



FlashReport

Building self-control strength: Practicing self-control leads to improved self-control performance

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ARTICLE INFO

Article history:

Received 2 September 2009

Revised 12 December 2009

Available online 4 January 2010

Keywords:

Self-control
Building strength
Inhibition
Depletion

ABSTRACT

Self-control performance may be improved by the regular practice of small acts of self-control.

Ninety-two adults' self-control capacity was assessed using the stop signal paradigm before they started practicing self-control and again at the end of 2 weeks. Participants who practiced self-control by cutting back on sweets or squeezing a handgrip exhibited significant improvement in stop signal performance relative to those who practiced tasks that did not require self-control. Participants who did not practice self-control believed that the tasks should improve self-control, engaged in tasks that were effortful and made self-control salient, but did not actually require self-control. Supplemental analyses suggested that only practicing self-control built self-control capacity; the improved outcomes cannot be explained by self-fulfilling prophecies, increased self-efficacy or awareness of self-control. The results may have implications for understanding the development of self-control in both children and adults, as well as clinical implications for treating disorders that involve low self-control.

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Introduction

A model of self-control strength (Muraven & Baumeister, 2000) has suggested that it may be possible to increase people's self-control. In particular, the model predicts that the regular practice (interspersed with rest) of small acts of inhibiting moods, urges, thoughts or feelings should increase self-control strength. This increased strength should generalize to any and all tasks that require self-control. Hence, the particular self-control task being practiced is unimportant, providing it requires the individual to override or inhibit a response.

Prior research has provided some evidence that practicing small acts of self-control leads to a general increase in self-control capacity. For instance, Muraven, Baumeister, and Tice (1999) found that individuals who exerted self-control over their eating habits or who regulated their posture for 2 weeks performed better on a task that required overriding physical discomfort. Other training programs, such as avoiding colloquialisms or cursing while speaking, or using the nondominant hand, have also been shown to improve people's ability to regulate their use of stereotypes (Gailliot, Plant, Butz, & Baumeister, 2007). Other research found that people who practiced self-control by forcing themselves to study (Oaten & Cheng, 2006a) or exercise (Oaten & Cheng, 2006b) also exhibited better self-control. In short, preliminary research is supportive of the prediction that practicing small acts of inhibition leads to a general increase in self-control ability.

However, this prior research has several noteworthy shortcomings. Most importantly, the experimental design failed to account for potential confounds, such as whether practicing self-control leads to increased self-efficacy or confidence in self-control, or greater awareness of self-control. The present research attempts to address this limitation by having people practice tasks that either increase the saliency of self-control or boost feelings of self-efficacy, without actually increasing the amount of self-control exerted. Additional analyses will also examine how beliefs about practice and the amount of effort exerted affect changes in self-control performance.

Methods

Participants

Ninety-two (46 females and 46 males) volunteers from the Albany, New York metropolitan area were recruited through newspaper ads, flyers hung in meeting places, and radio spots as part of a larger study on smoking cessation.

Overview

Participants undertook a 2 week training program to build their self-control. Their self-control ability was measured at baseline and again at the end of the 2 weeks using the stop signal procedure (de Jong, Coles, Logan, & Gratton, 1990; Logan, 1994). They called a telephone system (IVR; Perrine, Mundt, Searles, & Lester, 1995;

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Searles, Perrine, Mundt, & Helzer, 1995) daily to report their compliance with and perceptions of the task they were practicing.

Practice instructions

At the initial laboratory meeting, participants were randomly assigned to practice one of four tasks for 2 weeks: avoiding sweets, handgrip, math, and diary. Participants in all groups were led to believe that practicing regularly should build their self-control capacity.

Participants assigned to the building strength conditions (avoid sweets and handgrip) had to inhibit their urges, feelings, and behaviors. The theory suggests that the particular nature of the self-control task being practiced is less important than the amount of effort exerted (Muraven & Baumeister, 2000; Muraven et al., 1999). Hence, the two building strength conditions should equally improve self-control, providing participants do it diligently.

Participants in the *avoid sweets* group were told to eat as little cake, cookies, pies, candy, and other dessert foods as possible for 2 weeks. Not eating tempting food is a very difficult self-control exercise (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998, Experiment 1); hence the avoiding sweets group should be practicing self-control.

Participants in the *handgrip* group were given commercially available handgrips (purchased in a sporting goods store) and instructed to hold the handgrip for as long as possible twice a day. Holding a handgrip requires overcoming physical discomfort and the desire to release it and hence it requires considerable self-control (Bray, Ginis, Hicks, & Woodgate, 2008; Rethlingshafer, 1942; Thornton, 1939).

