

**The moderating role of narcissism on the reciprocal relationship between self-efficacy and performance**

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1 Running head: Narcissism, self-efficacy and performance

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5 The moderating role of narcissism on the reciprocal relationship between self-efficacy
6 and performance

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Abstract

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We examined the moderating role of narcissism – a personality variable associated with overconfidence – on the reciprocal relationship between self-efficacy and performance.

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Participants ($N = 87$) completed ten experimental trials on a driving simulator and we

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recorded participants' performance and self-efficacy beliefs across trials. Hierarchical linear

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modelling demonstrated that performance had a positive relationship with self-efficacy

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(supporting the majority of self-efficacy research). However, narcissism moderated this

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relationship. Specifically, when narcissism was high, performance had no relationship with

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subsequent self-efficacy. Conversely, self-efficacy had a significant negative relationship

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with performance and narcissism did not moderate this relationship. A secondary purpose of

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the study was to examine the role of narcissism in the relationship between self-efficacy and

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effort, and between effort and performance. Narcissism significantly moderated the

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relationship between self-efficacy and self-reported effort, and between self-reported effort

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and performance.

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Keywords: Self-efficacy, performance, narcissism, effort, positive, negative

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1 of goal progress, which in turn might lead them to believe that they are closer to their goal
2 than they really are. Consequently, they reduce effort and performance suffers.

3 Vancouver et al. (2001; Vancouver, Thompson, Tischner, & Putka, 2002) conducted a
4 series of studies to examine the reciprocal relationship between self-efficacy and performance
5 using the analytical task, Mastermind. Results revealed a significant positive relationship
6 between past performance and subsequent self-efficacy; and a significant negative
7 relationship between self-efficacy and subsequent performance. However, subsequent
8 research testing Vancouver et al.'s predictions have revealed mixed results. For example,
9 several studies have revealed significant negative relationships between self-efficacy and
10 performance (e.g., Vancouver & Kendall, 2006; Woodman, Akehurst, Hardy, & Beattie,
11 2010; Yeo & Neal, 2006); non-significant relationships (e.g., Beattie, Lief, Adamoulas &
12 Oliver, 2011; Richard, Diefendorff, & Martin, 2006); and significant positive relationships
13 (e.g., Beattie, Fakehy, & Woodman, 2014; Seo & Ilies, 2009).

14 One potential reason for the negative self-efficacy performance relationship is
15 miscalibration (e.g., Beattie et al., 2011, 2014; