Prior self-control exertion and perceptions of pain during a physically demanding task

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Abstract

Objectives

Exertion of self-control has been associated with impaired performance on subsequent physical tasks also requiring self-control, but it remains unknown why this occurs. This study, therefore, explored whether a) prior self-control exertion reduces subsequent persistence on a physically demanding task, and b) whether any observed performance decrements could be explained by changes in perceptions of pain.

Method

In a within-subject design, sixty-three individuals completed an easy (congruent) Stroop task or a difficult (incongruent) Stroop task that required self-control. Participants were then required to remain in a physically demanding posture (i.e., a ‘wall-sit’) until voluntary exhaustion and their perception of pain was recorded during the task.

Results

When participants completed the difficult Stroop task, they quit the wall-sit sooner. This decrement in performance was explained by greater perceptions of pain at the beginning of the wall-sit.

Conclusions

Perceptions of pain may, therefore, be an important attentional mechanism explaining why self-control use interferes with subsequent persistence during physically effortful tasks.

Keywords: self-regulation, ego depletion, pain tolerance, physical performance

Prior self-control exertion and perceptions of pain during a physically demanding task

Self-control has been defined as the process of volitionally controlling and overriding predominant, habitual tendencies in order to achieve a specific goal (Baumeister, Vohs, & Tice, 2007). This process enables individuals to initiate or inhibit particular responses, attend to stimuli, and engage in purposeful, effortful, and goal-directed behaviors (Baumeister, Heatherton, & Tice, 1994). The capacity to exert self-control can differ between individuals (i.e., trait self-control), as well as within individuals across situations (i.e., state self-control; Tangney, Baumeister, & Boone, 2004). Regarding the latter, meta-analytic evidence has shown that, following the exertion of self-control on one task, individuals typically have an impaired ability to self-regulate when performing a subsequent second task, even if this task is drawn from a different domain (Hagger, Wood, Stiff, & Chatzisarantis, 2010). Some researchers, however, have questioned the existence of this depletion effect and suggested that it is not a real phenomenon (Carter, Kofler, Forster, & McCullough, 2015).

Despite the controversies within the literature, considerable research has demonstrated that self-control use can lead to impaired performance on subsequent physical tasks also requiring self-control. One task that has been frequently employed to explore this effect is squeezing an isometric handgrip for as long as possible (e.g., Muraven, Tice, & Baumeister, 1998; Muraven & Shmueli, 2006; Tice, Baumeister, Shmueli, & Muraven, 2007). Although this task requires muscular endurance, overcoming fatigue or pain and overriding the urge to quit are acts of self-control and mental persistence (Muraven et al., 1998). Following the completion of a task requiring self-control (incongruent Stroop task), individuals persisted less at squeezing an isometric handgrip, compared to when they completed a task requiring no self-control (congruent Stroop task; Bray, Graham, Martin Ginis, & Hicks, 2011; Bray, Martin Ginis, Hicks, & Woodgate, 2008). This is substantively interesting because one could assume that the underlying self-control mechanisms involved in overriding learned responses in the Stroop task are different to those required to overcome pain and persist in the handgrip task. Despite these differences, employment of the former type of self-control still effects the latter, suggesting the same mechanism is responsible for a large variety of self-control tasks (Baumeister et al., 2007). Indeed, psychometric and neurological evidence points to considerable overlap between the inability to attend to difficult cognitive tasks (e.g., incongruent Stroop tasks) and the inability to resist strong impulses (e.g., pain avoidance; Duckworth & Kern, 2011; Steinberg, 2008).

Callisthenic measures of physical action have also been employed so that assumptions concerning more complex human performance can be formulated. For instance, following a cognitively demanding task, competitive athletes performed significantly worse on a sit-up task compared to when they completed a cognitively simple task (Dorris, Power, & Kenefick, 2012). The ability for self-control exertion to reduce subsequent physical endurance performance has been substantiated during cycling tasks (e.g., Boat, Taylor, & Hulston, 2017; Englert & Wolff, 2015; Martin Ginis & Bray, 2011; Wagstaff, 2014). Clearly, self-control seems to be crucial in order to be able to achieve high levels of physical performance that require prolonged effort. What is unknown and, therefore, the focus of the present study is *why* self-control is diminished following prior use. Understanding the causal explanations would provide a more complete model of self-control.

