# Reflecting on past failures leads to increased perseverance and sustained attention

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# Reflecting on past failures leads to increased perseverance and sustained attention

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Psychology has struggled for years to define the traits and tendencies that make an individual successful. Past research has focused on intelligence. Recently, there has been a focus on perseverance or "grit". We set out to examine the extent to which grit exhibits state-like facets and the relation between manipulations of grit and performance. Results from the first experiment provide evidence that reflecting on failures results in higher grit scores than reflecting on success. The second experiment extends the failure–grit relationship to explore how this relation might modify performance: Encouraging individuals to reflect on failures resulted in a significant reduction in error rates on a cognitive task requiring perseverance. Together, these results provide support for the idea that grit exhibits state-like tendencies, and that encouraging individuals to reflect on failures may result in improved behavioural outcomes.

One of the most enduring questions in psychology is what variables predict success. Much of the research on traits that are related to success, or the achievement of goals, has focused on IQ (Cattell, 1963; Neisser et al., 1996; Terman, 1925; Wechsler, 1981). Other factors, such as genetics (Plomin & Spinath, 2004), standardised tests (i.e. Scholastic Aptitude Test (SAT), Graduate Record Examinations (GRE); Bridgeman, McCamley-Jenkins, & Ervin, 2000; Kuncel, Hezlett, & Ones, 2001), working memory capacity (Kane, Hambrick, & Conway, 2005) and measures of self-control (Tangney, Baumeister, & Boone, 2004), have also been examined as possible predictors of cognitive achievement. However, it has long been thought that much of the variance in success exhibited by normal individuals might be predicted by attitudes, or personality traits, more than ability (James, 1896).

The idea that the trait of perseverance is critical to success has long held sway in sports; as noted by Chicago Bears coach Mike Ditka, "You're never a loser until you quit trying". In psychology, there has been renewed interest in the personality trait of perseverance or tenacity in the face of adversity as a predictor of lifelong success. A measure of perseverance termed *hardiness*—the courage to regard extenuating circumstances as opportunity—was found to predict performance of first year military cadets at West Point Academy (Maddi, Matthews, Kelly, Villarreal, & White, 2012). Duckworth and colleagues also measured a personality

trait similar to hardiness called *grit*—perseverance and passion for long-term goals—and found grit to be a better predictor of college grade point average (GPA) (Study 3; Duckworth, Peterson, Matthews, & Kelly, 2007), military academy attrition rates (Study 4; Duckworth et al., 2007), adult achievement of certain types of goals (Study 2; Duckworth et al., 2007) and elementary school spelling bee study diligence (Study 6; Duckworth et al., 2007) compared to cognitive measures such as IQ or performance on standardised tests such as the SAT. The Grit Scale developed by Duckworth and colleagues (2007) is a 12-item self-report measure (8-item for children) in which scores range from 1 to 5, 5 being the most "gritty". The Grit Scale contains two facets: *Consistency of Interest* and *Perseverance of Effort*. For example, "I often set a goal but later choose to pursue a different one" is an item in the *Consistency of Interest* subscale, whereas "I am diligent" is one item in the *Perseverance of Effort* subscale. Although these subscales are highly correlated ($r = .59$, Duckworth & Quinn, 2009), recent work has suggested that these two facets of grit may be differentially related to behaviours indicative of high grit. For example, Duckworth and Quinn (2009) found that *Consistency of Interest* was strongly predictive of career consistency, whereas *Perseverance* was predictive of GPA. Furthermore, recent work in regards to psychophysiological measures found that greater physiological expenditure was positively correlated with scores on the *Perseverance of Effort* subscale, whereas these measures were negatively correlated with the *Consistency of Interest* subscale (Silvia, Eddington, Beaty, Nusbaum, & Kwapil, 2013).

Previously, grit has been shown to correlate with several of the Big Five personality traits: conscientiousness, agreeableness, extraversion and openness to experience positively correlate with grit, whereas neuroticism is negatively correlated (Duckworth et al., 2007). One interpretation of this finding is that grit is related to a host of socially valuable traits, in the same way that IQ is related to positive outcomes on many academically relevant measures such as SAT scores (Frey & Detterman, 2004). Alternatively, a social desirability bias may underlie the identified relationship between grit and the endorsement of other positive Big Five traits. Thus, we conducted a pilot study in order to explore the relation between grit and other traits and tendencies as well as the role that social desirability may play in any of these relationships (see Supplementary Material). Because the most desirable responses are

relatively transparent in the Grit Scale, we were concerned that subjects might skew their answers to make themselves appear in a more positive light. In brief, we found that partialing out variance between grit and social desirability eliminated the relation between grit and many of the traits and tendencies assessed in our pilot study. Importantly, we found that the positive correlation between grit and the (self-reported) reduced tendency to mind wander remained significant even after controlling for social desirability scores, suggesting that gritty individuals may engage in lower levels of mind-wandering.

Given the importance of this personality trait for success, one might wonder about ways in which to make people "grittier", either over the long-term or for shorter, transient periods. For example, there may be periods when high levels of perseverance and focused concentration on a single topic might have a high payoff, such as before a big test or a job interview. Although both personality and cognitive traits exhibit stability within individuals over long timescales (Roberts & Del-Vecchio, 2000), it also appears possible to influence the state presentation of many of these traits and abilities. For example, recent research has demonstrated flexibility in relatively fixed cognitive and social faculties. Working memory (Morrison & Chein, 2011), delay discounting (Kim, Seligman, & Kable, 2012), executive functioning (Karbach & Kray, 2009) and social responsiveness (Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012) are all traits and abilities that appear to be at least partially subject to manipulation.

With respect to the flexibility of motivation specifically, previous research suggests that mental (Boksem, Meijman, & Lorist, 2006; Lorist et al., 2009) and physical (Beckers, 2008) fatigue can affect motivation on a task. For example, self-control is known to rely on a limited pool of resources (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Vohs & Faber, 2007; Vohs & Heatherton, 2000), potentially leading to mental fatigue after self-control has been exhausted. However, practicing self-control has been shown to increase self-control on a task (Muraven, 2010; Muraven, Baumeister, & Tice, 1999). Furthermore, previous research has suggested one can improve self-control after ego depletion by inducing positive affect (Tice, Baumeister, Shmueli, & Muraven, 2007), again suggesting that there is some flexibility regarding one's self-control "set point". Moreover, there is evidence that people can become "hardier" through training. In one such study,

individuals were asked to identify current stressors and practice various coping methods. Those that received training aimed at improving hardiness reported greater job satisfaction, less strain and illness severity than controls or those trained in meditation (Maddi, Kahn, & Maddi, 1998). These findings suggest that there are at least some aspects of hardiness, and potentially grit, which may be malleable. However, although the concept of grit and perseverance seem crucial to success, the idea that some aspects of grit may be flexible has remained relatively unexplored.

