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## Brief Report

## Self-control training decreases aggression in response to provocation in aggressive individuals

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## ABSTRACT

One common cause of aggression is self-control failure, yet research suggests that practicing self-control over time can improve subsequent self-control. This experiment tested whether self-control training over a 2-week period could decrease anger and aggression in response to provocation. Seventy undergraduates completed 2 weeks of self-control training or a control task. At the end of the 2 weeks, participants were insulted and given the opportunity to retaliate by delivering a blast of loud white noise. Self-control training reduced aggression among those high in trait aggression. Participants who received the training also reported less anger than those in the control condition. These results provide initial support that self-control training might prove beneficial for assisting aggressive individuals to overcome aggressive impulses.

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## 1. Introduction

Interpersonal provocation often increases anger and aggressive impulses. Failure to control anger-driven aggressive impulses when provoked is a common cause of aggression and violence (DeWall, Baumeister, Stillman, & Gailliot, 2007; Gottfredson & Hirschi, 1990). Indeed, many homicides and assaults are impulsive and opportunistic rather than premeditated (cf. Australian Institute of Criminology, 1989; Felson & Steadman, 1983; Hazelwood & Warren, 2000). In the present research, we tested the notion that improving self-control should reduce aggression among those who have difficulty controlling aggressive impulses. Specifically, we examined whether one demonstrated method of improving self-control in other domains (i.e., engaging in a 2-week self-control training [SCT] regimen) can reduce impulsive aggression among individuals high in trait aggression. In the present research SCT training refers to building self-control capacity by practicing self-control in a domain unrelated to anger or aggression. This is distinct from anger management interventions which specifically emphasize improving control over aggressive urges within anger-inducing situations (e.g., Novaco, 1977).

Aggressive individuals often show deficits in the neural circuitry supporting executive control and emotion regulation (Davidson, Putnam, & Larson, 2000; Denson, 2011; Hoaken, Allaby,

& Earle, 2007; Raine, 2008; Siever, 2008). Indeed, participants with poor frontal lobe function administered more intense shocks to a fictitious participant than those with better functioning (Lau, Pihl, & Peterson, 1995) and prefrontal lesions are associated with increased aggression (Grafman et al., 1996). Moreover, among prisoners, individual differences in scores on executive control measures predicted the severity of violent crimes, but not non-violent crimes (Hancock, Tapscott, & Hoaken, 2010). Thus, augmenting executive control capacity is an ideal point of intervention for reducing aggression among aggressive individuals.

Research conducted within the framework of the strength model of self-control (Baumeister, Vohs, & Tice, 2007) suggests that executive control capacity can be strengthened either immediately by consuming glucose or over time by practicing self-control. Evidence demonstrates that glucose consumption can reduce reactive aggression among those high in trait aggression (Denson, von Hippel, Kemp, & Teo, 2010). Although SCT improves self-control in a variety of domains unrelated to aggression (Baumeister, Gailliot, DeWall, & Oaten, 2006; Gailliot, Plant, Butz, & Baumeister, 2007; Hui et al., 2009; Muraven, 2010a, 2010b; Muraven, Baumeister, & Tice, 1999; Oaten & Cheng, 2006a, 2006b, 2007), no research has examined whether practicing self-control in an unrelated domain can reduce aggression.

Suggestive evidence that SCT might decrease aggressive behavior comes from a study in which participants who were assigned to use their non-dominant hand (thereby exercising self-control) rated themselves as less likely to be physically aggressive toward their partner upon provocation (e.g., catching their partner in bed

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with someone), than participants in the control condition (Finkel, DeWall, Slotter, Oaten, & Foshee, 2009). A test of SCT on actual aggressive behavior is warranted if such training is to be considered for use in interventions tailored for aggressive individuals. This was the primary aim of the present research. Because individuals high in trait aggression have difficulty controlling anger-driven aggressive behavior, the urge to aggress should be greatest among those high in trait aggression (and very weak or possibly non-existent among those low in trait aggression). Therefore, SCT should best help aggressive individuals refrain from behaving aggressively. Thus, we expected an SCT × trait aggression interaction whereby relative to a control condition, completing SCT would result in lower levels of aggressive behavior among those high in trait aggression. Furthermore, because anger is a common antecedent of aggressive behavior, a secondary goal was to examine the effects of SCT on anger in response to provocation. Thus, we examined whether SCT would reduce aggression in aggressive individuals by reducing anger in response to provocation.