There were also two control groups to help rule out alternative explanations for the effect. Participants in the *math* group condition performed simple math problems that were graduated to become harder over the 2 weeks. Prior research has found that solving math problems is not a preferred activity to many people but doing it for a few minutes does not require overcoming a strong impulse (Muraven, Tice, & Baumeister, 1998). Hence, solving math problems for several minutes every day should not build much self-control. However, participants were still practicing a demanding task, which should test whether practicing any task will build self-control or if the task has to involve inhibition.

Finally, participants assigned to the *diary* group maintained a diary of any acts of self-control they engaged in (e.g., want a sweet but do not have one, not yell despite being mad). Again, maintaining a diary should require a minimal amount of self-control. The diary ought to make self-control very salient to the participant, however. In that way, this condition should control for self-monitoring—that is, whether the improved self-control is a product of self-control being more salient rather than building self-control per se.

Participants called the IVR daily during the practice period to report how much they practiced their assigned task, how much effort they felt they exerted practicing, whether the assigned task required self-control, and whether they believed practicing would help self-control. They made these ratings on a 1 (strongly disagree) to 5 (strongly agree) scale. At the end of the 2-week practice, participants returned to the laboratory and their self-control was assessed again using the stop signal task.

Self-control assessment

The stop signal task, a well-established cognitive test of inhibition, was used to assess self-control performance (de Jong et al., 1990; Logan, 1994). Previous research has found that inhibition failures on the stop signal task is related to self-control capacity (e.g., Muraven, Shmueli, & Burkley, 2006).

In the stop signal task, participants are asked to press the right button if a square appears on the right side of a fixation point and to press the left button if a square appeared on the left side of a fixation point. On 25% of the trials, a tone sounded. Participants were asked to suppress their response (i.e., not to hit any key when they saw a square) whenever they heard the tone. To control for individual differences in reaction times and differences in reaction time over the experiment, participants' reaction time to the square was calculated for each block of trials. The auditory stop signals were then presented 50, 200, 350, and 500 ms before the mean reaction time in the preceding block. The overall number of inhibition failures (responses when the tone sounded) was calculated as a measure of self-control. In addition, the mean stop signal reaction time (SSRT) was computed using Logan's (1994) race model.

Results

Perception of practice tasks

Every day, using the IVR system, participants reported how much effort they exerted, how much self-control they exerted, and whether they thought practicing would help improve their self-control. These daily reports were averaged for each person (α for each item $> .88$). Participants reported not practicing approximately 2 days during the 2 week session (mean days practiced = 11.68, $SD = 3.28$). There were no differences across groups, $F(3, 90) = .254$, *ns* (see Table 1).

Participants in all conditions reported exerting the same amount of effort on their assigned task, $F(3, 90) = 1.63$, *ns*. This suggests that the control instructions matched the experimental instructions in how much work they required. Hence any difference in self-control outcomes between groups cannot be ascribed to work effort alone.

Although there was a main effect for how much self-control participants thought they exerted, $F(3, 90) = 3.98$, $p < .01$, the effect was entirely driven by the math condition. Individuals in that group felt that they were exerting less self-control than the other three groups, $F(1, 87) = 3.12$, $p < .01$. Indeed, the other three groups did not differ from one another, $F(1, 87) = .630$, *ns*. This suggests that participants felt that they were exerting as much self-control in the diary condition as the building strength conditions; any difference between these groups cannot be explained by greater saliency of self-control.

Similarly, whether they thought practicing would help them get better at self-control did differ across condition, $F(3, 90) = 6.62$, $p < .05$. Again, this difference was entirely driven by the math condition, $F(1, 87) = 4.37$, $p < .001$, as the diary group did not differ from the two treatment groups, $F(1, 119) = .65$, *ns*. Put another way, individuals in the diary group thought they were building self-control to the same extent as participants in the avoid sweets or handgrip groups.

Stop signal

On no-tone trials of the stop signal, participants made very few errors ($< 2\%$). The number of errors did not differ across condition or session and is not considered further. Reaction time on the no-tone trials is shown on Table 1, after removal of responses greater than 2.5 standard deviations above the mean (2.1% of all data). There were no significant differences across groups, $F(3, 88) = .91$, *ns* or between sessions, $F(1, 88) = .04$, *ns*. Likewise, the interaction between session and condition was not significant, $F(3, 88) = 2.19$, *ns*. The inclusion of the outliers had no effect the outcome of these analyses. In short, the differences in inhibition failures between

Table 1
Practice variables and stop signal performance across groups.