We conducted a study aimed at altering self-reported grit (Experiment 1), as well as a study aimed at examining how manipulations of self-reported grit might affect performance on a cognitive task requiring endurance (Experiment 2). Although previous research has found that self-control, ego depletion and even mental fatigue can affect performance on a monotonous task, the extent to which reflecting on past experiences can affect perseverance on a task has been relatively unexplored (but see Maddi et al., 1998), leaving many questions unanswered about cognitive mechanics of perseverance that underlie greater achievement and the manipulability of these processes. In addition, it is not well understood how perseverance on a task requiring endurance might relate to moment-by-moment fluctuations in cognitive processes such as attention and cognitive control in service of achieving a goal.

## EXPERIMENT 1

Experiment 1 was conducted to explore the idea that grit might have "state"-like tendencies in addition to the more widely discussed stable, trait-like aspects. Similar dimensions of state and trait have been exhibited in disparate domains such as anxiety (Bernstein & Eveland, 1982), social responsiveness (Chevallier et al., 2012), self-regulation (Gailliot, Schmeichel, & Baumeister, 2006) and stereotype threat (Stone, Lynch, Sjomeling, & Darley, 1999). On the whole, these studies suggest that, while trait-level biases exert a strong effect on outcomes, manipulation at the state level can exacerbate (Bernstein & Eveland, 1982; Gailliot et al., 2006; Stone et al., 1999) or temper (Pennebaker, 1997) the extent to which the stable trait is exhibited.

We hypothesised that, if grit does in fact possess state tendencies, putting individuals in a "gritty" state would lead to significantly higher self-reported grit scores compared to a control condition. In an attempt to induce a gritty state, we asked randomly assigned participants to reflect on and write about a difficult time in which they succeeded or a difficult time in which they had failed (as well as a control condition), and then immediately after, complete the Grit Scale (Duckworth et al., 2007). The writing manipulation was adopted from Pennebaker's (1997) writing manipulation that asked individuals to reflect on past traumas. This manipulation has previously been shown to reduce anxiety about a traumatic experience. Moreover, others have used similar writing manipulations in regards to "ego threat" (Baumeister, Heatherton, & Tice, 1993; Bushman & Baumeister, 1998; Stucke & Sporer, 2002), defined as a threat which results in diminished self-esteem (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). Based on this prior work, we expected that our writing manipulation would be powerful enough to allow us to observe significant group differences in grit scores, above and beyond participant-level variance in trait-level grit or current mood. Due to previous research regarding "stereotype threat" (Bernstein & Eveland, 1982; Gailliot et al., 2006; Ramirez & Beilock, 2011; Stone et al., 1999), which has found that reminding individuals of their negative stereotype can reduce performance, we expected that individuals who were forced to be reminded of and reflect on a major previous failure would score the lowest on the Grit Scale, whereas individuals who reflected on a difficult time in which they succeeded would score highest.

## Method

*Participants.* Two hundred and twenty-seven participants were recruited to complete the experiment online via SurveyMonkey. Of this group, 37 failed to complete the survey, 47 subjects were excluded for time (see Measures), and 2 subjects were excluded for failing to follow the prompt, leaving 141 participants with usable data (mean age = 20.74, SD = 2.75, 76 females). There was no significant difference in drop-out rates between conditions. There were 47 participants in each group. Participants were awarded a half credit hour for their participation.

*Measures.* Participants were randomly assigned to one of three groups in which they were asked to write about: (1) a difficult time they persevered and subsequently succeeded (the "success" condition);

(2) a difficult time they persevered and subsequently did not succeed (the "failure" condition); or (3) the plot of a recent movie they watched (the trivial or control condition). Participants were asked to complete a 10-minute writing task online via SurveyMonkey. For example, an individual who was asked to write about a difficult time in which they succeed wrote about effort expended to pass a very difficult class, whereas an individual asked to write about failures chose to write about not making a sports team. Also, whereas individuals in the control condition could have described a movie that may have more or less characterised the idea of grit, it seemed likely that the key to the manipulation seems to be the reference to self. Although research has shown that online results do not vary significantly from in-lab results (Dandurand, Shultz, & Onishi, 2008), responses were checked for quality, compliance with tasks instructions, and to make sure those who were assigned to write about a success truly wrote about a success (instead of a failure) and vice versa. Exclusion criteria were not following the assigned prompt, as well as writing for less than 7 minutes or greater than 13 minutes in order to control for potential timing effects across all samples. After the writing exercise was completed, participants filled out the Grit Scale (Duckworth et al., 2007).

## Results and discussion

A between-subjects analysis of variance (ANOVA) comparing grit scores following the three different writing manipulations revealed a significant difference between scores, $F(2, 138) = 4.99$, $p = .008$, $\eta_p^2 = 0.23$. A post-hoc least significant differences test revealed that individuals who focused on failures exhibited higher grit scores ($M = 3.35$, $SD = 0.56$), compared to individuals who wrote about a difficult time in which they succeeded ($M = 3.03$; $p = .003$, $SD = 0.55$). Although individuals who reflected on failures also reported higher grit scores than those who reflected on a trivial topic ($M = 3.27$, $SD = 0.62$), this finding was not significant ($p > .25$). However, when comparing the grit scores of individuals who reflected on a trivial topic with those who reflected on a difficult time in which they succeeded, the result was significant ($p = .022$).

Although previous research has found that the two different facets of grit correspond differently to behaviour (see Silvia et al., 2013), a betweensubjects ANOVA yielded similar differences among groups both on the *Perseverance of Effort*, $F(2, 138) = 5.17$, $p = .007$, $\eta_p^2 = 0.25$, and *Consistency of Interest* subscales, $F(2, 138) = 4.69$, $p = .011$, $\eta_p^2 = 0.17$), with similar least squares difference test results across groups. Similar to the findings reported by Duckworth and Quinn (2009), the two subscales were highly correlated in our sample ($r = .41$, $p < .001$), though our sample scored significantly higher on the *Perseverance of Effort* subscale ($M = 1.88$, $SD = 0.35$) than the *Consistency of Interest* subscale, $M = 1.51$, $SD = 0.33$ $t(140) = 11.75$, $p < .011$. This difference could be due to the usually short career length of undergraduates and the characterisation of adolescence as a time to "find oneself" potentially leading to changes in major, career goals and consideration of personal goals and values (Steinberg & Silverberg, 1986).

Unlike the physical task implemented by Silvia and colleagues (2013), we did not have an additional measure of behaviour to relate to grit; we randomly assigned participants to a writing manipulation and then had them complete the grit questionnaire. It appears that our writing manipulation was salient enough to significantly influence self-reported scores. These results suggest that reflecting on past experiences can influence grit scores.

Counter to our hypothesis, individuals who reflected on failures actually reported the highest grit scores; meanwhile, individuals who reflected on a difficult time in which they succeeded exhibited the lowest grit scores. Although this finding may be surprising, Ramirez and Beilock (2011) found a similar pattern: when asking students in a high pressure testing situation to reflect on their anxious feelings (rather than a mundane event in one's life), these students showed improvement in test scores. This suggests that reflecting on unpleasant experiences may allow us to recast or reframe the negative experience to make the experience more constructive. It is possible that reflecting on a failure increases perceived perseverance, whereas reflecting on successes can actually deflate self-reported grit scores, especially since there was no significant difference between the grit scores of individuals in the failure condition and individuals in the control condition. Perhaps reflecting on a difficult time in which an individual succeeded causes one to focus on the end result of their effort rather than the experience of exerting effort itself. Conversely, it is possible that reflecting on failures causes individuals to focus on the immense amount of effort needed to succeed, instead of reflecting on the end

result of the effort. Most often, reflecting on personal failures is not a positive experience for individuals. Perhaps to then assuage a negative self-image, people may focus on positive qualities in order to prevent more failures in the future. When thinking about a difficult time in which one succeeded may be a simpler and transient experience, it appears that reflecting on failures may allow individuals to focus and acknowledge the crucial personal qualities and effort required for perseverance in order to succeed.

