Protecting an important goal:
When prior self-control increases motivation for active goal pursuit

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Abstract

The recent debate in the study of ego depletion casts doubt on the assumption that self-control has a limited capacity. Adopting a revisionist perspective, we assume that people manage self-control exertion efficiently and ask what psychological mechanism would counteract motivational withdrawal following initial exertion in order to sustain an important goal pursuit. We predicted and found that prior self-control increased students’ motivation for active pursuit of the academic goal. In Study 1, prior self-control reduced students’ behavioral intentions for school work and non-academic activities alike when academic pursuit was not activated. Under active pursuit of the academic goal, however, prior self-control uniquely increased students’ intentions for school work. In Study 2, this facilitatory effect of prior self-control on behavioral intention toward an academic goal was replicated and accompanied by positive implicit attitudes toward study-related stimuli. In Study 3, when preparing to pursue the academic goal, prior self-control increased students’ tendency to proactively remove a temptation from the immediate context (leave their phone with the experimenter) to support better task performance. Our investigation illustrates the importance of examining not only the debilitating but also the potentially facilitatory effect of prior self-control exertion.

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Self-control—the exertion of control over the self by the self—has been linked to survival throughout the early stages of human evolution (Beedie & Lane, 2012) as well as for success in modern society (Moffitt et al., 2011; Tangney, Baumeister, & Boone, 2004); indeed, self-control is frequently needed in everyday life (Hofmann, Vohs, & Baumeister, 2012). For such an important and readily used ability, people should have developed an efficient system to manage sustained self-control. Past research on ego depletion, however, has highlighted the limited capacity and inefficiency of self-control exertion. Exerting self-control for a short duration (5~10 minutes) has been shown to decrease subsequent self-control output and leads to diverse negative outcomes (see Baumeister & Vohs, 2016a; Hagger, Wood, Stiff, & Chatzisarantis, 2010 for reviews).

Recently, vigorous replication attempts recalibrated the effect size of brief self-control exertion to small (Carter, Kofler, Forster, & McCullough, 2015; Hagger et al., 2016; see Friese, Loschelder, Gieseler, Frankenbach, & Inzlicht, 2019, for a review). This empirical development further encourages a revisionist perspective that moves beyond the negative effects of self-control exertion (Apfelbaum & Sommers, 2009; Dewitte, Bruyneel, & Geyskens, 2009; Jia & Hirt, 2016). In this paper, we contemplate the motivational process that would counteract a general motivational withdrawal to protect important goals. Specifically, we explore a goal protection mechanism that increases people’s motivation for important goal pursuit following prior self-control.

**Self-Control Withdrawal after Prior Use**

Studies on everyday experience show that people’s self-control steadily declines after repeated use. For example, health care professionals regulate their hygiene behaviors less the longer they have worked (Dai, Milkman, Hofmann, & Staats, 2015). This self-control decline was more pronounced under higher work intensity, and breaks between shifts restored the professionals’ adherence to hygiene standards. Another study showed self-control decline in
clinicians’ decision making across their shift (Linder et al., 2014). Clinicians were increasingly more likely to resort to prescribing antibiotics—the easy and safe option—throughout the course of a morning shift. After lunch, the pattern of increasing reliance on the safe option again emerged in the afternoon. Augenblick and Nicholson (2016) found a similar self-control decline in the political domain. Across nearly one million voting outcomes on issues occupying different positions on the ballot, the later an issue was positioned on the ballot, the more abstentions and more votes of the status quo (i.e., the default option) it received. Having made effortful decisions for the issues earlier on the ballot seemed to reduce voters’ further effort. In the academic domain, Danish students’ performance on a test was poorer the later the test was taken (Sievertsen, Gino, & Piovesan, 2016). Similar effects were found using domain-general measures of self-control. For example, an experience-sampling study showed that people’s ability to curb impulses decreased as prior attempts at resisting everyday desires increased (Hofmann et al., 2012).

This correlational pattern is consistent with a large body of experiments on ego depletion which suggests that self-control has a small, limited capacity. The Strength Model of self-control posits that self-control is governed by a limited, depletable pool of resources such that prior exertion of self-control reduces the available resources for subsequent self-control (Baumeister & Vohs, 2016a; Baumeister, Vohs, & Tice, 2007). Since its initial proposal, substantial evidence has been accumulated for ego depletion effects. Regulating one’s behavior, attention, or emotion for just 5-10 minutes in Task 1 leads to a reduction in self-control output in a subsequent Task 2 (see Baumeister & Vohs, 2016a; Hagger, Wood, Stiff, & Chatzisarantis, 2010 for reviews).

An initial meta-analysis conducted by Hagger and colleagues (2010) concluded that the ego depletion mean effect size is medium ($d = 0.62$). Yet recent evidence suggests the magnitude of ego depletion effects may be smaller. A meta-analysis that corrected for
publication bias (Carter, Kofler, Forster, & McCullough, 2015) and a large pre-registered, multi-lab replication (Hagger et al., 2016) concluded that ego depletion effects may not be different from zero (but see some criticisms: Blázquez, Botella, & Suero, 2017; Cunningham & Baumeister, 2016; Baumeister & Vohs, 2016b). This has spurred several high-power investigations to test the veracity of ego depletion effects. Garrison, Finley, and Schmeichel (in press) found a small ego depletion effect on people’s attentional control ($d = 0.20$). Francis, Milyavskaya, Lin, and Inzlicht, (2018) utilized the power of a within-subjects manipulation and found that a 90-second exertion could lead to a miniscule effect of depletion ($d = .045$). Multi-lab replications corroborated these small effects ($d = .10$ in Vohs et al. 2018; $g = .12$ in Dang et al., working paper). Overall, while ego depletion effects have been reliably detected, their magnitude has firmly remained in the territory of small effects.

The recalibration of the effect size aligns with theories suggesting that self-control withdrawal after prior use is a motivational shift that serves distal functions, rather than a response to the imminent exhaustion of a small limit. People may maintain a balance between labor and leisure, which serves the distal function to maintain the equilibrium between exploitation and exploration of the environment (Inzlicht, Schmeichel, & Macrae, 2014; Kool & Botvinick, 2014). According to this perspective, laborious, effortful self-control is innately aversive and an initial exertion increases the cost of further effort, resulting in effort avoidance and increased motivation for leisure or resting (Kool & Botvinick, 2014; Kool, McGuire, Rosen, & Botvinick, 2010). Another perspective argues for a complex system in which a self-control mechanism co-opts an evolutionarily older system of physical exertion (Evans, Boggero, & Segerstrom, 2016). Such a complex system uses the processes governing physical exertion to manage self-control. Hence, although sustained self-control has no injurious consequences, initial exertion leads to effort withdrawal because withdrawal after use is an effective way to prevent bodily injuries from over-exertion of physical effort.
Admittedly, the exact nature of the motivational shift remains unclear, but the shift in explanation from limited capacity to motivational shift has direct implications for examining potentially facilitatory psychological processes during sustained self-control.