	Control conditions				Building strength conditions			
	Math problems		Diary		Avoid sweets		Handgrip	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Days practiced	11.16	4.22	11.19	3.50	11.92	2.08	12.45	3.22
Effort	3.10	.72	3.62	.78	3.41	.65	3.44	.93
SC	3.25	.69	4.00	.72	4.03	.77	3.72	1.08
Help	2.77	.75	3.62	.80	3.82	.70	3.68	1.02
Choice RT T1	504.53	67.45	530.66	49.92	526.23	51.90	526.02	47.52
Choice RT T2	537.33	53.22	536.79	47.56	509.08	46.34	511.06	58.75
Inhibition failures T1	24.68	8.48	22.92	8.80	27.58	8.50	25.39	11.78
Inhibition failures T2	25.26	10.31	23.84	9.75	20.75	6.98	21.47	11.93
SSRT T1	211.74	64.07	212.12	36.60	232.48	87.40	224.35	80.82
SSRT T2	235.71	60.44	243.58	91.61	204.23	80.78	197.51	107.91

Notes: Effort = effort exerted practicing task. SC = perceived self-control exerted on practice task. Help = perception that practice task will help build self-control. Choice RT = reaction time on no signal trials. SSRT = stop signal reaction time.

groups reported below are not due to participants changing their responding on the stop signal.

The number of responses (button presses) when the tone sounded served as the measure of self-control capacity in this experiment. There were 64 critical trials in total; lower numbers indicate fewer inhibition failures (and hence, better self-control). The number of missed trials was distributed normally, with no significant outliers. Participants completed the stop signal twice, once at the start of the 2 week building strength session and again at the end. The data was analyzed using a 4 (practice group) X 2 (session) repeated measure design.

The main effect for group was not significant, $F(3, 88) = .152, ns$. There was a main effect for testing session, indicating that, on average, participants improved on the stop signal over the 2 weeks, $F(1, 88) = 7.49, p < .01$. Most importantly, participants in some groups improved more than others, as shown by a significant interaction between condition and session, $F(3, 88) = 5.04, p < .01$.

Examining this interaction in more detail using focused contrasts finds that the change in stop signal performance was driven by the division between participants who were practicing self-control and those who did not, $F(1, 88) = 13.14, p < .001$. Consistent with this, the two building strength conditions did not differ from each other, $F(1, 88) = 1.55, ns$. The two control groups did not differ from each other, either, $F(1, 88) = .02, ns$. In other words, what people practiced did not matter, as long as they practiced something that required self-control.

The data for the SSRT largely replicated these results. Although there was no main effect for condition, $F(3, 88) = .498, ns$ or session, $F(1, 88) = .281, ns$, the interaction between practice condition and assessment session approached conventional levels of significance, $F(3, 88) = 2.465, p < .068$. A more powerful test that contrasted the two building strength groups with the two control groups found a significant interaction, $F(1, 88) = 7.89, p < .01$. A contrast test found that the differences in SSRT were significant for both the control, $t(44) = 2.40, p < .025$, and building strength conditions, $t(46) = 1.67, p < .05$ in one-tailed tests.

Supplemental analyses

As noted above, whereas the building strength instructions were associated with improvement in self-control performance, the control instructions were not. Those control conditions were designed to control for feelings of self-efficacy, self-awareness, and overall belief that any practice should help (e.g., self-fulfilling prophecy). Indeed, participants in the diary condition felt that they were exerting self-control to the same extent as participants in the building strength conditions, yet their stop signal performance did not improve.

Consistent with the argument that only practicing self-control builds self-control capacity, how hard participants worked did not matter. Only working hard on tasks that require self-control improved self-control. Using a moderated multiple regression that examined the change in stop signal performance, there was no main effect for self-reported effort on the practice task, $\beta = -.022, t(87) = .17, ns$. The main effect for condition (coded for building strength versus control instructions) also was not significant, $\beta = .48, t(87) = 1.12, ns$. The interaction between condition and effort was significant, however, $\beta = -.88, t(87) = 2.01, p < .05$ (see Fig. 1). A simple slope analyses found that effort exerted was not related to change in stop signal performance for participants who did not practice self-control, $\beta = .245, t(43) = .30, ns$, but was related to stop signal performance for those who practiced self-control, $\beta = -.428, t(44) = 3.14, p < .01$. Working hard on a task that requires self-control builds strength; working hard on a task that does not is not helpful, even when the task is thought to be beneficial.