A number of theories have been proposed to explain self-regulatory failures following previous exertion of self-control. Some researchers have suggested that self-control is a limited resource; therefore, prior acts of self-control can lead to a temporary loss of self-control strength in subsequent acts (Baumeister, Bratslavsky, Muraven, & Tice 1998). This hypothesis has come under severe criticism (e.g., Kurzban, 2010; Lange & Eggert, 2014). An alternative perspective is the *shifting priorities model of self-control*, which is centred on motivational and attentional processes (Inzlicht & Schmeichel. 2016; Milyavskaya &

Inzlicht, 2017). Self-control fades as a result of a subjective valuation process, whereby distal and proximal goal choices are continuously assessed (Berkman, Livingston, Kahn, & Inzlicht, 2015). Following the use of self-control, attention and motivation shifts to the extent that the value of exerting further self-control in pursuit of the distal goal diminishes, while the value of conceding to the tempting proximal goal is increased (De Witte Huberts, Evers, & de Ridder, 2014; Kool & Botvinick, 2014). Ultimately, self-control represents a decision to exert effort to resist a tempting proximal goal in favour of a distal goal (Milyavskaya & Inzlicht, 2017).

Many of the physical or athletic tasks that have been utilized previously are unpleasant and induce considerable levels of discomfort and pain (e.g., Boat et al., 2017; Bray et al., 2008; 2011; Dorris et al., 2012; Englert & Wolff, 2015). A fundamental function of pain is to disturb and galvanize attention (Eccleston & Crombez, 1999). This provides an opportunity to use participants' perceptions of pain during physical tasks as an indicator of attentional shift concordant with the 'shifting priorities' perspective. We propose that self-control exertion leads to an attentional shift towards perceptions of pain during subsequent endurance tasks. This leads to increasing focus on the proximal goal (quitting or reducing effort to relieve the pain), relative to the distal goal (persisting on the task to maximize performance), resulting in reduced performance. In other words, perceptions of pain may explain why self-control exertion interferes with subsequent performance on a physical task. Individuals with higher levels of trait self-control persisted longer when required to submerge their hand in painfully cold water for as long as possible, compared to those participants with lower levels of trait self-control (Schmeichel & Zell, 2007). However, this does not explain why a bout of self-control use reduces subsequent physical performance.

Extending the literature described above, the aims of the current research were to determine whether exerting self-control a) reduces performance and b) increases perceptions of pain during a subsequent, unrelated physical task that required self-control. In addition, we investigated whether any observed performance decrements as a result of self-control exertion could be explained (i.e., mediated) by an individual's perceptions of pain. In the present experiment, our self-control manipulation was a congruent versus incongruent Stroop task performed for four minutes. Previous research has shown this task to require self-control (McEwan, Martin Ginis, & Bray, 2013) and the same length of time has been used previously (e.g., Gailliot et al., 2007). To measure physical performance we used a 'wall-sit', which entails leaning with one's back against a wall with hips and knees bent at 90 degrees. This procedure is increasingly painful and requires participants to resist the temptation to alleviate the pain by quitting the task, and instead to invest sustained effort to persist as long as possible.

Based on the broad self-control literature (e.g., Bray et al., 2011; Dorris et al., 2012; Englert & Wolff, 2015; Inzlicht & Schmeichel, 2016) it was hypothesized that engaging in a cognitively demanding task previously shown to require self-control (i.e., an incongruent Stroop task) would result in poorer performance (hypothesis 1) and increased perceptions of pain (hypothesis 2) in a subsequent wall-sit task, compared to a cognitively simple task (i.e., a congruent Stroop task). In addition, we expected that perceptions of pain would mediate the effects of the self-control manipulation on wall-sit performance (hypothesis 3). Recent evidence suggests that cognitive and performance disruption associated with self-control may be time-dependent (Boat et al., 2017; Englert & Wolff, 2015), therefore, we examined potential mediating effects at different points during the endurance task. This would enable investigation of whether shifts in pain early or late in the endurance task drive any reductions in performance.

Methods

Participants

A power calculation (G*Power version 3.1; Faul, Erdfelder, Lang, & Buchner, 2009) with power = .80 and $\alpha = .05$, indicated a minimum sample size of $N = 52$ would be sufficient to detect a medium effect size (.40), which is typical of previous self-control studies. Our sample consisted of 63 participants (21 male, 42 female) aged 18-34 years old (*M* age = 22 years, *SD* = 3 years). The participants spent, on average, four days *(SD* = 2 days) per week exercising, and 56 participants reported that they had completed a wall-sit previously.

Following approval from a university ethics committee, each participant signed an informed consent form after the study was explained in full and it was clarified that involvement was anonymous and voluntary. Furthermore, all participants were healthy, as assessed by a university approved general health questionnaire.

Protocol

Each participant took part in two experimental sessions. Given previous evidence (e.g., Englert & Rummel, 2016; Tangney et al., 2004) and the nature of the wall-sit experimental task, participants first completed questionnaires to control for the influence of daily stress and physical fatigue (see measures section). Participants were then familiarized with the wall-sit procedure. Subjects were directed to stand with his/her back against a wall, feet shoulder width apart and knees and hips flexed at a 90 degree angle, with his/her hands resting against the wall. Specific exercise instructions were scripted so that they remained constant for each participant. Participants practiced the wall-sit once to ensure that they were familiar with and understood what was required, but they were not asked to persist at the task.

Participants were then administered a computerized version of the Stroop task. Color words were presented on a screen and participants were required to read aloud the color of the print ink and ignore the text of each word presented. However, when participants encounter a word presented in red ink, they are required to override the general instructions and read aloud the printed word. In the self-control condition, the print ink colour and printed text were mismatched. For example, if the word ‘yellow’ was printed in green, the correct verbal response would be green. However, if the word ‘orange’ was presented in red ink, the correct verbal response would be orange. In the non-self-control condition, the words were matched (e.g., the word ‘yellow’ was printed in yellow ink, ‘red’ was printed in red ink). Previous studies have repeatedly demonstrated that the incongruent version of the Stroop task is cognitively challenging and requires self-control because individuals have to volitionally override their primary impulse of naming the word instead of the font colour (e.g., Englert & Wolff, 2015; McEwan et al., 2013). Participants sat in a quiet room and were instructed to respond as accurately as possible. The Stroop task was four minutes in duration and words were presented on the screen at 1,500 ms intervals. Prior to the actual test, participants completed a practice session lasting 30 seconds to acquaint with the task. Following the experimental manipulation of self-control, participants completed a manipulation check which assessed their perceived mental exertion during the Stroop task (see measures section).

Participants then performed the wall-sit. Subjects were instructed to hold the position for as long as possible, until exhaustion. Throughout the wall-sit, participants’ perception of pain was recorded (see measures section). In sum, participants completed two seated wall-sits under two experimental conditions: prior self-control and no self-control. Sessions were counterbalanced and separated by 24 hours.

Measures

Daily stress. Daily stress was assessed using the seven stem questions from the Daily Inventory of Stressful Events Questionnaire (Almeida, Wethington, & Kessler, 2002). Participants were instructed to indicate whether any of a number of stressful events had occurred today by circling either ‘yes’ or ‘no’ (e.g., “An argument or disagreement with someone”). The item scores have demonstrated acceptable internal consistency and predictive validity in previous research (Almeida et al., 2002).

Perceptions of physical fatigue. Physical fatigue was measured using two items from the fatigue subscale from the Profile of Mood States (McNair, Lorr, & Droppleman, 1992; i.e., “I feel physically worn out” and “I feel physically exhausted”). Participants were instructed to consider the degree to which they were currently experiencing the items on a five-point scale anchored by 1 (*not at all true*) to 5 (*very true*). These items were selected based on high factor loadings in previous research and acceptable reliability (e.g., Beedie, Terry, & Lane, 2000).

Mental exertion. Participants rated their mental exertion during the Stroop task using Borg’s single-item CR-10 scale (Borg, 1998; 0 = *extremely weak*; 10 = *absolute maximum*). This single item measure has been shown to be a valid measure in previous research (e.g. McEwan et al., 2013).

Perceptions of pain. Participants’ current pain perception was measured using the short-form McGill pain questionnaire (SF-MPQ; Melzack, 1987), which consists of three subscales. First, participants reported the degree to which they were currently experiencing various sensations on a four-point scale anchored by 0 (*none*) to 3 (*severe*). Four items each from the sensory (“Throbbing”, “hot-burning”, “cramping”, “aching”) and affective (“Tiring-exhausting”, “sickening”, “fearful”, “punishing-cruel”) subscales were used. The investigator presented the participants with a printed copy of each item and they were instructed to verbally communicate their answer. Next, participants completed the Visual Analog scale from the SF-MPQ; a 10-centimeter line, where one end represented no pain and the other end represented the worst pain. Participants were asked to make a mark on the line that represented his/her current pain intensity. The SF-MPQ has been used previously in studies of pain as a relatively quick assessment tool to examine pain levels during physical activities (e.g., Osborne & Gatt, 2010), and has demonstrated acceptable reliability and predictive validity in previous research (Wright, Asmundson, & McCreary, 2001).

Participants completed a subscale of pain measurement at 15 second intervals for the entire duration of the wall-sit task. For instance, participants completed the four items from the sensory subscale after 10 seconds, the four items from the affective subscale after 25 seconds, and the VAS after 40 seconds. This same order was subsequently repeated throughout the wall-sit. Intervals of 15 seconds were employed to allow participants enough time to answer the items from each subscale and a period of rest before the following subscale was presented.

Task performance. Performance was assessed using the time (in seconds) participants stopped the wall-sit task.

Results

Preliminary Analysis

The Statistical Package for Social Sciences (SPSS; Version 22.0) was used for all statistical analyses. Table 1 displays descriptive statistics for each variable across each experimental condition. The Cronbach alpha coefficients for the Daily Inventory of Stressful Events Questionnaire and physical fatigue subscale ranged between .62 - .76 across the two trials. Paired samples *t*-tests revealed that participants did not differ in their levels of daily stress $t(61) = -.88$, $p = .24$, $r = .01$, or ratings of physical fatigue $t(61) = -.34$, $p = .74$, $r = .04$, across experimental conditions. Neither stress ($r = .22$, $p = .08$; $r = .12$, $p = .33$) nor fatigue ($r = -.13$, $p = .31$; $r = -.11$, $p = .33$) were correlated with wall sit-performance in either experimental condition. Based on these results, it was not necessary to control for stress or fatigue in the main analysis. The manipulation check revealed that participants reported higher mental exertion following the incongruent Stroop task ($M = 5.15$, $SE = 0.23$) compared to the congruent Stroop task ($M = 1.33$, $SE = .15$), $t(61) = 16.68$, $p < .001$ $r = .90$.

Primary Analyses

A mixed one-way ANOVA was conducted to evaluate the impact of exerting self-control on wall sit performance (within-subjects; hypothesis 1) as well as examine order effects (between-subjects) on performance. Variances and covariance's were homogenous across all trials (Levene's and Box's test $p > .05$). The results revealed that there was a significant main effect for experimental trial on wall sit performance ($F(1,60) = 7.62$, $p = .01$, $r = .78$). Participants gave up quicker in the self-control experimental condition ($M = 130.20$, $SE = 8.98$), compared to the non-self-control condition ($M = 147.07$, $SE = 9.31$). There was no significant main effect of order on performance ($F(1,60) = .14$, $p = .71$, $r = .28$) or interaction effect between experimental trial and order ($F(1,60) = 1.92$, $p = .17$, $r = .05$), indicating that there were no order effects.

Within-subjects (i.e., two treatments) multivariate analysis of variance (MANOVA) with noncommensurate dependent variables (sensory, affective and VAS pain measures) was used to test the effect of experimental condition on participants' perception of pain during the wall-sit task (hypothesis 2). Although our protocol required participants to complete multiple measures of sensory, affective, and VAS subscales, 57% of participants did not complete more than two complete set of measures before they quit the task. To maintain the maximum sample size, we therefore conducted separate MANOVAs on all participants' first and final set of pain scores before quitting the task only. Variances and covariances were homogeneous across trials (all Levene's tests and Box's tests $p > .05$).

At the beginning of the wall-sit, differences in pain across the experimental conditions were bordering on conventional levels of statistical significance and a moderate effect size was observed: $F(3, 58) = 2.44$, $p = .07$, $\eta^2 = .11$. Follow-up univariate tests indicated that VAS scores at the beginning of the wall-sit task were significantly higher following the self-control experimental condition ($M = 3.83$, $SE = .24$) compared the non-self-control condition ($M = 3.37$, $SE = .21$), $F(1,60) = 6.23$, $p = .02$, $\eta^2 = .09$). Experimental condition had no effect on sensory scores (*F*(1,60) = 1.68, p = .20, η^2 = .03) or affective scores (*F*(1,60) = 2.70, p = .11, η^2 = .04).

Eighteen participants did not complete a second set of pain scores before quitting and we did not consider it appropriate to re-use their first pain scores as their final pain scores. Therefore, a second MANOVA was conducted on results from the remaining 45 participants. Results revealed significant differences in final pain scores before quitting across experimental conditions and a large effect size: *F*(3, 42) = 2.77, p = .05, η^2 = .17. Follow-up univariate tests revealed that VAS scores at the end of the wall-sit task were significantly higher following the self-control experimental condition (*M* = 6.68, *SE* = .32), compared to the non-self-control condition (*M* = 6.19, *SE* = .36), *F*(1,44) = 8.38, p = .01, , η^2 = .16). No differences were found for sensory scores (*F*(1,44) = .71, p = .40, η^2 = .02) or affective scores (*F*(1,44) = .12, p = .73, η^2 = .00) across experimental conditions.

Within-subject mediation analysis (Judd, Kenny, & McClelland, 2001) using the MEMORE macro (Montoya & Hayes; 2016) was employed to test whether the VAS pain scores mediated the observed differences in wall-sit performance time (hypothesis 3). MEMORE has been specifically developed for cases in which the experimental manipulation varies within participants, as in our study. It provides estimates of total, direct, and indirect effects and produces confidence intervals for inference about the indirect effect using bootstrapping techniques. Five thousand bootstrap samples were used in the present study.

Only the VAS pain scores were explored because these appeared to be driving the differences in perceptions of pain across experimental conditions. Results for VAS scores at the beginning of the wall sit (i.e., after 40s) revealed a significant total effect of experimental condition on wall sit performance (*b* = -17.20, 95% CI (-29.71, -4.68), p = .01). Direct effects were non-significant (*b* = -10.68, 95% CI (-22.88, 1.52), p = .09), however, indirect effects were significant (*b* = -6.52, 95% CI (-14.56, -.92), p = .01), suggesting that pain in the early stages of the wall-sit task fully explained differences in performance across experimental conditions.

The mediation analysis was repeated with participants' final VAS pain scores before quitting the task as the mediating variable. Results indicated a non-significant total effect of experimental condition on wall sit performance (*b* = -13.62, 95% CI (-27.81, .56), *p* = .06). In addition, non-significant direct (*b* = -13.95, 95% CI (-29.80, 1.91), *p* = .08) and indirect (*b* = .32, 95% CI (-7.49, 9.16), *p* = .06) effects were observed. Therefore, pain at the end of the wall-sit task did not explain differences in performance across experimental conditions.

Discussion

The present study explored the effects of exerting self-control on a subsequent physical task requiring self-control and whether any observed performance decrements could be explained by an individual's perceptions of pain. Consonant with our predictions, participants quit a physically demanding 'wall-sit' task faster when they had exerted self-control in a prior task, relative to when they did not. This effect was attributable to participants' elevated perceptions of pain during the early stages of the wall-sit. The findings provide new evidence that perceptions of pain may explain why the use of self-control interferes with subsequent performance on a physically demanding task.

In accordance with previous research (e.g., Bray et al., 2008; 2011; Dorris et al., 2012; Englert & Wolff, 2015; McEwan et al., 2013; Wagstaff, 2014), exertion of self-control significantly reduced subsequent performance in a physical task, in this case persistence at a wall-sit. Participants gave up quicker following a difficult cognitive task, compared to when they completed a simple cognitive task. The results provide yet more evidence that when participants are required to perform two consecutive acts of self-control, diminished performance on the second task ensues (Hagger et al., 2010). Recent evidence has questioned the existence and replicability of the depletion effect (Hagger et al., 2016) and suggested that it is not a real phenomenon (Carter et al., 2015). However, by employing a within-subjects design individual differences in performance on the self-control tasks are controlled for. Such designs may improve the replicability of the depletion effect, as opposed to traditional between-participant designs typically employed (Cunningham & Baumeister, 2016; Schweizer & Furley, 2016).

The most significant contribution to knowledge of the present study is the demonstration that exertion of self-control led to elevated perceptions of pain during the physical task. Indeed, the mediation analysis evidenced that perceptions of pain in the early stages of the wall-sit task explained the performance decrements. These findings align well with the shifting priorities model of self-control (Inzlicht & Schmeichel, 2016). Self-control use quickly brought about a state of elevated distress and attentional priorities shifted towards the pain relatively early in the wall-sit task (Elkins-Brown, Teper, & Inzlicht, 2016; Inzlicht, Schmeichel, & Macrae, 2014). This aversive state has been proposed to encourage individuals to consciously attend to the presence of task goal conflict (Baumeister & Bargh, 2014), and encourage alleviation of the distressing state (Inzlicht & Legault, 2014). Consequently, motivational priorities shift towards an increased focus on the proximal goal (quitting to relieve the pain), relative to the distal goal (demonstrating high levels of persistence on the task), resulting in disengagement from the task relatively earlier (Inzlicht & Schmeichel, 2016).