## EXPERIMENT 2

The results of Experiment 1 provided the justification for using the success/failure writing manipulation in Experiment 2. The goal of this experiment was to test the hypothesis that reflecting on past experiences could have an effect on grit (in this case, represented by performance on a cognitive task requiring perseverance) regardless of inherent traits and current mood state. The writing manipulation described in Experiment 1 was again employed here: Individuals were assigned to either reflect on a task in which they either succeeded or failed, or to reflect on the plot of a recently viewed movie. Following the writing manipulation, participants completed a sustained attention to response task (SART). The SART was chosen because it is a relatively long and boring task that requires a period of focused attention to succeed. Since individuals who reflected on failures exhibited the highest grit scores in Experiment 1, we expected individuals who reflected on failures to demonstrate the "grittiest" performance (e.g., the highest accuracy) since our task required sustained, focused attention. Furthermore, in our pilot study, we found that the trait of grit was negatively correlated with a trait tendency to mind-wander. The SART has also previously been used as a lab task to promote mind-wandering (McVay & Kane, 2009). Based on the results from our pilot study, we expected those demonstrating the most perseverant performance would also exhibit the lowest amount of self-reported mind-wandering.

## Method

*Participants.* Participants were 73 undergraduate students (mean age = 20.91, *SD* = 3.95, 54 females).

*Manipulation.* Upon arrival at the laboratory, participants were asked to perform the 10-min writing exercise as described in Experiment 1. Responses were again examined for compliance with the prompt (see requirements in Experiment 1), and one participant was excluded for not following the prompt correctly, leaving us with a final sample of 72 subjects (24 participants in each group). Participants then performed a variant of the SART (Robertson, Manly, Andrade, Baddeley, & Yiend, 1997) task lasting about 40 min. The design was as follows: Letters appeared on a computer screen, and participants were asked to press the spacebar for every letter except vowels (all letters were included in the sample except the letter "y" in order to prevent confusion). Participants were given up to 2 s to respond, and each participant completed 625 trials (500 trials consonants, 125 trials vowels). Errors of both commission (i.e. pressing when withholding a response was the appropriate action) and omission (i.e. failing to press the spacebar when it was required) were recorded; however, overall errors were the outcome of interest.

In addition, mind-wandering probes were also included. On 60% of vowel trials, participants were randomly prompted by an inquiry related to mind-wandering (following the design of McVay & Kane, 2009), in which they were asked to press: (1) if they were thinking about the task; (2) if they were thinking about task performance; (3) if they were thinking about recent or impending life tasks or events; (4) if they were thinking about their current conditions such as boredom or hunger; (5) if they were thinking about personal worries; (6) if they were daydreaming about fantasies apart from reality; and (7) for other thoughts. Participants completed 75 mind-wandering probes total. Response (1) was coded as an on-task thought; responses of (3–7) were coded as off-task. These probes and coding scheme follow directly from McVay and Kane (2009). Like McVay and Kane (2009), Response (2) was dropped from analysis because, although it was a sensible option to include in order to completely characterise participants' internal thoughts during the task, their data—as well as ours—suggested that Response (2) did not completely illustrate either on-task or mind-wandering thoughts, but instead another type of thought processing entirely. Further, Smallwood, Riby, Heim, and Davies (2006) found that task-related inferences resulted in significant differences in task performance as compared to

on-task and off-task responses. Therefore, although it was important to include this option in the probe to address a wide variety of possibilities, the correct categorisation for this response type as on- or off-task remains unclear. Task depiction and the mind-wandering probe can be seen in Figure 1. Based on our findings from Experiment 1, we expected that individuals in the failure group would perform the "grittiest" and, therefore, report the least amount of mind-wandering tendencies and fewer errors than the other groups.

## Results and discussion

The dependent measure of interest on the SART was number of errors. Although some previous work has focused solely on errors of commission rather than overall accuracy since omission errors tend to be at ceiling (Manly, Robertson, Galloway, & Hawkins, 1999; McVay & Kane, 2009; Smallwood et al., 2006), other research has examined overall error rate as their depend measure of interest (Robertson et al., 1997). Since we were examining overall perseverance and attention on the task and not ability to inhibit, we expected our manipulation to affect both errors of commission as well as errors of omission (but see Table 1 for differences in error rates). Furthermore, the qualitative pattern of our results examining only errors of commission was similar to that reported for overall error rates. Therefore, we examined total errors on the task. Data are shown in Figure 2a.

A between-subjects ANOVA comparing the error profiles of all three writing groups revealed a significant difference, $F(2, 69) = 3.315$, $p = .042$, $\eta_p^2 = 0.09$. Based on the results of Experiment 1, we hypothesised that there would be significant differences among the error rates of the three writing groups, and so a post-hoc least significant differences test was used to compare the results of the three groups. Individuals who reflected on a difficult time in which they failed had fewer errors than those who reflected on a difficult time in which they succeeded ($M$ failure = 13.54, $SD = 8.8$; $M$ success = 23, $SD = 15.7$; $p = .025$) or trivial topics ($M = 22.50$, $SD = 17.0$; $p = .034$). There were no other significant effects related to performance on the task.

Furthermore, a paired-samples $t$-test revealed that individuals who reflected on successes experienced significantly greater errors in the second half of the SART ($M = 15.04$, $SD = 12.19$) when compared to the first half of the SART, $M = 4.54$, $SD = 5.48$; $t(24) = -3.037$, $p = .006$, $d = 1.111$. Individuals who reflected on a trivial topic also had significantly fewer errors in the first half of the SART ($M = 3.48$, $SD = 7.93$) compared to the second half, $M = 12.74$, $SD = 10.19$; $t(24) = -3.472$, $p = .002$, $d = -1.014$. However, individuals who reflected on failures did not experience a significant difference over the course of the experiment, mean difference = 0.78, $SD = 5.80$, $t(24) = -1.302$, $p = .206$, $d = -0.157$, suggesting that individuals who reflecting on failures were more likely to persevere through the entirety of the task (Table 2).

With respect to mind-wandering probes, there were no significant differences between mean proportions of self-reported percentage of time spent mind-wandering across writing groups, $M$ failure = .73, $SD = 0.25$; $M$ success = .73, $SD = 0.27$; $M$ control = .62, $SD = 0.29$; $F(2, 69) = 0.332$, $p = .719$. In accordance with the design of McVay and Kane (2009), Response (1) was coded as being on task, whereas Responses (3–7) were recorded as off-task. See Figure 2b for depiction. Furthermore, additional analyses examining group differences among mind-wandering prompts did not reveal significant differences. Results of these analyses are depicted in Table 3.

