participants were asked to regulate their emotions while watching the video, so that they minimized any positive mood they might experience and displayed no signs of amusement (e.g., smiling or laughing). In the Performance Contingent Reward condition, participants were told that if they did not express any emotion, they would receive \$5, and every time they expressed an emotion, they would lose some of that money. In the Non-Contingent Reward condition, participants were given the same instructions not to show emotions, but they were told that they would receive \$5 for participating, regardless of their performance. Because not laughing requires minimal skill and participants were clearly informed that they were expected not to laugh, losing money should not affirm competence. Based on previous research on self-determination theory, getting paid based on performance decreases feelings of personal freedom and autonomy support, whereas getting paid merely for participating should maintain participants’ feelings of autonomous motivation.

After watching the clip, participants were asked to complete a recall questionnaire that contained filler questions about the movie (including whether they had seen it before). They were then told that while the experimenter would correct their recall questionnaire, they could work on an unrelated task that was being pilot tested for a future study. This task was the dependent measure of self-control performance. The task required participants to find a string of eight digits among a page full of digits and highlight it with a marker. The string could appear 0, 1, or 2 times on one page. They were given a pile of 50 trials to work on and were told they could do as few or as many as they wanted.

After 10 min, the experimenter stopped them if they had not already. They were then asked to complete a measure of affect (the PANAS; Watson et al. 1988), probed for suspicion (none divined the true purpose of the

experiment), debriefed, paid their \$5 (regardless of condition or performance), and dismissed.

Results and discussion

Performance on the pattern recognition task was assessed by the number of trials correctly completed. Participants higher in self-control capacity should find more of the hidden digits than participants lower in self-control capacity. Consistent with our argument, individuals in the Performance Contingent Reward condition solved less trials ($M = 16.15$, $S.D. = 4.26$) than individuals in the Non-Contingent Reward condition ($M = 20.30$, $S.D. = 3.50$), $t(24) = 2.72$, $p < .01$. Individuals who exerted self-control for controlled reasons performed more poorly on the task than individuals who were autonomously motivated. Finally, positive and negative affect as measured with the PANAS were not influenced by the contingency manipulation, $t(23) = .54$, ns, and $t(23) = .36$, ns, respectively.

The results suggest that participants who received a contingent reward for exerting self-control performed more poorly on a subsequent test of self-control than participants who received a non-contingent reward. The differences in performance were not related to participants’ positive or negative affective state, however. Thus, it appears that feeling less autonomous while exerting self-control depletes more self-control strength.

Experiment 2

Experiment 2 was meant to replicate the results of Experiment 1, and extend these findings with additional analyses and manipulation checks. Most notably, in Experiment 1, participants’ performance on the initial task was not assessed. Hence, it is possible that differences in exertion on the first task influenced the subsequent self-control outcome. This is especially important based on the alternatively explanation put forth by learned industriousness theory which suggests that effort exerted on the first task may affect performance on the second task. Experiment 2 rectifies this may including a measure of performance on the depleting task. We also sought to use difference measures of self-control and mood to help generalize the results.

Methods

Participants

Thirty (21 women and 9 men) undergraduate students were recruited from introductory psychology courses. They

participated in return for partial fulfillment of a course requirement. Participants were individually tested in one 30-min response session.

Procedure

Participants were told that the purpose of the study was to examine how the completion of certain tasks affects people's feelings of stress and mental abilities. Participants and the experimenter were not informed how contingent or non-contingent rewards influence feelings of autonomous motivation. They were also unaware that self-control performance was the primary focus of the experiment.

After signing the consent form, participants were asked to describe their idea of a perfect day into a tape recorder without using filler words (words such as “um”, “er” or “like”). The use of filler words is habitual and automatic (Christenfeld and Creager 1996) and therefore overriding this habit should require self-control. Indeed, previous work has found that individuals who inhibited the use of speech fillers performed more poorly on subsequent tests of self-control than individuals who did not have to inhibit the use of speech fillers (Muraven and Slessareva 2003).