**Goal Protection Mechanism**

Given the evolutionary and contemporary relevance of self-control, we assume that people have developed an efficient system to adaptively manage its output. If so, is self-control withdrawal always the most adaptive response after initial exertion? If a small pool of limited resources governs self-control, then yes: one may make an argument for the absolute value of effort withdrawal. An efficient self-control system should prioritize the conservation of the resources to prevent the system from being ever in danger of complete exhaustion (Baumeister & Vohs, 2016a; Muraven, Shmueli, & Burkley, 2006). Any process that continues to output self-control after prior exertion will leave the individual increasingly more vulnerable to any unexpected threats. Except for vital activities for survival (e.g., securing food), thus, any further expenditure of effort should be shunned.

By contrast, if self-control withdrawal after prior use is a motivational shift—that is, people only behave as if they have limited self-control (Inzlicht et al., 2014)—then an efficient system should evoke some process to counteract it during the effortful pursuit of important goals. In such cases whereby sustained self-control is called for, motivational withdrawal is of little adaptive value. Indeed, behavioral studies show that when people are determined to excel at an important task, those who had exerted prior control exhibited comparable self-control output with those who had not (Muraven & Slessareva, 2003). While this finding makes sense from the assumption of an efficient self-control system, how the system achieves sustained self-control output at the motivational level has not been specified and examined.
In this paper, we propose a goal protection mechanism that would counteract the motivational withdrawal of self-control during the pursuit of important goals. Research on counteractive control has found that when anticipating obstacles, people increase their motivation to adhere to goal pursuit (Trope & Fishbach, 2000; Fishbach, Friedman, & Kruglanski, 2003; Fishbach & Converse, 2010). This is analogous to lifting a piece of furniture. If one expects it to be heavier than usual, he or she will approach it with more force to counter the expected challenge. We argue that people engage in a similar process following self-control exertion. The motivational withdrawal, which may be manifested in effort avoidance (Kool & Botvinick, 2014; Kool et al., 2010), poses a threat or challenge to the ongoing pursuit. In response, the goal protection mechanism kicks in and increases individuals’ motivation for the goal. An increased motivation—a psychological force that compels action—allows the individual to not only channel more self-control to the important goal pursuit, but also facilitates approach orientation toward that pursuit (Ferguson, 2008; Ferguson & Cone, 2013) and the adoption of self-regulatory strategies to help goal pursuit (Duckworth, Gendler, & Gross, 2016; Fishbach & Trope, 2005).

It is important to point out that the goal protection mechanism does not necessarily translate to a net increase in the behavioral output of self-control. Following prior exertion, subsequent self-control is jointly determined by the increased motivation from the protection mechanism and the general motivational withdrawal of effort. As the former counteracts the latter, the relative strength of the two processes would determine if the net effect of prior exertion on self-control performance is facilitatory or inhibitory. Using the furniture lifting metaphor, the actual heavier weight might not be completely offset by the increase in force; it would depend on the relative strength of these opposing forces.

This partly explains why past research has not readily demonstrated this potential facilitatory effect of prior self-control exertion on motivation. Research guided by the
traditional emphasis on the costs of self-control exertion has not systematically examined the key conditions under which the facilitatory effect occurs—namely, important, self-relevant goal pursuit. It is commonplace that ego depletion experiments employ self-control tasks that are not key to participants’ personal striving. A secondary reason is that researchers have focused on measuring the behavioral output of self-control (Hagger et al., 2010). As the behavioral output is determined by potentially countervailing forces, the proposed facilitatory motivational effect would require measuring motivation independently of performance.

To circumvent this problem, we aim to capture people’s motivation for active goal pursuit with measures that do not directly implicate self-control exertion. Specifically, we sought to examine participants’ behavioral intentions for goal-congruent activity, implicit attitudes toward the goal state, as well as behavioral strategies that would facilitate goal pursuit. An increased motivation for an important goal pursuit should translate into increased behavioral intention (Strack & Deutsch, 2004). Striving for a goal should also lead to positive implicit attitudes toward the goal state and goal-congruent objects, a motivational tuning that prepares the individual for more effective goal pursuit (Ferguson, 2008; Ferguson & Cone, 2013). Finally, increased motivation for goal pursuit should also translate to the adoption of effective strategies. We examined people’s tendency to proactively prepare a conducive environment (removing a salient temptation) for goal pursuit. Such proactive self-control counteracts temptation and has been shown to enables goal success (Ariely & Wertenbroch, 2002; Duckworth et al., 2016; Fishbach & Converse, 2010; Fishbach & Trope, 2005). Together, the various measures are aimed at providing a comprehensive assessment of motivation (Touré-Tillery & Fishbach, 2014).

**Present Research**

We examined the goal protection mechanism with regard to academic pursuit, an important goal for our college student samples (Fishbach et al., 2003). In general, we
activated academic pursuit in our participants and observed the effect of prior self-control exertion on their motivation for goal pursuit. In Studies 1 and 2, students’ implicit attitude toward and intentions to engage in the academic goal were measured. In Study 3, we examined students’ tendency to engage in a proactive strategy to prepare a conducive environment (removing a temptation) for academic pursuit.

We also incorporated methodological features to increase the robustness of our findings. Studies 1 and 2 employed a within-subjects manipulation of prior self-control. Given the nearly exclusive reliance on between-subjects manipulations of depletion used in past research, a within-subjects manipulation would bolster the statistical power of our investigation by removing between-subjects variation from individual differences (Francis et al., 2018; May & Hittner, 2012). Study 3 employed a different manipulation of prior self-control to test the generalizability of our findings.

All measures, manipulations, and exclusions, as well as the method of determining the final sample size are disclosed. All studies with sample size consideration guided by a priori power analysis are reported¹. Experimental materials, data, pre-registration report (Study 3), and exploratory analyses are shared at https://osf.io/x3prf.