To further characterise mind-wandering in our sample, an analysis of the variability in reaction time (RT) was performed. RTs have been previously examined as an implicit marker of mind-wandering; higher rates of variability are thought to indicate greater degrees of mind-wandering (Rosenberg, Noonan, DeGutis, & Esterman, 2013). However, an analysis of each individual participant's standard deviation of RTs indicated no significant difference across writing groups ($p = .730$). This finding, as well as the previous finding about self-reported mind-wandering, suggests that all groups faced the same mind-wandering tendencies throughout the task. Yet, since individuals who reflected on a failure exhibited the least number of errors on the SART, this finding suggests that individuals who focused on a difficult time in which they failed—as opposed to a difficult time in which they succeeded or a trivial topic—are better at reallocating their attention towards a task requiring perseverance.

Furthermore, an ANOVA comparing the average RTs of all three writing groups revealed significant differences, $F(2, 69) = 3.224$, $p = .046$, $\eta_p^2 = 0.09$. Individuals who reflected on a failure exhibited the slowest RTs ($M = 606.203$ ms,
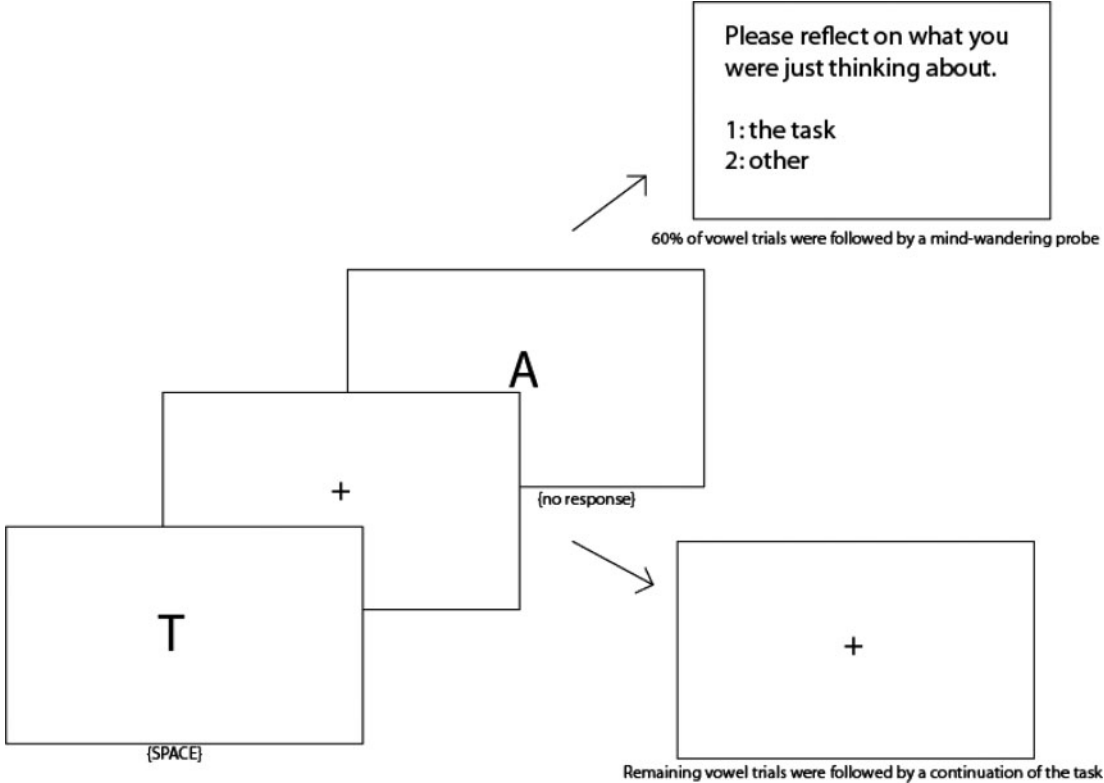
**Figure 1.** SART depiction and mind-wandering probe. Subjects were asked to reflect on thought content throughout the SART. For the complete set of mind-wandering choices, see Experiment 2, Methods.

$SD = 119.04$), compared to subjects who reflected on a success ($M = 590.276$ ms, $SD = 91.95$; mean difference $= 15.927$, $p = .022$) and individuals in the control group who reflected on a trivial topic ($M = 599.918$, $SD = 90.07$; mean difference $= 6.285$, $p = .047$) as revealed by the least significant difference test. There was no significant difference between the RTs of individuals who reflected on successes and those who reflected on a trivial topic

**TABLE 1**
Types of errors across conditions

| Condition | Error type | | |
| --- | --- | --- | --- |
| | Omission errors | Commission errors | Total |
| Success | 4.52 | 18.48 | 23.00 |
| Failure | 2.71 | 10.83* | 13.54* |
| Control | 3.48 | 19.02 | 22.50 |

Individuals who reflected on past failures exhibited the lowest number of both commission and omission errors on the SART. There was no significant difference between the error rates of those who reflects on successes and the error rates of controls.
*Significant at a $p < .05$ level.

($p = .748$). Therefore, individuals who reflected on failures exhibited increased accuracy at the cost of not responding as quickly as the other groups. In other words, as a group, participants in the failure condition exhibited a more deliberate and conservative response strategy, suggesting that these individuals may have placed a premium on performing the task to a high level rather than speed of response.

Together, these results suggest that reflecting on different types of past experiences can significantly alter performance on a sustained attention task. The failure group exhibited significantly better performance (i.e., highest accuracy) on a long, dull, attention task compared to both the success condition and the control condition. In contrast, thinking about a difficult time in which success was the outcome led to a numerically higher error rate on the same task. These data provide a novel link between the personality construct of perseverance and cognitive performance; our findings suggest that reflecting on failures causes an individual to exert greater effort in order to counteract a perceived disparity.
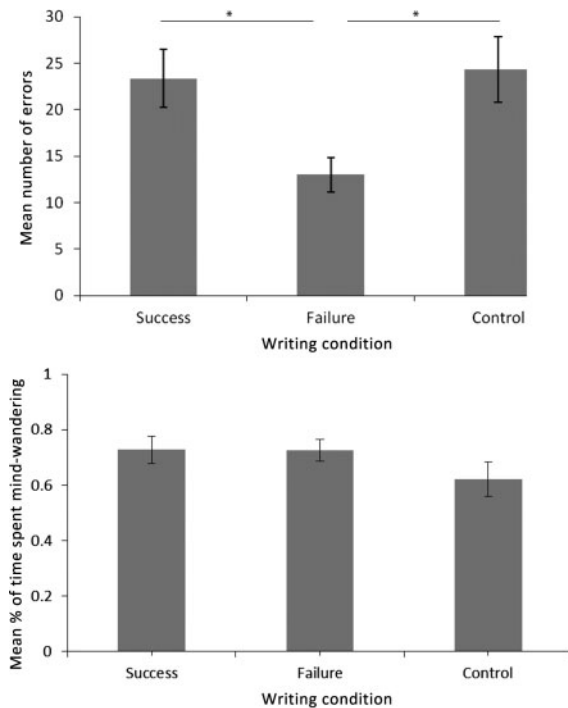
**Figure 2.** (a) SART errors across writing conditions. Individuals who reflected on past failures exhibited the lowest number of total errors (of both commission and omission) on the SART. There was a significant difference in the average number of errors of the failure group and the average number of errors of the success group, as well as the errors of the failure group and errors of the control group. There was no significant difference between the error rates of those who reflects on successes and the error rates of controls. (b) Reported mind-wandering across writing conditions. There was no significant difference in mind-wandering tendencies across the three writing groups. Error bars on both (a) and (b) reflect standard errors of each writing group's mean.