Participants' feelings of autonomous motivation for overriding speech fillers was manipulated through task contingent payment (Deci 1971; Deci et al. 1999; Deci and Ryan 1980). Participants were assigned to one of two conditions that differed in how controlling the self-control task was framed. In particular, participants in the Non-Contingent Reward condition were told they would receive \$5 for participating in the experiment. This should result in greater feelings of autonomous motivation because participants are not likely to think that the reward is based on their performance. They were told to try to use less than 15 filler words. Participants in the Performance Contingent Reward condition were told they would receive \$5 only if they used less than 15 filler words (all participants used less than 15 filler words). As in Experiment 1, not using filler words is not a high skill task and participants were told that they should be to reach this goal. Hence, the performance contingent reward should not convey information about competency and instead, should result in lower feelings of autonomy because participants will think the reward is based on the activity. Although the outcome was the same and all participants received \$5, this payment structure should affect participants' feelings of autonomous motivation for exerting self-control. The description of a perfect day typically took between 1 and 2 min.

After describing their perfect day, participants completed the Situational Motivation Scale (SIMS; Guay et al. 2000). The SIMS consists of 16 questions that load on four subscales designed to assess the constructs of motivation: identified regulation, external regulation, and amotivation.

Prior research has found the SIMS to have good internal consistency (Cronbach's alphas from .77 to .95) and validity. The scale is also responsive to experimental manipulations of autonomy (Guay et al. 2000). Participants also completed the Spielberger State-Trait Anxiety Inventory (STAI; Spielberger et al. 1970), to determine if the conditions differed in the amount of anxiety or stress they produced in participants.

Participants then completed the Stroop test (Stroop 1935), which was presented as a test of mental performance. More specifically, participants were first presented with a sheet of color-words, such as the word “red” written in red ink. Participants were asked to read the words on the sheet out loud and were timed using a stopwatch. On the second sheet, the color-words were in contrasting ink colors (e.g., the word “blue” is in green ink). Participants were again asked to read the words out loud while ignoring the ink color and were again timed during this process.

Ignoring the ink color while reading the second list should require the individual to inhibit automatic processes. Participants who are lower in self-control capacity should perform more poorly on the Stroop task. Indeed, individuals lower in trait self-control capacity (e.g., individuals with attention deficit hyperactivity disorder) perform more poorly on the Stroop than individuals with greater self-control capacity (e.g., Barkley 1997; White et al. 1994). Likewise, individuals who have to override the ink color were more depleted than individuals who did not have to override the ink color (Wallace and Baumeister 2002). Hence, Stroop performance should index self-control capacity. Consistent with previous research, participants' performance was measured by subtracting the participants' time on the first sheet from their time on the second sheet to remove differences in reading speed and to get a more pure measure of interference. After subjects completed the Stroop test, they were debriefed and dismissed.

Results and discussion

Manipulation check

Participants' feelings of autonomy were assessed using the SIMS. Consistent with the predictions of self-determination theory, participants in the Performance Contingent Reward condition reported being marginally more externally motivated ($M = 19.6$, $S.D. = 6.33$) than participants in the Non-Contingent Reward condition ($M = 15.4$, $S.D. = 7.62$), $t(28) = 1.64$, $p < .06$ (one-tailed). No other subscale of SIMS was significant. Being paid based on their performance increased participants' feelings of being controlled. Reward condition had no effect on participants'

anxiety, however. As assessed with the STAI, participants in the Performance Contingent Reward condition were as anxious ($M = 48.5$, $S.D. = 11.0$) as participants in the Non-Contingent Reward condition ($M = 49.6$, $S.D. = 7.91$), $t(28) = .75$, ns. Any differences between the conditions in performance on the final self-control task cannot be attributed to stress or anxiety.

Moreover, experimental condition had no effect on the number of times participants said “um” during the speech (Performance Contingent Reward: $M = 8.07$, $S.D. = 2.81$; Non-Contingent Reward: $M = 7.60$, $S.D. = 2.97$), $t(28) = .195$, ns. The length of the speech was also equal (Performance Contingent Reward: $M = 119$ s, $S.D. = 37.9$; Non-Contingent Reward: $M = 141$ s, $S.D. = 40.6$), $t(28) = 1.55$, ns. In short, performance of the initial task was equal across conditions; any differences in performance on the final task should be due to feelings of autonomy. This suggests that learned industriousness theory is not viable alternative theory.

Self-control outcomes

Participants' performance on the Stroop was computed by subtracting their baseline reading time from their performance on the interference task. Thus, lower self-control capacity should lead to slower reading times. As predicted, participants given a performance contingent reward in the first part of the experiment performed more poorly on the Stroop (mean decline over baseline = 3.69 s, $S.D. = 2.50$) than participants given a non-contingent reward (mean decline = 2.17, $S.D. = 1.69$), $t(28) = 1.96$, $p < .05$.¹ Participants who exerted self-control in the first part of the experiment for less autonomous reasons performed more poorly on a subsequent measure of self-control than participants who exerted self-control for more autonomous reasons.

Alternatively, we looked at the relationship between participants' SIMS scores and their Stroop performance. The more controlled participants felt on the initial task, the more poorly they performed on the Stroop, $r(30) = .40$, $p < .05$. In other words, it appears that exerting self-control under autonomy undermining conditions is more depleting than exerting self-control for more autonomous reasons. On the other hand, participants' STAI scores were unrelated to Stroop performance, $r(30) = .16$, ns. As in Experiment 1, it appears that mood and arousal appears to be unrelated to self-control outcomes.

¹ After controlling for baseline reading time using regression, the relationship between condition and reading time for the interference list was also significant, $\beta = .143$, $t(27) = 2.10$, $p < .05$.

Experiment 3

The first two experiments demonstrated that participants who exert self-control under autonomy undermining conditions are more depleted than participants who exert self-control under more autonomy supportive conditions (payment meeting a standard versus payment for simply participating). However, the experiments did not include a no self-control condition, which reduces their interpretability. Most notably, it is possible that the motivation surrounding the reward was carried over from the first task to the second; that is, the performance contingent reward reduced overall motivation in the experiment. To help address that concern, Experiment 3 included a no self-control group. If performance contingent rewards reduce motivation for the second measure, there should be a main effect for reward type. We however, predict an interaction: the effect of performance contingent rewards should be much larger for participants who have to exert self-control in the first part of the experiment as compared to participants who do not have to exert self-control.

Methods

Participants

Sixty (23 women and 34 men; data on gender was not collected from 3 participants) undergraduates were recruited from introductory psychology courses and participated in return for partial fulfillment of a course requirement. Participants were individually tested in one 30-min response session.

Procedure

All instructions were presented on the computer and the computer randomly assigned participants to condition at run-time. Participants believed this was a study of language processing. Participants were not informed how contingent or non-contingent rewards influence feelings of autonomous motivation.

After signing a consent form, participants engaged in a Stroop task on the computer. They had to indicate font color of the word on the screen by pressing the correct key. Participants saw a total of 80 words. How long it took them to respond after the word appears on the screen was measured by the computer. If participants took longer than 2 s to supply a correct answer, the time for that trial was recorded as 2 s. Less than 3% of all the data points were handled in this way; no single participant had more than four responses (5%) cut off. No participant made more than 10 (12%) incorrect responses.

To manipulate how much self-control the task required, the color words matched the font color for half the participants (Match). For the other half of the participants, there was a mismatch between font color and word (Mismatch). Previous research (Wallace and Baumeister 2002) has found that inhibiting the natural response to say the word color on the mismatching Stroop requires self-control. Hence, the Mismatch condition should require more self-control than the Matching condition.

Participants were given reward based on their Stroop performance. Participants in the Performance Contingent Reward condition were told that they would be given \$5 if they were able to correctly identify 60% or more of the words. As in the previous experiments, this reward was presented in a non-informative way, so that participants' feelings of competency were not affirmed. Hence, this reward should be perceived as controlling and reduce participants' feelings of autonomous motivation. All participants reached this criterion and were given their money at the end of the Stroop task. This contingent or controlling reward can be contrasted with the non-contingent reward. In the Non-Contingent Reward condition, participants were not told about the money ahead of time, but instead were given the \$5 at the end of the experiment. They were told that this money was "in appreciation for your efforts on the test. This is yours to keep and is unrelated to how well you did on that test or how well you do on the next test." Based on previous research, such instructions should not reduce feelings of autonomous motivation.

At this point, participants completed the interest/enjoyment subscale of Intrinsic Motivation Inventory (IMI; e.g., Ryan 1982) to assess their perception of the Stroop task. The seven items (e.g., "I found the task very interesting," "I enjoyed doing the task very much") on this subscale measure feelings of intrinsic interest in the task. Individuals who score low on this scale felt less intrinsically interested in working on the task and hence should have a less autonomous motivation. Participants also completed the Brief Mood Introspection Scale (BMIS; Mayer and Gaschke 1988). This scale asks participants to rate their current mood using 16 different adjectives. The items are scored on two separate factors that correspond to pleasant versus unpleasant affect and high versus low arousal.

Finally, participants also completed a brief manipulation check questionnaire to assess their level of motivation (e.g., "how much effort do you plan to exert on the rest of the experiment?"), and their confidence (e.g., "how sure are you that you can do well on the rest of the experiment?"). These questions were answered on a 7-point Likert-type scale, with anchors of 1 = not at all and 7 = very much.

Participants' self-control performance was then assessed using a self-stopping task (Logan 1994). This task required participants to indicate whether a box appeared to the left

or right of a target on the computer screen by pressing the appropriate key as quickly as possible on the keyboard. The task was composed of five blocks each consisting of 64 trials; the first block was a practice block.

On 48 (25%) of the 192 trials (spaced randomly throughout the task), a sound came over the headphones that indicated they should not respond to the appearance of the box. Previous research has found that participants who have more self-control strength are more successful at stopping themselves from responding when the tone sounds (Muraven et al. 2006). The program compensated for individual differences in reaction times and changes in reaction time over the experiment by calculating participants' mean primary reaction time (MRT, how quickly they responded to the square) for each block. The auditory stop signals were then presented 50, 200, 350, and 500 ms before the MRT calculated in the preceding blocks. The proportion of number of responses not made when the tone sounded was calculated for each stop signal interval.

Results and discussion

Manipulation checks

The manipulation checks supported the conclusion that the performance contingent reward lead to decreased interest in the Stroop task (as assessed using the IMI), but had no effect on mood, arousal, or overall motivation (see Table 1). More precisely, using a 2 (Stroop: Match versus Mismatch) \times 2 (reward type: Performance Contingent Reward versus Non-Contingent Reward) ANOVA we found that participants who were given a reward that was contingent on their performance reported less autonomous motivation in the task based on the responses as reported on the IMI scale than participants who were given a non-contingent payment, $F(1, 56) = 10.37$, $p < .001$. Stroop condition had no effect on feelings of autonomous motivation, $F(1, 56) = 2.82$, ns. The interaction between Stroop and reward type also was not significant, $F(1, 56) = .94$, ns. This indicates that Stroop condition did not affect feelings of autonomy.

Although the performance contingent reward decreased feelings of interest and autonomous motivation, it had no effect on mood, $F(1, 56) = 1.27$, ns or arousal, $F(1, 56) = 1.61$, ns. Similarly, the main effects for Stroop or reward type and the interaction between them were not significant for the BMIS ratings of mood and arousal, all $F_s < 1.13$.

Participants reported exerting more control over themselves in the Mismatch than in the Matched Stroop condition, $F(1, 56) = 6.41$, $p < .025$. The rewards type had no effect on the amount of self-control exerted, $F(1,$

Table 1 Experiment 3: responses on key variables based on initial task and reward type

Variable	Depleted				Not depleted			
	Contingent reward		Non-contingent reward		Contingent reward		Non-contingent reward	
	<i>M</i>	S.D.	<i>M</i>	S.D.	<i>M</i>	S.D.	<i>M</i>	S.D.
IMI	19.86	7.58	30.00	8.22	23.27	8.11	31.71	7.04
Mood	3.14	9.97	-1.83	11.58	4.85	9.55	2.95	9.27
Arousal	20.29	2.50	22.83	3.76	19.81	4.50	20.57	4.19
Self-control exerted on Stroop	2.86	2.04	3.17	.98	1.69	1.35	2.00	1.70
Eagerness for stop signal	4.14	1.22	4.33	1.21	3.71	1.81	4.30	1.42
Engagement on stop signal	3.57	1.51	4.00	1.79	3.29	1.65	3.65	1.50
Stop signal performance	7.29	1.60	5.33	1.97	6.31	1.64	6.86	2.61

Note: $N = 60$

56) = .71, ns nor the interaction between Stroop and reward type, $F(1, 56) = .054$, ns. This suggests that the manipulation successful affected how much self-control strength was depleted.

Despite the difference in amount of self-control exerted and feelings of autonomous motivation on the initial task, participants' feelings about the second task did not differ across condition. Most notably, the type of reward $F(1, 53) = 3.20$, ns and Stroop condition, $F(1, 53) = 2.60$, ns as well as the interaction between these factors, $F(1, 53) = 1.12$, ns has no effect on participants' reported engagement on the stop signal task.² Similarly, participants did not differ in how eager they were to work on the stop signal, type of reward, $F(1, 53) = 3.24$, ns; Stroop condition, $F(1, 53) = 2.20$, ns; interaction, $F(1, 53) = .366$, ns. This suggests that any differences in performance on the stop signal performance cannot be attributed to reduction in motivation level or less autonomous motivation on the second task.

Finally, performance on the Stroop task (time to complete the task) indicates that there was a significant effect for the Match versus Mismatch condition, $F(1, 56) = 21.43$, $p < .001$. There was no differences in Stroop performance based on reward condition, $F(1, 56) = .829$, ns, nor was the interaction significant, $F(1, 56) = .676$, ns. As in Experiment 2, performance contingent rewards did not lead to less effort on initial self-control task.

Self-control outcomes

Consistent with previous research (Muraven and Shmueli 2006; Muraven et al. 2006), we focused on the most difficult stop signal interval: 50 ms before MRT. Longer intervals give participants more time to stop themselves and hence require far less self-control. The main effect for

² Due to a computer error, data on the final task was not collected from three participants.

reward type, $F(1, 56) = 1.17$, ns and for Stroop condition, $F(1, 56) = .18$, ns, were not significant. However, the interaction between these factors was nearly significant, $F(1, 56) = 3.71$, $p < .054$.

As shown on Table 1, participants who were depleted by engaging in the mismatching Stroop task and who were given a contingent reward for their performance were much less able to stop themselves from responding when the tone sounded as compared to participants in any other condition. Moreover, the contingency of the rewards had no effect on participants who were not depleted. The rewards only affected participants who had to exert self-control in the first part of the experiment.

Additional analyses supported the conclusion that performance contingent rewards do not directly affect performance on subsequent tasks. Using a regression analyses, there was no main effect relationship between self-reported autonomous motivation and performance on the stop signal task, $B = -.008$, S.E. = .033, $t(59) = .225$, ns. This means that performance contingent reward did not lead to poorer performance in all participants. However, the interaction between feelings of autonomous motivation and Stroop condition was a significant predictor of stop signal performance, $B = .160$, S.E. = .074, $t(59) = 2.15$, $p < .05$. The performance contingent rewards do not lead to reduced motivation for the second task, but instead seem to make the initial task more depleting.

Mediation

Finally, we examined whether feelings of autonomy support (as assessed with the IMI) mediated the relationship between performance contingent rewards and self-control performance. For these analyses, we only examined the mismatched Stroop condition. As would be expected, reward condition was significantly related to feelings of autonomy support, $B = 10.14$, S.E. = 3.84, $t(29) = 2.64$,

$p < .025$. Feelings of autonomy support were also related to stop signal performance, $B = .752$, $S.E. = .221$, $t(29) = 3.40$, $p < .001$. The Sobel test of mediation was significant, $z = 2.09$, $p < .05$. In other words, feelings of autonomy support mediate the relationship between performance contingent rewards and self-control performance.

General discussion

The results of three experiments suggest that individuals who are forced to exert self-control perform more poorly on a subsequent test of self-control than individuals who feel more autonomous while exerting self-control. More precisely, participants who were given performance contingent rewards for exerting self-control performed more poorly on a subsequent test of self-control than participants who were given non-contingent rewards. Moreover, there was a direct relationship between feelings of autonomy on the first task and self-control performance on the second task. The more participants felt compelled to exert self-control on the initial self-control task, the more poorly they performed on the final self-control task.

Receiving task contingent rewards had no effect on participants' stress, anxiety, or mood relative to participants in the non-contingent reward group. Although the task was more controlling for some participants, they engaged in the same relatively non-aversive task and received the same reward, which likely minimized any differences in affect.

Similarly, these results suggest that individuals who were given task contingent rewards did not perform worse on the final measure of self-control performance because they were stressed by the task, nor were their performances aversively affected by anxiety. Likewise, performance contingent rewards did not lead to lower motivation overall. Instead, task contingent rewards appear to directly affect the amount of self-control strength required by a self-control task. That is, these experiments suggest exerting self-control when autonomy is maintained is less depleting than exerting self-control when autonomy is thwarted.