It is important to highlight that the VAS scores appeared to be driving the observed differences in perceptions of pain, compared to the sensory and affective pain scores. This suggests that the pain mechanism responsible for reduced persistence is general, rather than any specific affective or sensory component of pain. In particular, scores of affective pain remained low throughout the wall-sit exercise; therefore, this pain component may not be salient during prolonged postural endurance tasks. Alternatively, the VAS is a highly responsive outcome measurement for monitoring changes in pain (Chaffee, Yakuboff, & Tanabe, 2011), whereas the sensory and affective scales are only 4-point scales and maybe less sensitive. It is possible that the different measurement scales explain the pattern of findings associated with different pain constructs.

From a sporting perspective, this study unearths a potentially critical explanation for intra-individual variation in performance. Although the Stroop task is a well-established self-control task (Englert & Wolff, 2015) and the wall-sit requires muscular endurance, they are not sport specific. This finding, therefore, requires replication with sport specific tasks which require self-control. If shown to be replicable, efforts are required to counteract the effect of self-control use and heightened perceptions of pain. Promisingly, regular practice exerting self-control can improve an individual's ability to perform future acts of self-control (Allom, Mullan, & Hagger, 2016). Squeezing a handgrip twice a day for as long as possible over a two week period improved individuals' self-control performance in subsequent self-control acts (Bray, Graham, & Saville, 2015). Performing relaxation and mindfulness techniques can also attenuate self-control reductions (Friese, Messner, & Schaffner, 2012; Tyler & Burns, 2008) and perhaps offer more applicable solutions to reducing the impact of self-control use.

Limitations

Despite yielding important findings, there are some study limitations worth noting. Numerous steps to eliminate any potential problems associated with bias were taken; for instance, the experimenter read the instructions for all tasks from a pre-prepared text to reduce the variability in the delivery of the instructions (Dorris et al., 2012). However, a blind-researcher protocol was not employed; therefore, the possibility of experimenter bias impacting the results of this study cannot be ruled out. Furthermore, performance on the initial self-control task was not assessed. Although manipulation checks in the current study confirmed our self-control manipulation, the identification of a decline in performance on the

Stroop task in future similar studies would be a useful measure of depletion and evaluating an individual's level of exertion (Lee, Chatzisarantis, & Hagger, 2016). Additionally, participants' mood was not assessed following the Stroop task designed to manipulate self-control. It could be argued that overriding a well-learned behavior (i.e., reading the ink color not the word) could be associated with negative emotional states (Tice & Bratslavsky, 2000). Therefore, it is possible that mood differences may well have been responsible for the current pattern of results. However, previous research has repeatedly shown that self-control manipulation does not affect mood (e.g., Englert & Bertrams, 2012; Muraven et al., 1998).

Although the findings of the current study are consistent with the shifting priorities model from an attentional perspective, we did not measure the motivational mechanisms of this model. Future research should make efforts to explore whether the exertion of self-control leads to a reduction in motivation during subsequent tasks (Inzlicht & Schmeichel, 2012). In the same way as the VAS was employed to measure pain in the present study, momentary measures of task importance may be taken. This may provide more precise measures of motivational shifts, rather than assessing motivation before or after the task, which is typical in self-control research. Explicit measures of proximal goal focus (how much does the participant want to avoid the pain?) relative to distal goal focus (how much does the participant want to continue persisting?) may also provide interesting insight into shifting priorities.

Conclusion

The present study provides further evidence that initial self-control exertion reduces performance on a physical task. Furthermore, the results make an important contribution to the self-control literature by highlighting that perceptions of pain may be a critical attentional mechanism explaining why self-control exertion interferes with subsequent persistence during physically effortful tasks.

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Table 1

Descriptive Statistics for all Variables

Variable	Experimental condition			
	Self-control		Non-self-control	
	M	*SD*	*M*	*SD*
Mental exertion	5.15	1.83	1.33	1.17
Physical fatigue	2.02	.86	2.05	.89
Daily stress	6.45	1.05	6.58	.86
Wall-sit performance time (seconds)	130.16	70.01	147.31	73.01
Sensory pain scores				
-Start of wall-sit task	.83	.57	.73	.55
-End of wall-sit task	2.21	.58	2.15	.65
Affective pain scores				
-Start of wall-sit task	.50	.48	.40	.40
-End of wall-sit task	.97	.59	.94	.61
VAS pain scores				
-Start of wall-sit task	3.83	1.88	3.37	1.67
-End of wall-sit task	6.68	2.13	6.19	2.40