Although our results suggest that reflecting on failures indeed results in improved performance, it is important to note the existence of the possibility of a speed-accuracy tradeoff (Fitts, 1966), especially considering that individuals who reflected on failures exhibited the slowest RTs. Since those in the failure group showed the lowest error rates on

the SART, participants in the failure condition may have placed greater emphasis on accuracy than speed. Although individuals who reflected on failures could excel at the task simply because they are trading speed for accuracy, it is appropriate to speculate that our manipulation could have increased the importance of doing well on the task, causing participants to be more cautious about their performance. In support of this idea, a review by Baumeister and colleagues (2001) suggested that individuals process negative events more thoroughly than positive events. Therefore, our participants could have exhibited slowed RTs on the SART because of more lengthy processing effects of the failure vs. other conditions. In other words, it is possible that slowed RTs in the failure condition reflect not specifically a speed-accuracy tradeoff, but instead are related to continued processing of the failure event, extending into the time allocated in our study for doing the SART. Future work utilising signal detection measures or allowing different amounts of "processing time" after each writing manipulation is necessary to follow up on these speculations.

However, because the task was long, easy and tedious, all groups exhibited high rates of mind-wandering ($M = 0.69$, $SD = 0.27$). Yet, the failure group had the lowest error rate on the task *in the face of* high rates of mind-wandering, suggesting that the failure group was able to better manage or disengage from off-task thoughts.

## GENERAL DISCUSSION

The trait of persevering in the face of adversity, or grit, correlates with success and achievement of long-term goals (Duckworth et al., 2007). Here, we extend prior research on this topic by showing that (1) the measurement of grit by the Grit Scale is heavily influenced by social desirability bias; (2) that grit exhibits state-like attributes because it is

TABLE 2
Mean errors in each half of experiment

| Condition | First half | Second half | p |
|---|---|---|---|
| Success | 4.52 | 15.04 | .006** |
| Failure | 6.38 | 7.16 | .213 |
| Control | 3.48 | 12.74 | .002** |

Individuals who reflected on past successes or a trivial topic experienced significantly greater errors on the SART in the second half of the experiment. However, there was no significant difference for individuals who reflected on failures, suggesting that these individuals were more perseverant on the task.

**Significant at a $p < .01$ level.

**TABLE 3**
Mean proportion (percentage) of each mind-wandering response across each writing condition

| | | | Writing condition | | |
|---|---|---|---|---|---|
| Response | F(2, 69) | p | Success M (SD) | Failure M (SD) | Control M (SD) |
| MW1 | 0.478 | .622 | .280 (.226) | .307 (.183) | .351 (.240) |
| MW2 | 1.025 | .364 | .102 (.144) | .103 (.144) | .061 (.061) |
| MW3 | 1.176 | .315 | .086 (.069) | .052 (.161) | .043 (.063) |
| MW4 | 0.057 | .945 | .347 (.278) | .322 (.240) | .336 (.229) |
| MW5 | 0.403 | .670 | .058 (.136) | .042 (.139) | .071 (.107) |
| MW6 | 0.053 | .949 | .052 (.099) | .045 (.044) | .046 (.078) |
| MW7 | 0.089 | .915 | .109 (.196) | .095 (.105) | .092 (.125) |

There were no significant differences in the self-reported percentage of time spent thinking about each of the seven prompt choices.

experimentally malleable; and (3) that there is an inverse relationship between grit and mind-wandering.

Many traits have state characteristics (Bernstein & Eveland, 1982; Chevallier et al., 2012; Karbach & Kray, 2009; Kim et al., 2012; Morrison & Chein, 2011; Poorman, Mastorovich, Molcan, & Webb, 2009), but this idea had yet to be examined in the context of state and trait perseverance. Experiment 1 was designed to assess whether grit scores can be manipulated in a state-like manner by having individuals write about, and reflect upon, their past experiences. Surprisingly, reflecting on past failures improved self-reported grit scores to a greater degree than both reflecting on successes or something trivial. It is important to begin to explore the state aspects of grit in order to capitalise on the extent to which perseverance can be "ramped up" in populations that would benefit from exhibiting high levels of grit (students, cadets, employees, etc.). Future research may explore alternate ways in which the state aspects of perseverance can be positively affected in order to maximise this feature of function in individuals in many different domains.

Since the results of Experiment 1 suggested that there may be state aspects of grit, Experiment 2 tested whether the same writing task that altered grit scores in Experiment 1 could acutely alter perseverance on a cognitive task requiring endurance. The results showed that individuals who reflected on past failures exhibited superior accuracy on this task in comparison to both the success and control conditions. Furthermore, individuals who reflected on failures did not experience a drop in performance as the task went on, common with fatiguing tasks that result in ego depletion (Baumeister, et al. 1998; Vohs & Faber, 2007;

Vohs & Heatherton, 2000). Because the task was long, easy and tedious, all groups exhibited high rates of mind-wandering. Interestingly, the failure group was able to perform the task more successfully than the other conditions *in spite of* high rates of mind-wandering. This suggests that the failure group was able to better manage off-task thoughts or better able to disengage from off-task thinking (see Levinson, Smallwood, & Davidson, 2012 for a similar discussion of the relation between high working memory capacity [WMC] and mind-wandering) suggesting that individuals who reflected on failures were more focused, effortful and persistent at the SART, indicative by their greater success on the SART compared to other groups. Furthermore, Stawarczyka, Majerus, Catale, and D'Argembeau (2014) found that individuals with lower SART performance did exhibit lower attentional control abilities and greater distractions from irrelevant environmental stimuli, but did not report significantly greater mind-wandering episodes. This finding suggests that the *frequency* of mind-wandering episodes is not likely to influence how perseverant an individual is on a task requiring sustained attention. In our data-set, individuals who reflected on failures were not significantly more likely to report being distracted by worries. While this task was chosen in order to produce a high rate of off-task thought, future research in this vein may want to employ a slightly more interesting or challenging context in which to probe mind-wandering in order to encourage greater variance in self-reported mind-wandering.

Although it may have been useful to control for an individual's inherent perseverant tendencies using the Grit Scale and the SART in the same experiment in order to account for variance in

inherent grit, since the Grit Scale tends to be relatively transparent, we were concerned that including the Grit Scale before the writing manipulation could increase participants' awareness of the hypotheses being tested in Experiment 2. Experiment 2 was concerned with altering performance on a task requiring persistence by random assignment to a writing condition meant to influence state-level facets of grit, *regardless* of their stable trait-like tendencies. Since reflecting on failures had an effect on grit scores in Experiment 1, we expected that asking individuals to reflect on failures would increase accuracy on a task requiring sustained attention. However, future research may want to also control for variance in trait perseverance by conducting a longitudinal study. For example, a future study could have participants complete the Grit Scale several months before participating in a writing manipulation similar to the paradigm used in Experiment 2. Then, participants could complete the Grit Scale after the writing manipulation and a SART or other challenging task. Researchers could then examine whether those within the failure condition are temporarily "changing" their grit level as well as performing better on the SART, or if these effects are truly independent.

The finding that reflecting on past failures, and not successes, leads to highest self-reported grit scores, and improved performance on a boring task is a bit surprising: after all, previous research has suggested that acknowledging an individual's shortcomings can produce poor performance on a cognitive (Spencer, Steele, & Quinn, 1999; Stangor, Carr, & Kiang, 1998; Steele & Aronson, 1995) or physical task (Baker & Horton, 2003; Beilock & McConnell, 2004; Chalabaev, Sarrazin, & Fontayne, 2009). However, cybernetic theory suggests individuals interact with their environments via corrective feedback loops, adjusting their behaviour to correct disparities in their environment (Ashby, 1966; Wiener, 1948). After subjects in our study were reminded of a previous failure, they could have felt the desire to increase their performance in order to prevent another failure.

In regards to cognition, research has suggested that making mistakes on a task can lead to greater recruitment of attentional resources, which has been observed at both the levels of behaviour as well as brain activity in regions known to be related to increases in attentional control (Botvinick, Cohen, & Carter, 2004; Kerns et al., 2004; King, Korb, Von Cramon, & Ullsperger, 2010). Furthermore, Schmeichel and Vohs (2009) found

that practicing self-affirmation—tasks that lead to a boost in perceived self-image (Steele, 1988)—reverses the effects of ego depletion, a common occurrence with long tasks requiring perseverance (Baumeister et al. 1998; Vohs & Faber, 2007; Vohs & Heatherton, 2000). Although the writing manipulation in our task that had subjects reflect on failures appears to be quite the opposite of self-affirmation, Lydon and Zanna (1990) found that when individuals are pursuing a goal that they value, experiencing adversity in their pursuit further increased an individual's commitment to that goal. Also, previous literature regarding goal pursuits found that individuals high in goal commitment reported they would be more likely to exert effort towards a task when that goal was farther from reach (Fishbach & Dhar, 2005; Koo & Fishbach, 2008). Although we would expect goal commitment to our simple laboratory experiment to be low, reflecting about failures could increase desire to exert greater effort towards any immediate goal. We also note that a prior study found that college students at an Ivy League school with low SAT scores tended to have higher grit scores and higher GPAs (Study 3, Duckworth et al., 2007) compared to their classmates with high SAT scores. One interpretation that can be made of this relationship is that when individuals believe that they are at a disadvantage relative to their peer group—a "perceived disparity", in this case by having a lower SAT score—they may be motivated to exert increased effort and perseverance in order to "keep up", or in this case, outpace, their peer group. In our study, participants who thought about failures may have felt that they were transiently in a disadvantageous state, causing them to expend greater effort on the task at hand. Together, these data suggest that being put in a relatively disadvantageous state, presumably via a wide variety of mechanisms, causes one to exert more effort for some period of time as a buffer against the "perceived disparity".

It is necessary to continue to explore the state aspects of perseverance in order to capitalise on the extent to which perseverance can be manipulated. More importantly, there might be subtle things about how an individual reflects on his or her failures that increase perseverance on a long, tedious task. For example, Nolen-Hoeksema and Morrow (1993) found that when depressed individuals were asked to ruminate on their depressed feelings, depression significantly increased, whereas a distractor task significantly decreased depression. However, they found no significant changes in

non-depressed individuals. Although our finding asked participants to reflect on past failures (a task strikingly similar yet qualitatively different from Nolen-Hoeksema & Morrow, 1993), their findings suggest that there may be individual differences in relation to the salience of our manipulation, especially among clinical populations. Future work to identify how one thinks about his or her past failures would be crucial in being able to use the experimental manipulation presented here in real-word circumstances.

## Limitations and open questions

One limitation of our approach lies with the writing manipulation aimed at altering grit state. We assumed that all participants would be able to write about experiences related to the prompts. However, if one perceives oneself as having few failures and/or few or trivial successes, it is unlikely that reflecting on failures would motivate that individual to do well on a subsequent task. Future research may wish to examine the way in which failures are discussed in order to decipher individual differences in the ability to describe failure.

Related to this, the longevity of the alterations in perseverance (in this case, measured by increased performance) remains unknown. Ideally, future work might uncover manipulations to state aspects of grit so that the effects persisted for long periods of time. Of course, it is likely that the trait outweighs the state aspect in terms of importance; as such, we aimed to explore the *extent* to which grit can be influenced by a manipulation such as the one used here. However, the extent to which our manipulation may have altered grit over the long term, or simply the short-term perseverance needed for the task at hand, remains unknown. Moreover, our writing manipulation may have altered specific *elements* of grit, such as mood, which had an effect on performance on our task requiring perseverance, and not the entirety of grit, per se. To this end, researchers should be aware that grit and other elements of performance can be affected by state changes, such as the writing manipulation presented here, as well as factors such as anxiety (Beilock, 2008; Beilock, Kulp, Holt, & Carr, 2004). However, since reflecting about failures resulted in increased performance on a task requiring cognitive endurance, this result suggested that some element of a failure reflection can be used to increase perseverance on cognitive tasks. The data presented here provide initial evidence for the potential of manipulations of grit state to be used to optimise performance of participants in "real-world" settings (students, cadets, etc.) or experimental conditions such as learning paradigms.

## Conclusions

Together, these findings indicate that reflecting on past failures can cause immediate improvements in performance on tasks requiring perseverance. Our findings suggest that perseverance is not simply a set trait exhibited from birth onward; instead our results suggest that a benefit in grit might be obtained from focused training or simply reflecting on failure events. However, since this finding is counterintuitive, more research regarding reflecting on failures and the existence of "perceived disparity" should be conducted. If future studies provide support for this data, these findings will have implications for strategies that parents, teachers, coaches and bosses might consider using to improve success in their children, classrooms, teams and employees. Ironically, reminding individuals of a minor failure may serve as a more motivating force than reflecting on past successes. This increased motivation can lead to improvements in behavioural output in (at least) a transient manner.

## Supplementary material

Supplementary content is available via the 'Supplementary' tab on the article's online page (http://dx.doi.org/10.1080/20445911.2014.995104).

## REFERENCES

Ashby, W. R. 1966. *An introduction to cybernetics*. New York, NY: Wiley.

Baker, J., & Horton, S. (2003). East African running dominance revisited: A role for stereotype threat? *British Journal of Sports Medicine*, 37, 553–555. doi:10.1136/bjsm.37.6.553

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology*, 5, 323–370. doi:10.1037/1089-2680.5.4.323

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology*, 74, 1252–1265.

Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1993). When ego threats lead to self-regulation failure: Negative consequences of high self-esteem.