Taken together, the experiments make a case that when individuals feel compelled to exert self-control, more self-control strength is depleted than when they feel volitional in choosing their behavior. One could argue, however, that the reward decreased overall motivation, rather than making a task more depleting. Of course, all participants received the same reward in the end, so their outcomes were equal (as were their mood, arousal, and anxiety, as noted above). Although research has shown that rewards can undermine autonomous motivation for future tasks (Deci et al. 1999), the second task was likely not internally motivated (participants were not given a choice about

actions, but instead were ordered to persist or say the ink color).

Experiment 3 demonstrated that motivation on the first task did not carry over to the second task even more directly: among participants who were not depleted, the performance contingent reward had no effect on their self-control performance. Only feeling compelled to exert self-control resulted in poorer performance subsequently. This also contradicts the predictions of learned industriousness theory (Eisenberger and Cameron 1996) because rewards on the first task did not carry over to later tasks, at least when the tasks require self-control. Overall, the results indicate that a general decline in motivation or less autonomous motivation likely cannot explain the effects.

The results suggest that self-control is affected by how one feels about the task. Self-control that feels more externally determined is more depleting than self-control that feels more personally chosen. Although it is unlikely self-control is probably rarely intrinsic, it appears that even small changes in feelings of autonomy surrounding the activity can affect how depleting the task is. Indeed, research by Moller et al. (2006) found that autonomously made choices are less depleting than choices that feel controlled. The present research builds upon that research by examining the effects of performance contingent rewards while exerting self-control. Together, these studies converge on the idea that why someone engages in a task (either making a choice or exerting self-control) matters as much as how much effort he or she puts forth. Additional research that directly manipulates autonomy support may help further refine this model. Overall, the pattern of results suggests the basic framework of depletion (e.g., Muraven and Baumeister 2000) needs some revision to include the effects of people's perception of the task.

Feelings of autonomy may affect how much self-control strength is required through several possible mechanisms. First, we suggest that when self-control feels more volitional, it may lead to greater feelings of vitality (Ryan and Frederick 1997) and this vitality, in some way, may lead to greater motivation to exert self-control. This mechanism was proposed by Moller et al. (2006). Alternatively, when self-control feels less required or demanded, the individual may feel less internal conflict, so that self-control requires overcoming a weaker or non-existent impulse. Previous research has indeed found a strong relationship between the strength of the impulse becoming overcome and the magnitude of the subsequent depletion effect (Muraven et al. 2002).

In conclusion, the difference between compelled and freely chosen self-control may have important implications for the subsequent success of self-control. Research has indeed found that freely chosen acts of self-control, such as weight loss (Williams et al. 1996); alcohol abstinence

(Ryan et al. 1995) and smoking cessation (Curry et al. 1990; Williams et al. 2002), are more likely to succeed when autonomously motivated. The present research may help explain why such autonomously motivated is more likely to succeed: it requires less self-control strength.

Acknowledgments Portions of this research were supported by Grants AA12770 provided by the National Institute on Alcohol Abuse and Alcoholism and DA015131 provided by the National Institute on Drug Abuse.

References

- Amabile, T. M., DeJong, W., & Lepper, M. R. (1976). Effects of externally imposed deadlines on subsequent intrinsic motivation. *Journal of Personality and Social Psychology, 34*, 92–98.
- Barkley, R. A. (1997). *ADHD and the nature of self-control*. New York: Guilford Press.
- Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1994). *Losing control: How and why people fail at self-regulation*. San Diego, CA: Academic Press.
- Christenfeld, N., & Creager, B. (1996). Anxiety, alcohol, aphasia, and ums. *Journal of Personality and Social Psychology, 70*, 451–460.
- Curry, S. J., Wagner, E. H., & Grothaus, L. C. (1990). Intrinsic and extrinsic motivation for smoking cessation. *Journal of Consulting and Clinical Psychology, 58*, 310–316.
- Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology, 18*, 105–115.
- Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin, 125*, 627–668.
- Deci, E. L., & Ryan, R. M. (1980). The empirical exploration of intrinsic motivational processes. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 13, pp. 39–80). New York: Academic Press.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.
- Eisenberger, R., & Cameron, J. (1996). Detrimental effects of reward: Reality or myth? *American Psychologist, 51*, 1153–1166.
- Grolnick, W. S., & Ryan, R. M. (1987). Autonomy in children's learning: An experimental and individual difference investigation. *Journal of Personality and Social Psychology, 52*, 890–898.
- Guay, F., Vallerand, R. J., & Blanchard, C. (2000). On the assessment of situational intrinsic and extrinsic motivation: The situational motivation scale (SIMS). *Motivation and Emotion, 24*, 175–213.
- Lepper, M. R., & Greene, D. (1975). Turning play into work: Effects of adult surveillance and extrinsic rewards on children's intrinsic motivation. *Journal of Personality and Social Psychology, 31*, 479–486.
- Logan, G. D. (1994). On the ability to inhibit thought and action: A user's guide to the stop signal paradigm. In D. Dagenback & T. H. Carr (Eds.), *Inhibitory processes in attention, memory, and language* (pp. 189–239). San Diego: Academic Press.
- Mayer, J. D., & Gaschke, Y. N. (1988). The experience and meta-experience of mood. *Journal of Personality and Social Psychology, 55*, 102–111.
- Moller, A. C., Deci, E. L., & Ryan, R. M. (2006). Choice and ego-depletion: The moderating role of autonomy. *Personality and Social Psychology Bulletin, 32*, 1024–1036.
- Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin, 126*, 247–259.
- Muraven, M., Collins, R. L., & Nienhaus, K. (2002). Self-control and alcohol restraint: An initial application of the self-control strength model. *Psychology of Addictive Behaviors, 16*, 113–120.
- Muraven, M., & Shmueli, D. (2006). The self-control costs of fighting the temptation to drink. *Psychology of Addictive Behaviors, 20*, 154–160.
- Muraven, M., Shmueli, D., & Burkley, E. (2006). Conserving self-control strength. *Journal of Personality and Social Psychology, 91*, 524–537.
- Muraven, M., & Slessareva, E. (2003). Mechanisms of self-control failure: Motivation and limited resources. *Personality and Social Psychology Bulletin, 29*, 894–906.
- Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as a limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology, 74*, 774–789.
- Norman, D. A., & Shallice, T. (1986). Attention to action: Willed and automatic control of behavior. In R. J. Davidson, G. E. Schwartz, & D. Shapiro (Eds.), *Consciousness and self-regulation: Advances in research and theory* (Vol. 4, pp. 2–18). New York: Plenum.
- Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43*, 450–461.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*, 68–78.
- Ryan, R. M., & Frederick, C. (1997). On energy, personality, and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality, 65*, 529–565.
- Ryan, R. M., Mims, V., & Koestner, R. (1983). Relation of reward contingency and interpersonal context to intrinsic motivation: A review and test using cognitive evaluative theory. *Journal of Personality and Social Psychology, 45*, 736–750.
- Ryan, R. M., Plant, R. W., & O'Malley, S. (1995). Initial motivations for alcohol treatment: Relations with patient characteristics, treatment involvement, and drop out. *Addictive Behaviors, 20*, 279–297.
- Schmeichel, B. J., Vohs, K. D., & Baumeister, R. F. (2003). Intellectual performance and ego depletion: Role of the self in logical reasoning and other information processing. *Journal of Personality and Social Psychology, 85*, 33–46.
- Spielberger, C. D., Gorsuch, R. C., & Lushene, R. F. (1970). *Manual for the state-trait anxiety inventory*. Palo Alto, CA: Consulting Psychologists Press.
- Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*, 643–662.
- Wallace, H. W., & Baumeister, R. F. (2002). The effects of success versus failure feedback on further self-control. *Self and Identity, 1*, 35–42.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063–1070.
- White, J. L., Moffitt, T. E., Caspi, A., Bartusch, D. J., Needles, D. J., & Stouthamer-Loeber, M. (1994). Measuring impulsivity and examining its relationship to delinquency. *Journal of Abnormal Psychology, 103*, 192–205.
- Williams, G. C., Gagné, M., Ryan, R. M., & Deci, E. L. (2002). Supporting autonomy to motivate smoking cessation: A test of self-determination theory. *Health Psychology, 21*, 40–50.
- Williams, G. C., Grow, V. M., Freedman, Z. R., Ryan, R. M., & Deci, E. L. (1996). Motivational predictors of weight loss and weight-loss maintenance. *Journal of Personality and Social Psychology, 70*, 115–126.