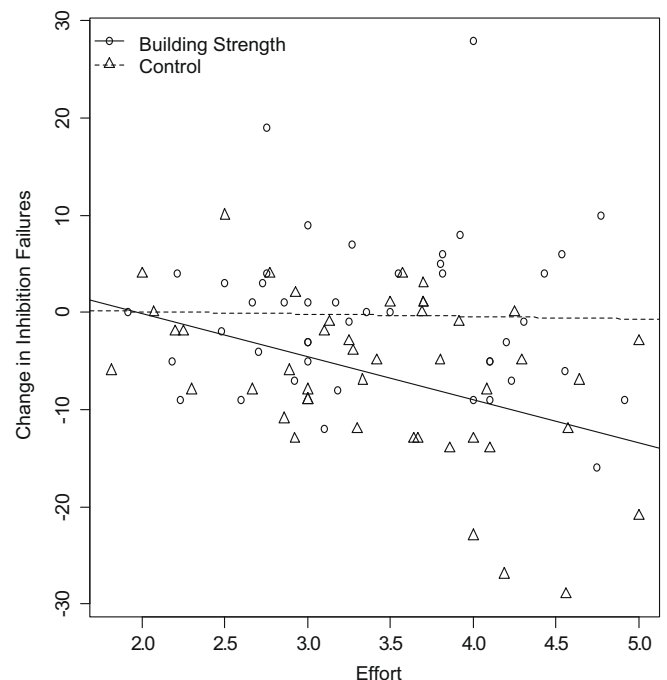


Fig. 1. Effects of effort exerted on assigned task and practice condition on change in inhibition failures from T1 to T2.

Discussion

Practicing small acts of self-control for 2 weeks led to a significant improvement on a laboratory measure of self-control. This improvement was apparently not due to self-fulfilling prophecy, increased awareness of self-control or increases in self-efficacy. Instead, it appears that effects are due to the active practice of self-control.

In particular, participants who had to resist eating sweets or who had to hold a handgrip twice a day exhibited a significant improvement in inhibiting their responses. Which task was being practiced did not matter; as long as the task required inhibiting an urge or behavior, it resulted in better self-control. On the other hand, participants who worked on difficult math problems that did not require inhibition did not exhibit a significant improvement in self-control, despite working just as hard. Similarly, participants who maintained a diary of their self-control undertakings (without increasing their efforts) did not improve their stop signal performance. The diary increased their awareness of self-control and indeed they thought they were building strength, yet their performance did not improve. In short, only practicing self-control builds capacity; explanations that rely on self-awareness or enhanced expectations are not a good fit to the data.

The results are consistent with the predictions made by self-control strength model (Muraven & Baumeister, 2000) that practicing self-control should build self-control resources. By increasing self-control resources, individuals may be better able to exert self-control. This increases their overall self-control capacity, much like lifting weights builds strength, so greater challenges can be overcome. Similarly, by practicing self-control, individuals may be better able to deal with the depletion of strength that comes from exerting self-control (Muraven et al., 1999). Put another way, practicing self-control may increase both the endurance and power of self-control.

The present research strongly suggests that the active ingredient in building self-control capacity is the practice of self-control. Obviously, this has clear developmental implications; if a 2 week training was enough to create a modest improvement on a laboratory measure in adults, it is likely that a similar process may explain the development of executive functions in children. Moreover, because deficits in self-control may underlie many psychological and societal problems, it may be possible to build clinical interventions around these ideas.

Although the results are consistent with the self-control strength model, there is much work needed to refine these results. First, it is not entirely clear how practice builds self-control capacity. It might work by influencing glucose use in the brain (Gailliot, Baumeister, et al., 2007), increasing people's motivation to use self-control resources (Muraven & Slessareva, 2003) or even help individuals tolerate distress better (Brown, Lejuez, Kahler, & Strong, 2002). The answer to that question might help answer additional

questions about how long, how frequently, and what should be practiced.

In conclusion, the results suggest that by practicing small acts of self-control, overall self-control capacity can be increased. Put another way, it is possible to strengthen the self-control muscle through exercise, leading to better outcomes. This may have significant implications for clinical interventions. It also suggests that our current conception of self-control as fixed and unchangeable probably needs to be revisited, as self-control can be built through practice.

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