**Study 1: When Prior Self-Control Increases Intention to Study**

We examined the effects of prior self-control on students’ intentions for and implicit attitude toward studying when the academic goal pursuit was activated versus not. Prior self-control was manipulated as a within-subjects factor; participants completed the prior-control and no-control conditions in two different experimental sessions. The academic goal pursuit was manipulated as a between-subjects factor; participants were randomly assigned to the academic goal or the hobby goal condition. Hence, the study employed a 2 (goal pursuit: academic goal vs. hobby goal; between-participants) × 2 (prior self-control: prior-control vs. no-control; within-participants) mixed design.
Students’ intentions to pursue school work (focal item) and three categories of non-academic activities: non-academic work, low-energy leisure, and high-energy leisure, were measured. We predicted that prior self-control (vs. not) would reduce students’ intentions for both studying and non-academic activities when the academic pursuit was not active (hobby goal condition). When the academic pursuit was active (academic goal condition), by contrast, prior control would uniquely increase their intentions for studying while continue to reduce their intentions for non-academic activities. We also examined students’ implicit attitude toward the academic goal with a variant of the evaluative priming task² (Fazio, Jackson, Dunton, & Williams, 1995). We expected that while prior self-control would reduce students’ attitude toward studying in the hobby goal condition, it would increase their attitude in the academic goal condition.

Method

**Power Analysis and Participants**

We adopted a conservative approach and aimed to detect a small effect, $f = 0.10$. Power analysis (G*power; Faul, Erdfelder, Buchner & Lang, 2009; repeated measures, within-between interaction, correlation among repeated measures = .5, 80% power) determined a target sample size of 200.

Two hundred students from the National University of Singapore (NUS) were recruited with either $10 or two research credits. Eighteen students missed one experimental session, two students’ data were not recorded due to technical errors, and one student withdrew from the study. The final sample of 179 (109 female, $M_{age} = 22.13, SD_{age} = 1.96$) had 80% power to detect a small effect size ($f = 0.105$).

**Procedure**

Participants completed two experimental sessions, separated by approximately one week (range: 4-9 days). Each session consisted of four main parts³.
Prior self-control manipulation. Participants completed an adapted version of the inhibited writing task (Schmeichel, 2007). Each participant completed the prior-control and no-control tasks across the two sessions, with the order counterbalanced. In both tasks, they spent 6 minutes trying to type out the description of a past trip. Participants were instructed not to use the letters ‘a’ and ‘n’ in the prior-control task and not to use ‘q’ and ‘z’ in the no-control task. Because ‘a’ and ‘n’ are much more commonly used than ‘q’ and ‘z’, the self-control task required much more self-control than the no-control task.

Manipulation checks. Participants responded to “How much control did you exert during the writing task?” (1 = not at all, 7 = very much) before completing the Brief Mood Introspection Scale (Mayer & Gaschke, 1988), which measured both mood valence and arousal, and the mental fatigue sub-scale from the Multi-Dimensional Fatigue Inventory (Smets, Garssen, Bonke, & De Haes, 1995). They also indicated their perceived level of energy (0-100%) at the moment.

Goal pursuit manipulation. We adapted the manipulation from Fishbach, Zhang, and Trope (2010) to induce active academic goal pursuit. Participants in the academic goal condition listed two challenging courses. They described the content and the importance of the courses, and how they would excel in them. Participants in the hobby goal condition provided similar information about pursuing two hobbies. When participants returned to the second session, they provided updates and described future steps in their respective pursuits. Hence, the academic goal pursuit was activated only in the academic goal condition. In the hobby goal condition, although participants’ goal striving was activated, it was with respect to a different goal.

Implicit attitude measure. Participants made a series of evaluative judgments on a computer. On each trial, they were presented with a valenced target word (e.g., love, evil) and had to decide whether the word was a positive or negative word as quickly and as accurately
as possible. Before the presentation of each target word, a prime word was subliminally presented. Goal-congruent primes were selected according to their relevance to the academic goal (graduate, exam, books, classroom, lecture, library, professor, project, reading, school). The goal-incongruent primes consisted of words that are related to tempting leisure activities (fun, game, movie, music, partying, television, socialize, bar, beer, vacation).

Each trial began with a fixation point (a plus sign) presented at the center of the screen for 300 ms. Participants were asked to focus their attention on this sign. The fixation point was then replaced by a prime word presented for 30 ms. A visual mask “XXXXXXXXX” was then presented for 150 ms before the valenced target word was presented. Participants’ task was to classify the target words as either good or bad, using the “Z” and “/” keys, respectively. The target word remained on the screen until participants responded. Each response was followed by a 700 ms pause before the next trial began. The brevity of the prime word presentation and the short inter-stimulus interval (150 ms) ensured that participants could not exert conscious control to override the influence of the prime words (Fazio et al., 1995).

To compute participants’ implicit attitude toward the academic goal, we first calculated their automatic positivity toward goal-congruent and goal-incongruent concepts, respectively. If the person automatically evaluated a prime word as positive, it should facilitate his/her subsequent categorization of a positive target word and inhibit the person’s categorization of a negative target word (Fazio et al., 1995). Following this logic, we subtracted the reaction time (RT) for positive target words from the RT for negative target words following the goal-congruent primes to arrive at participants’ positivity toward the goal-congruent concepts. Participants’ positivity toward the goal-incongruent concepts was computed in the same way with RTs following goal-incongruent primes. Finally, the implicit attitude index was calculated by subtracting the automatic positivity toward goal-incongruent concepts.
words from the automatic positivity toward goal-congruent words. Larger values indicated a greater preference for goal-congruent over goal-incongruent objects, or a more positive attitude toward the academic goal.

**Intentions for academic pursuit.** Participants reported their interest (0 = not interested at all, 100 = very interested) to engage in 10 activities for the rest of the day. The critical item *school work* was embedded among 9 control items which consisted of three categories: non-academic work (*clean the house, work on a part-time job, do sports, co-curricular activities*), low-energy leisure (*watch TV, surfing the Internet, listen to music*) and high-energy leisure (*partying, dancing*)⁴. No participants suspected the true purpose of the experiment at debriefing.

**Results**

**Manipulation checks.** Participants reported exerting more self-control, \( t(178) = 14.27, p < .001, d = 1.36 \), experiencing more negative mood, \( t(178) = -8.83, p < .001, d = .80 \), feeling more fatigued, \( t(178) = 2.75, p = .007, d = .23 \), and having a lower energy level, \( t(178) = -4.56, p < .001, d = .40 \), in the prior-control than in the no-control condition. No difference was observed in arousal (Table 1).

**Intentions for academic and non-academic activities.** The reliabilities and inter-session correlations of the various types of activities are presented in Table 2. We included the type of activity as another factor in a 2 (goal pursuit: academic goal vs. hobby goal) × 2 (prior self-control: prior-control vs. no-control) × 4 (activity: school work vs. non-academic work vs. low-energy leisure vs. high-energy leisure) mixed ANOVA. We found the predicted 3-way interaction, \( F(3, 531) = 5.59, p < .001, \eta^2 = .03 \).

In the hobby goal condition, the prior self-control × activity interaction was non-significant, \( F(3, 258) = 0.55, p = .65, \eta^2 = .01 \). While participants were less interested in school work in the prior-control (\( M = 52.11, SD = 28.33 \)) than in the no-control (\( M = 58.78, \ldots \))
In the academic goal condition, the prior self-control × activity interaction was significant, $F(3, 273) = 7.27, p < .001, \eta^2 = .07$. As predicted, prior self-control reduced participants’ interest in all non-academic activities: significantly for non-academic work, $t(91) = -3.34, p = .001, d = .19$, and high-energy leisure, $t(91) = -3.64, p < .001, d = .29$, and non-significantly for low-energy leisure, $t = -1.04, p = .30, d = .07$. By contrast, participants were no less (and even slightly more) interested in school work in the prior-control ($M = 58.72, SD = 22.69$) than in the no-control ($M = 53.80, SD = 25.66$) condition, $t(91) = 1.81, p = .07, d = .20$ (Figure 1, top right panel).

**Implicit attitude index.** The implicit attitude index in the prior-control and the no-control conditions yielded poor inter-session correlations, $r(178) = .12, p = .11$. The low inter-session reliability limited the utility of this measure in detecting the within-subjects difference between the prior-control and the no-control conditions. In comparison, the inter-session correlations of the other dependent measures were much higher (Table 2).

We nonetheless proceeded to examine our hypotheses. A 2 (prior self-control: prior-control vs. no-control) x 2 (goal pursuit: academic goal vs. hobby goal) mixed ANOVA yielded no significant effects, all $ps > .17$. Neither the main effect of prior self-control, $F(1, 177) = 1.91, p = .17, \eta^2 = .01$, or goal pursuit, $F(1, 177) = 0.22, p = .64, \eta^2 = .00$, was significant. Critically, the hypothesized interaction effect was also non-significant, $F(1, 177) = 0.10, p = .92, \eta^2 = .00$.

**Discussion**
The initial study provided partial support for our predictions. When academic goal pursuit was not active, prior self-control decreased participants’ intentions for both academic and non-academic activities. However, under active academic pursuit, prior control had different effect on intentions for non-academic activities (which decreased) versus intention for studying (which did not decrease and somewhat increased). Under active academic pursuit, students’ motivation for studying was not reduced by the general motivational withdrawal following prior self-control and even showed a trend for an increase.

On the other hand, students’ implicit attitude toward the academic goal did not reveal any reliable patterns. Whether this was due to the low inter-session correlation of the evaluative priming measure or an unsound prediction merits further investigation.

**Study 2: When Prior Self-Control Increases Intention and Implicit Attitude**

Study 2 aimed to replicate and extend the findings of Study 1. Although the divergent pattern between students’ intentions for academic and non-academic activities in Study 1 was consistent with our predictions, prior self-control only increased students’ study intentions in the academic goal condition to a small but non-significant degree. In Study 2, we focused on the academic goal condition and examined whether the predicted facilitatory effect could be reliably observed with higher power (i.e., we used a similar sample size with only academic conditions). We again manipulated prior self-control using a within-participants design and measured students’ intentions to engage in the same four types of activities as in Study 1, with the focal activity being school work. We predicted that prior-control, as compared with no-control, would increase students’ intentions for school work but would decrease their intentions for the three types of non-academic activities: non-academic work, low-energy leisure, and high-energy leisure.

We also employed the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998; Greenwald, Nosek, & Banaji, 2003) to measure students’ implicit attitude
toward studying. The IAT boasts high reliability for an implicit measure (Gawronski & De Houwer, 2014) and should increase the power of the within-subjects design in detecting the predicted effect on implicit attitude. Again, we predicted that participants in the prior self-control condition would have a more positive attitude toward studying than those in the no-control condition.

**Method**

*Power Analysis and Participants*

To replicate the effect of prior self-control \( (d = .20) \) observed in the academic goal condition of Study 1, power analysis (Faul et al., 2009; t-test, Means: Difference between two dependent mean, 80% power, one-tail) determined a sample of 156.

We collected data from 160 NUS students. Nine students missed one experimental session and one student’s data was not recorded due to technical errors. The final sample of 150 students (96 female, \( M_{age} = 21.73, SD_{age} = 1.67 \)) had 80% power to detect a small effect \( (d = .23) \) even for a two-tailed test.

*Procedure*

Participants completed a similar procedure as those in the academic goal condition in Study 1, except that they completed an IAT as the implicit attitude measure. The IAT assessed participants’ associations between study stimuli (images related to textbooks, notes, scenes of lectures) versus temptation stimuli (images related to sleep, cell phone, social media) and positive (e.g., loved, honest) versus negative (e.g., rude, hostile) concepts5. Consistent with past procedure (e.g., Greenwald et al., 2003), participants completed seven blocks of categorization tasks. In Block 1, participants categorized target stimuli into study-related and temptation-related categories. In Block 2, they categorized attribute concepts as either “Good” and “Bad”. In Block 3, participants practiced categorizing all items into two combined categories, each including a target and an attribute category that were assigned to
the same key in the preceding two steps (e.g., temptation+Good for the left key and
study+Bad for the right key). Block 4 repeated the double categorization task in Block 3,
except that the number of trials was doubled and participants were instructed to stop treating
the trials as practice. In Block 5, participants practiced with reversed key assignments for the
target stimuli. Block 6 was a practice round for double categorization with the just-switched
key assignments (e.g., temptation+Bad to the left, and study+Good to the right). Block 7,
again, doubled the number of trials in Block 6 and participants were instructed that it was no
longer a practice round. The D-score (Greenwald et al., 2003) was then computed; the higher
the score, the more positive participants’ implicit attitudes toward studying (vs. temptation)
were.

Results

**Manipulation checks.** We found the same pattern of results, with similar effect sizes,
as in Study 1 (Table 1). Manipulation checks indicated successful implementation of the prior
self-control manipulation.

**Intentions for academic and non-academic activities.** A 2 (prior self-control: prior-
control vs. no-control) × 4 (activity: school work vs. non-academic work vs. low-energy
leisure vs. high-energy leisure) within-participants ANOVA yielded a significant interaction,
\(F(3, 447) = 8.80, p < .001, \eta^2 = .056\). Critically, prior self-control (\(M = 57.16, SD = 25.72\))
significantly increased participants’ interest in school work as compared to no-control (\(M =
50.77, SD = 26.98\)), t(149) = 2.69, p = .008, d = .24. In contrast, prior self-control reduced
participants’ interest in non-academic work, t(149) = -2.73, p < .007, d = .20, low-energy
leisure, t(149) = -2.09, p = .039, d = .17, and high-energy leisure, t(149) = -2.57, p = .011, d
= .16 (Figure 1, lower panel).

**Implicit attitude index.** With a healthy inter-session correlation, r(149) = .49, p < .001,
the facilitatory effect of prior self-control on intention found a parallel in the D-scores from
the IAT. Participants had a more positive implicit attitude toward school work in the prior-control ($M = 0.20, SD = 0.57$) than in the no-control ($M = 0.04, SD = 0.55$) condition, $t(149) = 3.44, p < .001, d = .27$.

**Discussion**

We replicated the intention results in Study 1. With a salient academic goal, prior exertion of self-control, while reducing participants’ intentions for non-academic activities, increased their intentions to study. On a more reliable implicit attitude measure, we showed that prior self-control led to a more positive implicit attitude toward studying, which corresponds to greater motivation to pursue the academic goal (Ferguson, 2008; Ferguson & Cone, 2013).

**Study 3: When Prior Self-Control Promotes Proactive Preparation to Study**

In Studies 1 and 2, academic pursuit was activated in student participants with a mindset induction. In Study 3, we tested our prediction with respect to an actual pursuit of the academic goal. All students were given an important task that would contribute to their academic achievement in the long run. In anticipation of this task, they were given a chance to remove a major source of temptation, i.e., their mobile phone, from the task environment. We examined whether prior self-control would increase such a proactive self-regulatory strategy that might facilitate task performance (Ariely & Wertenbroch, 2002; Fishbach & Trope, 2005). To increase the generalizability of our findings, we manipulated prior self-control with a decision fatigue paradigm (Vohs et al., 2008). With a one-factor between-participants design, we predicted that students in the prior-control condition would be more likely to remove their phone from the task environment than those in the no-control condition. We also aimed to explore the effect of prior self-control exertion on participants’ actual task performance.

**Method**
Power Analysis and Participants

It is difficult to estimate the effect size for this novel behavioral measure. Power analyses based on a small (ω = .1) and a medium (ω = .3) effect yielded target samples of 785 and 88, respectively. Given the large uncertainty, we planned data collection with sequential stopping rules: \( \alpha_l = .01, \alpha_u = .35 \) (Botella, Ximénez, C., Revuelta, J., & Suero, 2006; Frick, 1998). After an initial sample, we planned to stop data collection if \( p < \alpha_l \) or \( p > \alpha_u \), and continue data collection if \( \alpha_l < p < \alpha_u \). A maximum sample of 400 was planned if the stopping rules would not be met.

An initial sample of 152 NUS students yielded a small-to-medium effect for the key test, \( \chi^2 = 5.40, p = .02, \omega = .18 \). But since \( \alpha_l < p < \alpha_u \), we collected data for another semester, at which point the stopping rule was fulfilled. A total of 230 students were recruited. Four students’ data were not recorded due to technical errors and 2 students withdrew from the experiment. The final sample of 224 students (156 female, \( M_{age} = 21.19, SD_{age} = 1.67 \)) had 80% power to detect a small-to-medium effect (\( \omega = .19 \)). We pre-registered our hypotheses and data collection plan (https://osf.io/x3prf) after the initial sample but before any data analysis.

Procedure

Participants completed the experiment one at a time in an individual room. Once they arrived, they were told that the main task for the study was to complete an important cognitive test and obtain feedback on their cognitive abilities.

Prior self-control manipulation. Participants were told that before the main task, their assistance was needed with a survey from the university’s International Relationship Office. The survey pertained to the existing partner universities for the student exchange program and students’ responses would influence which partnerships the university would be retaining. All participants received a list of 30 universities, divided into five groups. Each
university was furbished with 3-4 lines of information regarding factors such as reputation, vibrancy of curriculum, and living expenses.

Participants in the prior-control condition were to shortlist two out of the six universities in each group. Participants in the no-control condition simply read the descriptions of the universities and answered 3 general questions regarding the exchange program (e.g., “How interesting are the destinations offered for the exchange program?”). Hence, participants from both conditions ostensibly provided feedback to the university, but only those in the prior-control condition made decisions, which have been shown to require substantial self-control (Vohs et al., 2008). Participants had 5 minutes to complete this task in private. The experimenter administered the task through pre-prepared folders and remained blind to the participants’ condition.

Participants then rated how effortful and exhausting they found the survey (1 = not at all, 7 = very much) and completed the BMIS ($\alpha = .83$) and the mental fatigue subscale ($\alpha = .79$) before informing the experimenter to begin the next part.

*Proactive self-control measure.* The experimenter explained that some setting up was required for the main task and that participants needed to gather their belongings and wait outside the experiment room. While waiting, participants read a description of the upcoming test entitled the “Cambridge Neuropsychological Test Automated Battery (CANTAB)”.

The CANTAB was described as an accurate test of one’s cognitive abilities. To highlight the test as an opportunity to actively pursue their academic goal, participants were informed that getting accurate feedback from the CANTAB would benefit their future academic performance. The description ended with a clear recommendation that the test ought to be completed without any distraction for the most accurate results.

After about 1 minute, the experimenter emerged from the room and announced that the test was ready. Before participants re-entered the room, the experimenter remarked that
previous participants had complained that the CANTAB was “extremely boring” and suggested that future participants be “allowed to bring in their phones so that they can alleviate the boredom during the breaks”. The experimenter then asked the participants to decide whether or not they would like to bring their phones. The experimenter emphasized that “there is no right or wrong choice” and it was completely up to them. If the participant chose to leave the phone outside, the experimenter kept the phone for safekeeping until the end of the experiment.

*Bogus CANTAB task.* Participants re-entered the room and began the bogus CANTAB in private. They were told that the first task tested their attention. They watched a 10-minute silent video showing extremely slowly growing grass occupying the bottom 90% of the screen. The remaining portion of the screen showed a small section of road and pavement where cars and people occasionally passed by. Participants were to identify the number of cars and people present in the video. Because the video was silent and the cars and people passed by quickly, participants had to maintain their attention throughout the monotonous task. Participants only watched the video once.

At the end of the video task, participants reported the level of distraction they felt from their phone6 (“How distracted were you by your phone?” “Did you think about your phone at all?”; for both items: 1 = not at all, 7 = very much), $\alpha = .79$. They were then told that the experiment has ended and completed a demographic questionnaire. During the debriefing, no participant suspected that leaving the phone outside or not was the behavioral measure.

**Results**

*Manipulation checks.* Participants reported that the survey task was more effortful, $t(211.64) = 2.87, p = .004, d = .38$, and more exhausting, $t(222) = 4.45, p < .001, d = .60$, in the prior-control ($M_{effort} = 3.56, SD_{effort} = 1.46; M_{exhausting} = 2.87, SD_{exhausting} = 1.50$) than in the no-control ($M_{effort} = 2.93, SD_{effort} = 1.82; M_{exhausting} = 1.99, SD_{exhausting} = 1.44$) condition.
The differences in mood valence, $t(222) = .69, p = .49, d = .09$, arousal, $t(222) = .34, p = .71$, $d = .05$, and fatigue, $t(222) = 1.43, p = .16, d = .19$, were not significant.

**Proactive self-control.** As a pre-registered test, we found that more participants in the prior-control condition (50.9%) left their phone with the experimenter than in the no-control condition (31.3%), $\chi^2 = 8.93, p = .003, \omega = .20$.

**Task performance.** As an exploratory analysis, we tested the effect of prior self-control exertion on participants’ CANTAB performance. As their performance was scored on three values: 0 = getting both questions wrong, 1 = getting 1 question right, and 2 = getting both questions right, non-parametric test was conducted. Their performance did not differ between the prior-control and no-control conditions (Table 3), *Mann-Whitney U* = 6100.00, *SE* = 445.77, *p* = .72.

**Effect of proactive strategy.** As a pre-registered test, we examined if leaving one’s phone outside impacted participants’ thoughts and performance with regard to the bogus CANTAB task. When participants left their phone outside ($M_{\text{distraction}} = 1.63$, $SD_{\text{distraction}} = .90$), as compared to when they brought their phone in ($M_{\text{distraction}} = 2.83$, $SD_{\text{distraction}} = 1.92$), they were less distracted by the phone, $t(197.86) = 6.23, p < .001, d = .80$. Participants who left their phone outside also had better performance than those who brought the phone in (Table 3), *Mann-Whitney U* = 7083.50, *SE* = 438.60, *p* = .021.

**Discussion**

As predicted, students who had exerted self-control were more likely than those who had not to adopt a self-regulatory strategy to facilitate their pursuit of the academic goal; they proactively removed a major temptation (e.g., their mobile phone) from the environment. Although we did not observe any effect of prior self-control on the actual task performance, exploratory analysis indicated that adopting the proactive strategy was related to better concentration and performance on the boring but important task for academic achievement.
General Discussion

Research on ego depletion has traditionally highlighted the costs and inefficiency of the self-control process. The recent debate has cast serious doubt on the degree to which self-control exertion has debilitating effects. By adopting the revisionist perspective that people adaptively manage self-control exertion, we specify and find preliminary evidence that brief self-control exertion can increase motivation toward the active pursuit of an important goal. We observed evidence of an increase in motivation in students’ intentions, implicit attitudes, and their use of a proactive self-regulatory strategy following prior self-control exertion. Specifically, when academic pursuit was activated, prior self-control, as compared to no control, increased students’ intentions for school work while reducing their intentions for non-academic activities (Studies 1 & 2). Prior self-control also led to more positive implicit attitudes toward the academic goal, though this effect was only observed with the IAT (Study 2) and not in evaluative priming (Study 1), which was likely due to the poor reliability of the evaluative priming measure. Finally, prior self-control increased students’ proactive preparation for pursuing the academic goal through the removal of a temptation (Study 3)—a strategy that could potentially facilitate their subsequent task performance. These findings are consistent with the proposed goal protection mechanism, which would counteract the motivational withdrawal of self-control to ensure effective output for important goal pursuit.

Implications of Efficient Self-Control

Our findings demonstrate the importance of examining self-control exertion as an efficient process. Because of the traditional emphasis on the costs of exerting self-control, facilitatory effects of self-control exertion have been left under-specified and under-studied (Apfelbaum & Sommers, 2009; Dewitte et al, 2009; Jia & Hirt, 2016). The case of this goal protection mechanism offers an illustrative example. Although we have known for a while that incentives can counteract the debilitating effect of depletion (Muraven & Slessareva,
2003), what motivational mechanism enables high self-control output against the general self-control withdrawal following prior exertion has not been clearly specified or examined until now.

The proposal that self-control exertion boasts facilitatory effects may help to explain existing findings in the literature. On the one hand, the small to miniscule effect of ego depletion would be a natural consequence of a system that includes potentially countervailing processes. If facilitatory effects or processes such as goal protection are somehow activated to counteract the conservation mind-set, an overall weak or null decrease in self-control performance should be expected (Fiedler, 2017). On the other hand, the reason why prolonged self-control has shown a reliable decrement in subsequent levels of self-control (e.g., Dai et al., 2015; Hofmann et al., 2012; Vohs, Baumeister, & Schmeichel, 2013) could be due to the fact that the motivational withdrawal is too strong for goal protection or any other facilitatory effect to counteract. In these cases, additional external incentives and environmental regulations may be needed to maintain the pursuit of important goals. In fact, our perspective would further predict that prior self-control may improve task performance under unique circumstances: When the goal protection mechanism was more potent (e.g., an extremely effective strategy is activated) than the motivational withdrawal. Future research should thus specify the contexts in which the various effects, both positive and negative, are activated to allow more nuanced predictions about sequential self-control.

**Limitations and Future Directions**

Although our investigations included features that would potentially grant us greater sensitivity in detecting the effects of prior self-control, we still mostly uncovered small effects. First, our investigation (Studies 1 and 2) represents a rare and perhaps the most robust implementation of within-subjects manipulation of prior self-control to date. To the best of our knowledge, only Francis et al. (2018) have done so before us. In an attempt to integrate
both prior control and no-control conditions in a single experimental session (~30 minutes),
their manipulation entailed a very brief self-control exertion (90 seconds) and one needs to
assume that the resting phase between the two conditions was sufficient to rule out carry-over
effects across the conditions. In comparison, our manipulation budgeted for greater self-
control exertion (5 minutes) and, because the two conditions were administered across two
sessions on different days, we can assume little cross-condition effects. Hence, although our
manipulation incurs greater costs to administer, it is arguably much stronger. Second, we
examined motivational markers rather than self-control performance as our primary
dependent measures. Given that self-control behavior may be driven by multiple processes, it
should be easier to detect the influence of prior self-control on process markers. With a
stronger manipulation and more sensitive dependent measures, however, we could only
observe key effects that were small (Studies 1 and 2) or small-to-medium at best (Study 3).
The current findings thus join recent high-power investigations in identifying only small
effects of prior self-control exertion (Dang et al., under review, Francis et al., 2018; Garrison
et al., 2019; Vohs., 2018). This is a problem; a line of research that constantly deals with
small effects will find it challenging to establish practical and theoretical impact (but see
Funder & Ozer, 2019, for an alternative guideline for evaluating effect size in psychological
research). While studying sequential self-control beyond the lab has provided a fruitful and
alternative avenue (e.g., Augenblick & Nicholson, 2016; Dai et al., 2015; Hofmann et al.,
2012), future experiments may need to further strengthen the self-control manipulation as
well as identifying suitable and more sensitive dependent measures.

Theory development is perhaps more important than methodological improvement for
future studies of sequential self-control (Fiedler, 2017; Friese et al., 2019; Inzlicht &
Berkman, 2005; Lurquin & Miyake, 2017). For starters, it is important to specify what we
have observed and what we have not with respect to the current debate on whether ego
depletion is real or not (Friese et al., 2019). We did not find or replicate a classic ego depletion effect, which is defined as self-control performance decrement following an initial exertion. As our focus was on motivational measures, we did not assess dependent measures that would implicate direct self-control performance in every study. Only in Study 3, we measured task performance, and did not observe any effect of prior self-control exertion. It is possible that the particular task we had employed was not sensitive enough to capture any changes in self-control, though we note that people’s performance was predicted by whether they had adopted the proactive strategy or not. It is also possible that, closer to our conceptualization, prior self-control exertion activated countervailing forces that produced a net zero behavioral outcome. What we have shown is that prior self-control exertion has immediate psychological consequences, some of which may be facilitatory in nature. Hence, although our investigation does not lend overall support to the ego depletion phenomenon, it resonates with past research in suggesting the importance of studying sequential self-control in experimental settings (Savani & Job, 2017).

With the clarification above, we note that the current investigation plays at best an indirect role in distinguishing between the various theoretical models of ego depletion. While the Strength Model (Baumeister & Vohs, 2016a; Baumeister et al., 2007) may not predict our findings a priori, as it emphasizes the costs of self-control exertion, it can provide a post hoc explanation. It just needs to assume that prior self-control exertion not only activates a conservation mind-set (Muraven et al., 2006; Tyler & Burns, 2009), but also other psychological processes such as goal protection. It is, however, a legitimate concern as to whether the addition of such post hoc assumptions ultimately makes an otherwise elegant model unfalsifiable (Inzlicht & Berkman, 2015). The process model does not fare much better, as its conceptual efforts are directed toward explaining the ego depletion phenomenon. Other processes, too, would need to be added in a post hoc manner to fit our findings with the
process model. In comparison, models prescribing a complex, multi-input system to govern effortful self-control have greater potential to explain our results (Evans et al., 2016; Molden, Hui, & Scholer, 2016). Nonetheless, extensive empirical evidence needs to be accumulated before the precise pathways of such models can be validated.

We highlight two future directions for theory development of sequential self-control. There is now a greater impetus for scholars to consider depletion and fatigue as a common phenomenon (Inzlicht & Berkman, 2015; Wright, & Mlynski, 2018). Proponents of the strength model have previously argued that depletion and fatigue are distinct phenomena. The two lines of evidence they had relied upon are tricky to defend now. First, some research shows that the effect of prior self-control and that of fatigue, which was caused by sleep deprivation, were distinct from each other (Vohs, Glass, Maddox, & Markman, 2010). However, mental fatigue from effortful exertion and sleep deprivation have long been viewed as separate effects (Hockey, 2013; Hossain, Reinish, Kayumov, Bhuiya, & Shapiro, 2003). Second, proponents of the strength model argue that robust, moderate behavioral effects are often accompanied with small to miniscule effects on fatigue. This view received some early challenges from research showing the importance of subjective fatigue in ego depletion effects. Altering people’s perception of mental fatigue overrides the effect of prior self-control (Clarkson et al., 2010; Clarkson, Hirt, Chapman, & Jia, 2011). More recently, high-power studies place the behavioral effects of ego depletion as small or miniscule in magnitude—often not larger than the effect on subjective fatigue (Francis et al., 2018; Vohs et al., 2018). Our studies corroborated these findings and show that prior exertion of self-control produces effect on subjective feelings of fatigue that are comparable to outcome variables. Hence, it seems no longer tenable to defend the distinction between ego depletion and mental fatigue, and future theories need to incorporate subjective fatigue as an essential component to understanding sequential self-control.
Another avenue to consider is the interplay between sequential self-control and goal pursuit dynamics. Our findings suggest that how sequential self-control is related to specific goal pursuit dynamics such as goal monitoring (Jia & Hirt, 2016) should be studied. One specific direction could be to consider the difference between pre-decisional and post-decisional stages of goal pursuit (Achtziger & Gollwitzer, 2018; Gollwitzer, 2012). As we have focused on active pursuit in the current investigation, the increased motivation from the goal protection mechanism may only be observed during the post-decisional stage of goal pursuit. At the post-decisional stage, the implemental mind-set is activated; people are concerned with specific action plans to promote and protect goal pursuit. Only under this implemental mind-set would the goal protection mechanism be activated and counteract the effect of self-control withdrawal. However, if prior self-control is taken into consideration at the pre-decisional stage, where the deliberative mind-set is dominant, people may reassess their goal commitment and lowered their standards in goal pursuit (van Dellen, Shea, Davisson, Koval, & Fitzmons, 2014). This is just one example of how goal pursuit dynamics provide a rich context for sequential self-control. Integrating these two fields is likely a fruitful avenue for future research.

**Conclusion**

Recent investigations suggest that exerting self-control may not be as debilitating as previously thought. By assuming that self-control exertion is adaptive, we show preliminary evidence of a previously under-studied goal protection mechanism. The current investigation highlights the importance of examining not only the debilitating but also potentially facilitatory processes resulting from prior self-control exertion. We encourage future theories to integrate self-control exertion with relevant processes such as mental fatigue and goal pursuit dynamics. If the development of a comprehensive theory for self-control exertion is
like building a house (Friese et al., 2019), we hope that the current investigation serves to contributing a novel “brick”, a piece of empirical evidence, to the construction process.
Footnotes:

1. We report two file drawer studies in a supplement. They were excluded because they were aimed at testing related but different hypotheses and were underpowered. Meta-analyses of all the studies were reported in the supplement; the results supported our predictions.

2. We employed this measure of implicit attitude in File Drawer Study 2 and observed little effects on it. Given the under-powered nature of the file drawer study, we examined this measure again here. Nonetheless, the previous failure to observe any effect made our predictions tentative.

3. We also measured various individual differences across the studies. Since they were not the focus of the experiments, we report exploratory analyses on them in the supplemental material. In summary, we found tentative evidence that students with high self-consciousness benefited from the facilitatory effect of prior self-control to a greater extent than those with low self-consciousness. This result was consistent with past findings that self-consciousness plays an important role in the monitoring and striving of goal pursuit (e.g., Jia & Hirt, 2016; Scheier & Carver, 1982).

4. Analysis with a composite score of all the non-academic items yields a similar pattern of results. To avoid repetition, we report the results in the supplemental materials.

5. The full list of stimuli are detailed in the supplemental materials.

6. As stated in the pre-registration, students also reported their enjoyment and mental fatigue during the video task for exploratory purposes. We report the measures and exploratory analyses in the supplemental materials.
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### Table 1

*Manipulation Checks for Prior Self-Control in Studies 1 and 2*

<table>
<thead>
<tr>
<th></th>
<th>No-Control</th>
<th>Prior-Control</th>
<th>T-test</th>
<th>Effect Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Study 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exertion</td>
<td>2.69 (1.57)</td>
<td>4.86 (1.63)</td>
<td><em>t</em>(178) = 14.27, <em>p</em> &lt; .001</td>
<td><em>d</em> = 1.36</td>
</tr>
<tr>
<td>Mood Valence</td>
<td>12.77 (12.93)</td>
<td>2.37 (14.40)</td>
<td><em>t</em>(178) = 8.83, <em>p</em> &lt; .001</td>
<td><em>d</em> = .80</td>
</tr>
<tr>
<td>Mood Arousal</td>
<td>-17.13 (4.87)</td>
<td>-16.70 (4.82)</td>
<td><em>t</em>(178) = .97, <em>p</em> = .33</td>
<td><em>d</em> = .09</td>
</tr>
<tr>
<td>Mental Fatigue</td>
<td>2.36 (.77)</td>
<td>2.53 (.74)</td>
<td><em>t</em>(178) = 2.75, <em>p</em> = .007</td>
<td><em>d</em> = .23</td>
</tr>
<tr>
<td>Energy Level</td>
<td>66.94 (20.52)</td>
<td>58.39 (22.11)</td>
<td><em>t</em>(178) = 4.56, <em>p</em> &lt; .001</td>
<td><em>d</em> = .40</td>
</tr>
<tr>
<td><strong>Study 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exertion</td>
<td>2.69 (1.52)</td>
<td>5.02 (1.58)</td>
<td><em>t</em>(149) = 14.30, <em>p</em> &lt; .001</td>
<td><em>d</em> = 1.50</td>
</tr>
<tr>
<td>Mood Valence</td>
<td>13.37 (12.76)</td>
<td>1.19 (13.18)</td>
<td><em>t</em>(149) = 9.447, <em>p</em> &lt; .001</td>
<td><em>d</em> = .94</td>
</tr>
<tr>
<td>Mood Arousal</td>
<td>-17.63 (5.42)</td>
<td>-17.05 (5.45)</td>
<td><em>t</em>(149) = .962, <em>p</em> = .34</td>
<td><em>d</em> = .11</td>
</tr>
<tr>
<td>Mental Fatigue</td>
<td>2.29 (.76)</td>
<td>2.54 (.88)</td>
<td><em>t</em>(149) = 3.64, <em>p</em> &lt; .001</td>
<td><em>d</em> = .30</td>
</tr>
<tr>
<td>Energy Level</td>
<td>61.15 (21.57)</td>
<td>53.36 (22.92)</td>
<td><em>t</em>(149) = 3.88, <em>p</em> &lt; .001</td>
<td><em>d</em> = .35</td>
</tr>
</tbody>
</table>

*Notes.* Standard deviations are presented in parentheses.
### Table 2

*Reliability and Inter-Session Correlations of Dependent Variables in Studies 1 and 2*

<table>
<thead>
<tr>
<th>Dependent Measures</th>
<th>Study 1</th>
<th></th>
<th>Study 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reliability</td>
<td>Correlation</td>
<td>Reliability</td>
<td>Correlation</td>
</tr>
<tr>
<td>Intention for Activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schoolwork</td>
<td>-</td>
<td>$r = .50$</td>
<td>-</td>
<td>$r = .39$</td>
</tr>
<tr>
<td>Non-Academic Work</td>
<td>$\alpha_{pc} = .66$</td>
<td>$\alpha_{nc} = .63$</td>
<td>$r = .65$</td>
<td>$\alpha_{pc} = .60$</td>
</tr>
<tr>
<td>Low-Energy Leisure</td>
<td>$\alpha_{pc} = .61$</td>
<td>$\alpha_{pc} = .74$</td>
<td>$r = .69$</td>
<td>$\alpha_{pc} = .52$</td>
</tr>
<tr>
<td>High-Energy Leisure</td>
<td>$\alpha_{pc} = .65$</td>
<td>$\alpha_{pc} = .71$</td>
<td>$r = .71$</td>
<td>$\alpha_{pc} = .54$</td>
</tr>
<tr>
<td>Implicit Attitude</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluative Priming Measure</td>
<td>-</td>
<td>$r = .12^a$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Implicit Association Test</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>$r = .49$</td>
</tr>
</tbody>
</table>

*Notes.* $\alpha_{pc}$: Cronbach alpha in the prior-control condition. $\alpha_{nc}$: Cronbach alpha in the no-control condition.

$^a$Only the inter-session correlation of evaluative priming measure failed to reach significance. All other $ps < .001$. 
<table>
<thead>
<tr>
<th>Condition</th>
<th>Total N</th>
<th>0 questions right</th>
<th>1 question right</th>
<th>2 questions right</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>prior-control</td>
<td>112</td>
<td>38</td>
<td>33.9</td>
<td>56</td>
</tr>
<tr>
<td>no-control</td>
<td>112</td>
<td>43</td>
<td>38.4</td>
<td>49</td>
</tr>
<tr>
<td>bring in</td>
<td>132</td>
<td>56</td>
<td>42.4</td>
<td>57</td>
</tr>
<tr>
<td>leave out</td>
<td>92</td>
<td>25</td>
<td>27.2</td>
<td>48</td>
</tr>
</tbody>
</table>

*Notes.* Top two rows: distribution based on prior-control vs. no-control conditions. Bottom two rows: distribution based on bringing in the phone vs. leaving the phone outside.
Figure 1. The effect of prior self-control on students’ interest in the various activities. Top panels: the hobby goal and the academic goal conditions in Study 1 ($N = 179$). Bottom Panel: Study 2 ($N = 150$), which only had the academic goal condition. The mean and standard deviations (in parentheses) of various activities are included. ^$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$. 