## 2. Method

### 2.1. Participants and design

A total of 90 Australian psychology and other undergraduates participated in exchange for course credit or AUD\$40. The experimenter randomly allocated participants to either the SCT or the control condition. Data were removed from analyses due to: not attending the second experimental session ( $n = 5$  from the control condition and  $n = 4$  from the SCT condition), completing less than half of the SCT diaries ( $n = 6$ ), and suspicion about the provocation procedure ( $n = 5$ ). The final sample consisted of 70 individuals (54 women;  $M_{age} = 20.30$  years,  $SD = 2.99$ ; 44% Asian, 37% Caucasian, 9% other). The experimental conditions did not differ in trait aggression, distribution of men and women, or distribution of psychology and non-psychology students (see Table 1).

### 2.2. Procedure and materials

The experiment was conducted over two laboratory sessions separated by a 2-week interim. At the initial session, participants were informed the study was investigating techniques that could be beneficial to individuals recovering from a stroke such as using one's non-dominant hand and practicing mathematics.

#### 2.2.1. Trait aggression

At the first session, participants completed the Aggression Questionnaire (AQ; Buss & Perry, 1992) intermixed with 10 bogus personality questions to allay suspicion. The AQ was used to assess

individual differences in aggressive personality. The 29-item scale is composed of four subscales: physical aggression ( $\alpha = .89$ ,  $M = 2.22$ ,  $SD = 0.92$ ), verbal aggression ( $\alpha = .56$ ,  $M = 2.90$ ,  $SD = 0.67$ ), anger ( $\alpha = .81$ ,  $M = 2.49$ ,  $SD = 0.78$ ), and hostility ( $\alpha = .78$ ,  $M = 2.81$ ,  $SD = 0.92$ ; 1 = *extremely uncharacteristic of me*, to 5 = *extremely characteristic of me*). Because our primary dependent measure was physical in nature (i.e., a blast of white noise, see below), we expected the physical aggression subscale to have the strongest relationship with aggressive behavior.

#### 2.2.2. SCT manipulation

The SCT condition involved a physical regulation task which effectively improves performance on self-control tasks in 2 weeks (Finkel et al., 2009; Gailliot et al., 2007). Participants were required to use their non-dominant hand between 8 am and 6 pm every day. They were given examples (e.g., brushing their teeth, opening doors, striking a match or using a lighter, operating a computer mouse, carrying items, drinking with a glass or mug, and stirring). When performing these tasks, participants were asked to exert as much effort as possible to facilitate the effortful use of self-control. Participants in the control condition were not required to complete any tasks during the interim period other than respond to two text messages (described next). Research also suggests that the effects of SCT manipulations like this one are due to practicing self-control and not alternative mechanisms such as awareness of self-control, self-fulfilling prophecies, or self-efficacy (Muraven, 2010a).

#### 2.2.3. Manipulation checks

All participants in the SCT condition were required to accurately complete an online, time-stamped diary every second day for 2 weeks (seven total), and reply to two text messages during the interim regarding their progress. The diary asked participants to rate the frequency to which they used their non-dominant hand that day on each of the tasks (1 = not at all, 10 = consistently). Participants were instructed to be as accurate as possible in the diaries, and were told that despite the importance of task compliance they would not be penalized for reporting non-compliance, so long as the diaries were completed as instructed. Participants in the SCT condition were also sent one text message per week to which they were to reply with a score reflecting their weekly progress. Those who completed all seven of the online diaries, either went into the draw to win gift certificates (psychology students), or paid an additional \$10 (if participants were not enrolled in introductory psychology). To keep experimenter contact equal, those in the control condition were sent one text message each week with a simple equation to which they were to answer in a return text message (see Finkel et al., 2009).

**Table 1**

The correlations between aggressive personality traits and aggressive behavior (noise blast) in the two experimental conditions are presented in the left columns. Descriptive statistics are presented in the remaining columns. The total AQ score is a mean composite of the preceding four AQ subscales.

	Control ( $n = 34$ )		Self-control training ( $n = 36$ )		Control ( $n = 34$ )		Self-control training ( $n = 36$ )		Significance test	
	$r$	$p$ -Value	$r$	$p$ -Value	$M$	$SD$	$M$	$SD$	$t$ -Value	$p$ -Value
Physical aggression	.39	.02	-.12	.50	2.14	0.95	2.30	0.90	0.74	.47
Verbal aggression	.20	.25	.16	.35	2.78	0.70	3.02	0.63	1.51	.14
Anger	.38	.03	-.27	.18	2.38	0.76	2.59	0.79	1.13	.26
Hostility	.15	.40	.00	.98	2.89	0.80	2.74	0.67	0.81	.42
Total AQ score	.34	.05	-.07	.67	2.55	0.67	2.66	0.61	0.76	.45
Age					20.94	3.45	19.69	2.39	1.75	.09
Number of text messages sent					1.47	0.75	1.17	0.88	1.15	.13
					%		%		$\chi^2$ -Value	$p$ -Value
Percentage of women					71		83		1.61	.20
Percentage of psychology students					36		50		1.54	.21

### 2.2.4. Provocation procedure

At the second session, participants were told that they would engage in a videoconference with another student. In fact the other participant was a sex-matched actor who was pre-recorded. The video was carefully timed to give the illusion of a live conference. The participants were given 10 min to prepare a 2-min speech on their life plans and goals. The experimenter instructed the fictitious partner to speak first, followed by the participant while the partner appeared to be listening. After the speech, participants were then asked to provide 1–2 sentences of feedback in response to the fictitious partner's speech in return for an evaluation of their own speech by their partner. All participants received the following insulting feedback (i.e., "Honestly, I wasn't impressed. Ur speech was boring and u sounded like u haven't given much thought at all to ur future goals. What a waste of my time listening to u."). This procedure successfully increases anger, aggression, and blood pressure (Denson et al., 2010; Memedovic, Grisham, Denson, & Moulds, 2010).

### 2.2.5. Aggressive behavior

Participants were then told that they would be playing a competitive reaction time game against the same fictitious participant from the videoconference. Participants completed a modified, single-trial version of the Taylor Aggression Paradigm (Taylor, 1967), which allowed the participant to deliver a retaliatory blast of loud noise (Anderson & Dill, 2000; Bushman, 1995; see also Denson et al., 2010). Participants were to click the mouse as fast as possible when a yellow rectangle changed color, and were allowed to aggress against their opponent by specifying the intensity (60–105 dB) and duration (0.5–1.75 s) of the blast of white noise to be delivered to their opponent. There was also a non-aggressive option (i.e., 0 dB). The outcome of the reaction time game was predetermined so that the participant always won the trial. Aggressive behavior was operationalized as the mean duration and intensity of the noise blast selected. The Taylor paradigm is a valid and widely used laboratory measure of aggression for both genders (Anderson & Bushman, 1997; Carlson, Marcus-Newhall, & Miller, 1989; Giancola & Chermack, 1998; Giancola & Zeichner, 1995; Hoaken & Pihl, 2000).

### 2.2.6. Angry affect

Upon completion of the Taylor paradigm, participants completed seven items assessing the extent to which they experienced angry reactions to the insulting feedback (i.e., *angry, grouchy, irritable, annoyed, upset, offended, hostile*;  $\alpha = .92$ ,  $M = 2.85$ ,  $SD = 1.30$ ; 1 = *not at all*, 7 = *extremely so*).

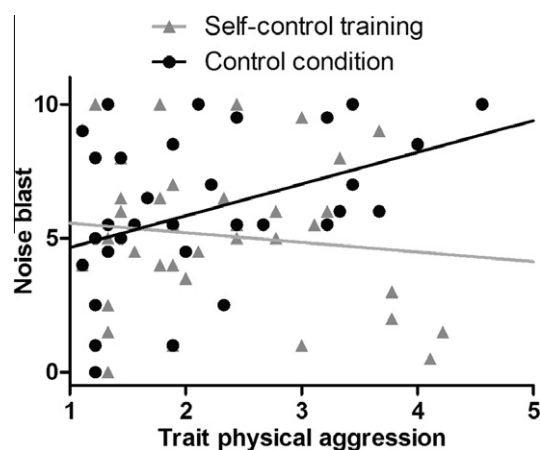
### 2.2.7. Debriefing

Upon completion of the second session, participants were probed for suspicion and debriefed.

## 3. Results

### 3.1. Manipulation checks

Participants in the SCT condition completed an average of 6.72 diaries (out of a possible 7) ( $SD = 3.16$ ) during the 2-week period. The majority of participants reported completing the SCT tasks to an adequate level:  $M = 7.31$  (out of 10),  $SD = 1.31$ . Participants reported increasing the frequency of the SCT tasks during the second week,  $t(35) = 4.19$ ,  $p < .01$ , suggesting high levels of engagement in the SCT. There was no difference in the number of text messages returned between conditions,  $F(1, 68) = 2.42$ ,  $p = .13$ . In summary, these data suggest an effective manipulation.



**Fig. 1.** Aggression (noise blast) as a function of trait physical aggression and condition. The lines are regression slopes for the simple effects demonstrating that in the control condition participants high in trait physical aggression were more aggressive than those low in trait physical aggression. For those in the SCT condition, individual differences in trait physical aggression did not influence aggressive behavior.

### 3.2. Aggressive behavior

There were no gender differences in aggressive behavior,  $F < 1$ , and controlling for gender revealed an identical pattern of results. We therefore collapsed across gender. There was also no main effect of SCT,  $F(1, 68) = 1.80$ ,  $p = .18$ . However, because SCT was expected to be most beneficial for those who have trouble controlling aggressive behavior, we conducted hierarchical regression analyses to examine the moderating effects of SCT and trait aggression on aggressive behavior.

At the first step, the dummy coded SCT variable (0 = SCT, 1 = control) and mean-centered AQ physical aggression scores were entered into the model,  $R^2 = .05$ . Neither variable was a significant predictor of aggressive behavior,  $ps > .15$ . However, as expected, at the second step the two-way interaction term (i.e. AQ physical aggression  $\times$  SCT), revealed a significant interaction,  $\beta = .36$ ,  $t(66) = 2.15$ ,  $p = .04$ ,  $\Delta R^2 = .06$ . Follow-up analyses showed that trait aggression was positively correlated with aggressive behavior in the control condition,  $r = .39$ ,  $p = .02$ , but not in the SCT condition,  $r = -.12$ ,  $p = .50$ , (Fig. 1). The correlations with all the AQ subscales are presented in Table 1.<sup>1</sup>

### 3.3. Angry affect

Participants reported less anger in the SCT ( $M = 2.44$ ,  $SD = 1.20$ ) than those in the control condition ( $M = 3.28$ ,  $SD = 1.29$ ),  $F(1, 68) = 7.78$ ,  $p = .007$ ,  $d = -.67$ . This difference remained significant even when controlling for trait anger,  $F(1, 67) = 9.70$ ,  $p = .003$ . Self-reported angry affect was positively correlated with aggressive behavior in the control condition,  $r = .62$ ,  $p < .001$ , but not in the SCT condition,  $r = .27$ ,  $p = .11$ . Moreover, these relationships remained stable even when controlling for trait physical aggression: control,  $r_{\text{partial}} = .60$ ,  $p < .001$ ; SCT,  $r_{\text{partial}} = .28$ ,  $p = .10$ . There was no SCT  $\times$  AQ interaction.

## 4. Discussion

The present research is the first to demonstrate the effectiveness of SCT in reducing aggressive behavior among individuals high in trait

<sup>1</sup> We re-ran the analyses with the six participants that missed more than half the SCT included. The correlations between the AQ subscales and noise blast in the SCT condition remained non-significant, although the correlation between the AQ verbal aggression subscale and noise blast approached significance,  $r = .26$ ,  $p = .08$ . All other  $r$ s were between  $-.06$  and  $.07$ ,  $ps > .63$ .

aggression. Specifically, using one's non-dominant hand to complete common tasks for 2 weeks reduced aggression among aggressive individuals. The results are consistent with the strength model of self-control as well as prior work broadly examining the effects of SCT on non-aggression related domains (Baumeister et al., 2006, 2007). According to the strength model, self-control can be acutely depleted by engaging in an act of self-control but can increase over time with practice. Thus, the self-control exerted by using one's non-dominant hand is thought to have bolstered self-control capacity.

The pattern of results for the aggression data is identical to our prior work examining the effects of acute glucose consumption on aggression (Denson et al., 2010). Thus, both practicing self-control and consuming glucose assist those high in trait aggression in restraining aggressive impulses when provoked. Although the behavioral effects of SCT and glucose may be identical, the underlying mechanisms may differ. Glucose consumption does not appear to reduce aggression by altering affective reactions to provocation (e.g., Denson et al., 2010); yet in the present study, participants in the SCT condition reported less anger than participants in the control condition. Anger in the SCT condition was uncorrelated with aggressive behavior, but not so in the control condition. Taken together, these data suggest that SCT may reduce aggression by increasing anger regulation capacity, whereas glucose might exert its effects via a different mechanism. For instance, glucose consumption can increase working memory capacity (Martin & Benton, 1999; Stephens & Tunney, 2004; Sünram-Lea, Foster, Durlach, & Perez, 2002). Thus, glucose may reduce aggression via increased working memory capacity, which allows one to maintain and follow through with the goal of behaving in a normative, non-aggressive manner. Suggestive evidence for a different mechanism underlying SCT comes from Muraven (2010a) who found improvement on a test of inhibitory control among participants who practiced self-control. Thus, whereas both glucose and SCT reduce aggression in aggressive individuals, the underlying executive control processes may differ. Future work should examine possible underlying mechanisms.

One interesting aspect of the present research is that SCT decreased anger for participants at the group level but aggression only for those high in trait aggression. This is likely because provocation increases anger in most participants, but only those high in trait aggression have difficulty restraining anger-driven aggressive impulses. In addition, because we relied on self-reported anger, it is possible that SCT reduced the expression of anger – be that the willingness to report anger or aggressive behavior – rather than the experience of anger per se. Future work incorporating indicators of sympathetic nervous system activation would assist in this regard.

Although future research with violence-prone samples is necessary, these data suggest that SCT may eventually form a part of aggression reduction programs. SCT with the non-dominant hand paradigm is inexpensive and does not rely on a high level of cognitive ability to implement. As such, it could be particularly helpful in boosting self-regulatory resources among aggressive individuals.

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