*Journal of Personality and Social Psychology*, *64*(1), 141–156. doi:10.1037/0022-3514.64.1.141

Beckers, D. G. J. (2008). *Overtime work and well-being: Opening up the black box*. [Sl: sn].

Beilock, S. L. (2008). Math performance in stressful situations. *Current Directions in Psychological Science*, *17*, 339–343. doi:10.1111/j.1467-8721.2008.00602.x

Beilock, S. L., Kulp, C. A., Holt, L. E., & Carr, T. H. (2004). More on the fragility of performance: Choking under pressure in mathematical problem solving. *Journal of Experimental Psychology: General*, *133*, 584–600. doi:10.1037/0096-3445.133.4.584

Beilock, S. L., & McConnell, A. R. (2004). Stereotype threat and sport: Can athletic performance be threatened. *Journal of Sport and Exercise Psychology*, *26*, 597–609.

Bernstein, I. H., & Eveland, D. C. (1982). State vs trait anxiety: A case study in confirmatory factor analysis. *Personality and Individual Differences*, *3*, 361–372. doi:10.1016/0191-8869(82)90002-2

Boksem, M. A. S., Meijman, T. F., & Lorist, M. M. (2006). Mental fatigue, motivation and action monitoring. *Biological Psychology*, *72*, 123–132. doi:10.1016/j.biopsycho.2005.08.007

Botvinick, M. M., Cohen, J. D., & Carter, C. S. (2004). Conflict monitoring and anterior cingulate cortex: An update. *Trends in Cognitive Sciences*, *8*, 539–546. doi:10.1016/j.tics.2004.10.003

Bridgeman, B., McCamley-Jenkins, L., & Ervin, N. (2000). *Predictions of freshman grade-point average from the revised and recentered SAT I: Reasoning test (College board report 2000–2001)*. New York, NY: College Entrance Examination Board.

Bushman, B. J., & Baumeister, R. F. (1998). Threatened egotism, narcissism, self-esteem, and direct and displaced aggression: Does self-love or self-hate lead to violence? *Journal of Personality and Social Psychology*, *75*, 219–229. doi:10.1037/0022-3514.75.1.219

Cattell, R. B. (1963). Theory of fluid and crystallized intelligence: A critical experiment. *Journal of Educational Psychology*, *54*(1), 1–22. doi:10.1037/h0046743

Chalabaev, A., Sarrazin, P., & Fontayne, P. (2009). Stereotype endorsement and perceived ability as mediators of the girls' gender orientation–soccer performance relationship. *Psychology of Sport and Exercise*, *10*, 297–299. doi:10.1016/j.psychsport.2008.08.002

Chevallier, C., Kohls, G., Troiani, V., Brodkin, E. S., & Schultz, R. T. (2012). The social motivation theory of autism. *Trends in Cognitive Sciences*, *16*, 231–239. doi:10.1016/j.tics.2012.02.007

Dandurand, F., Shultz, T. R., & Onishi, K. H. (2008). Comparing online and lab methods in a problem-solving experiment. *Behavior Research Methods*, *40*, 428–434. doi:10.3758/BRM.40.2.428

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology*, *92*, 1087–1101. doi:10.1037/0022-3514.92.6.1087

Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the Short Grit Scale (GRIT–S).

*Journal of Personality Assessment*, *91*, 166–174. doi:10.1080/00223890802634290

Fishbach, A., & Dhar, R. (2005). Goals as excuses or guides: The liberating effect of perceived goal progress on choice. *Journal of Consumer Research*, *32*, 370–377. doi:10.1086/497548

Fitts, P. M. (1966). Cognitive aspects of information processing: III. Set for speed versus accuracy. *Journal of Experimental Psychology*, *71*, 849–857. doi:10.1037/h0023232

Frey, M. C., & Detterman, D. K. (2004). Scholastic assessment org? The relationship between the Scholastic Assessment Test and general cognitive ability. *Psychological Science*, *15*, 373–378. doi:10.1111/j.0956-7976.2004.00687.x

Gailliot, M. T., Schmeichel, B. J., & Baumeister, R. F. (2006). Self-regulatory processes defend against the threat of death: Effects of self-control depletion and trait self-control on thoughts and fears of dying. *Journal of Personality and Social Psychology*, *91*(1), 49–62. doi:10.1037/0022-3514.91.1.49

James, W. (1896). *The will to believe: And other essays in popular philosophy*. Harvard University Press. New York, NY: Longmans, Green.

Kane, M. J., Hambrick, D. Z., & Conway, A. R. A. (2005). Working memory capacity and fluid intelligence are strongly related constructs: Comment on Ackerman, Beier, and Boyle (2005). *Psychological Bulletin*, *131*(1), 66–71. doi:10.1037/0033-2909.131.1.66

Karbach, J., & Kray, J. (2009). How useful is executive control training? Age differences in near and far transfer of task-switching training. *Developmental Science*, *12*, 978–990. doi:10.1111/j.1467-7687.2009.00846.x

Kerns, J. G., Cohen, J. D., MacDonald, A. W., Cho, R. Y., Stenger, V. A., & Carter, C. S. (2004). Anterior cingulate conflict monitoring and adjustments in control. *Science*, *303*, 1023–1026. doi:10.1126/science.1089910

Kim, B. E., Seligman, D., & Kable, J. W. (2012). Preference reversals in decision making under risk are accompanied by changes in attention to different attributes. *Frontiers in Neuroscience*, *6*, 109.

King, J. A., Korb, F. M., Von Cramon, D. Y., & Ullsperger, M. (2010). Post-error behavioral adjustments are facilitated by activation and suppression of task-relevant and task-irrelevant information processing. *The Journal of Neuroscience*, *30*, 12759–12769. doi:10.1523/JNEUROSCI.3274-10.2010

Koo, M., & Fishbach, A. (2008). Dynamics of self-regulation: How (un)accomplished goal actions affect motivation. *Journal of Personality and Social Psychology*, *94*, 183–195. doi:10.1037/0022-3514.94.2.183

Kuncel, N. R., Hezlett, S. A., & Ones, D. S. (2001). A comprehensive meta-analysis of the predictive validity of the graduate record examinations: Implications for graduate student selection and performance. *Psychological Bulletin*, *127*, 162–181. doi:10.1037/0033-2909.127.1.162

Levinson, D. B., Smallwood, J., & Davidson, R. J. (2012). The persistence of thought evidence for a role of working memory in the maintenance of task-unrelated thinking. *Psychological Science*, *23*, 375–380. doi:10.1177/0956797611431465

Lorist, M. M., Bezdan, E., ten Caat, M., Span, M. M., Roerdink, J. B. T. M., & Maurits, N. M. (2009). The influence of mental fatigue and motivation on neural network dynamics; An EEG coherence study. *Brain Research*, *1270*, 95–106. doi:10.1016/j.brainres.2009.03.015

Lydon, J. E., & Zanna, M. P. (1990). Commitment in the face of adversity: A value-affirmation approach. *Journal of Personality and Social Psychology*, *58*, 1040–1047.

Maddi, S. R., Kahn, S., & Maddi, K. L. (1998). The effectiveness of hardiness training. *Consulting Psychology Journal: Practice and Research*, *50*, 78–86. doi:10.1037/1061-4087.50.2.78

Maddi, S. R., Matthews, M. D., Kelly, D. R., Villarreal, B., & White, M. (2012). The role of hardiness and grit in predicting performance and retention of USMA cadets. *Military Psychology*, *24*(1), 19–28. doi:10.1080/08995605.2012.639672

Manly, T., Robertson, I. H., Galloway, M., & Hawkins, K. (1999). The absent mind: Further investigations of sustained attention to response. *Neuropsychologia*, *37*, 661–670. doi:10.1016/S0028-3932(98)00127-4

McVay, J. C., & Kane, M. J. (2009). Conducting the train of thought: Working memory capacity, goal neglect, and mind wandering in an executive-control task. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *35*, 196–204. doi:10.1037/a0014104

Morrison, A. B., & Chein, J. M. (2011). Does working memory training work? The promise and challenges of enhancing cognition by training working memory. *Psychonomic Bulletin & Review*, *18*(1), 46–60. doi:10.3758/s13423-010-0034-0

Muraven, M. (2010). Building self-control strength: Practicing self-control leads to improved self-control performance. *Journal of Experimental Social Psychology*, *46*, 465–468. doi:10.1016/j.jesp.2009.12.011

Muraven, M., Baumeister, R. F., & Tice, D. M. (1999). Longitudinal improvement of self-regulation through practice: Building self-control strength through repeated exercise. *The Journal of Social Psychology*, *139*, 446–457. doi:10.1080/00224549909598404

Neisser, U., Boodoo, G., Bouchard Jr., T. J., Boykin, A. W., Brody, N., Ceci, S. J., … Urbina, S. (1996). Intelligence: Knowns and unknowns. *American Psychologist*, *51*, 77–101. doi:10.1037/0003-066X.51.2.77

Nolen-Hoeksema, S., & Morrow, J. (1993). Effects of rumination and distraction on naturally occurring depressed mood. *Cognition & Emotion*, 7 561–570. doi:10.1080/02699939308409206

Pennebaker, J. W. (1997). Writing about emotional experiences as a therapeutic process. *Psychological Science*, *8*, 162–166. doi:10.1111/j.1467-9280.1997.tb00403.x

Plomin, R., & Spinath, F. M. (2004). Intelligence: Genetics, genes, and genomics. *Journal of Personality and Social Psychology*, *86*(1), 112–129. doi:10.1037/0022-3514.86.1.112

Poorman, S. G., Mastorovich, M. L., Molcan, K. L., & Webb, C. A. (2009). Decreasing performance and test anxiety in practicing nurses. *Journal for Nurses in Staff Development*, *25*(1), 13–22. doi:10.1097/NND.0b013e318194b4d7

Ramirez, G., & Beilock, S. L. (2011) Writing about testing worries boosts exam performance in the classroom. *Science*, *331*, 211–213. doi:10.1126/science.1199427

Roberts, B. W., & DelVecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin*, *126*(1), 3–25. doi:10.1037/0033-2909.126.13

Robertson, I. H., Manly, T., Andrade, J., Baddeley, B. T., & Yiend, J. (1997). "Oops!": Performance correlates of everyday attentional failures in traumatic brain injured and normal subjects. *Neuropsychologia*, *35*, 747–758. doi:10.1016/S0028-3932(97)00015-8

Rosenberg, M., Noonan, S., DeGutis, J., & Esterman, M. (2013). Sustaining visual attention in the face of distraction: A novel gradual-onset continuous performance task. *Attention, Perception, & Psychophysics*, *75*, 426–439. doi:10.3758/s13414-012-0413-.x

Schmeichel, B. J., & Vohs, K. (2009). Self-affirmation and self-control: Affirming core values counteracts ego depletion. *Journal of Personality and Social Psychology*, *96*, 770–782. doi:10.1037/a0014635

Silvia, P. J., Eddington, K. M., Beaty, R. E., Nusbaum, E. C., & Kwapil, T. R. (2013). Gritty people try harder: Grit and effort-related cardiac autonomic activity during an active coping challenge. *International Journal of Psychophysiology*, *88*, 200–205. doi:10.1016/j.ijpsycho.2013.04.007

Smallwood, J., Riby, L., Heim, D., & Davies, J. B. (2006). Encoding during the attentional lapse: Accuracy of encoding during the semantic sustained attention to response task. *Consciousness and Cognition*, *15*, 218–231. doi:10.1016/j.concog.2005.03.003

Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). Stereotype threat and women's math performance. *Journal of Experimental Social Psychology*, *35*(1), 4–28. doi:10.1006/jesp.1998.1373

Stangor, C., Carr, C., & Kiang, L. (1998). Activating stereotypes undermines task performance expectations. *Journal of Personality and Social Psychology*, *75*, 1191–1197. doi:10.1037/0022-3514.75.5.1191

Stawarczyk, D., Majerus, S., Catale, C., & D'Argembeau, A. (2014). Relationships between mind-wandering and attentional control abilities in young adults and adolescents. *Acta Psychologica*, *148*, 25–36. doi:10.1016/j.actpsy.2014.01.007

Steele, C. M. (1988). The psychology of self-affirmation: Sustaining the integrity of the self. *Advances in Experimental Social Psychology*, *21*, 261–302. doi:10.1016/S0065-2601(08)60229-4

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology*, *69*, 797–811. doi:10.1037/0022-3514.69.5.797

Steinberg, L., & Silverberg, S. B. (1986). The vicissitudes of autonomy in early adolescence. *Child Development*, *57*, 841–851. doi:10.2307/1130361

Stone, J., Lynch, C. I., Sjomeling, M., & Darley, J. M. (1999). Stereotype threat effects on Black and White athletic performance. *Journal of Personality and*

*Social Psychology*, 77, 1213–1227. doi:10.1037/0022-3514.77.6.1213

Stucke, T. S., & Sporer, S. L. (2002). When a grandiose self-image is threatened: Narcissism and self-concept clarity as predictors of negative emotions and aggression following ego-threat. *Journal of Personality*, 70, 509–532. doi:10.1111/1467-6494.05015

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality*, 72, 271–324. doi:10.1111/j.0022-3506.2004.00263.x

Terman, L. M. (1925). *Genetic studies of genius* (Vol. 1, p. 1925). Stanford, CA: Stanford University Press.

Tice, D. M., Baumeister, R. F., Shmueli, D., & Muraven, M. (2007). Restoring the self: Positive affect helps improve self-regulation following ego depletion. *Journal of Experimental Social Psychology*, 43, 379–384. doi:10.1016/j.jesp.2006.05.007

Vohs, K. D., & Faber, R. J. (2007). Spent resources: Self-regulatory resource availability affects impulse buying. *Journal of Consumer Research*, 33, 537–547.

Vohs, K. D., & Heatherton, T. F. (2000). Self-regulatory failure: A resource-depletion approach. *Psychological Science*, 11, 249–254.

Wechsler, D. (1981). *Wechsler adult intelligence scale-revised*. New York, NY: The Psychological Corporation.

Wiener, N. 1948. *Cybernetics: Control and communication in the animal and the machine*. New York, NY: Wiley.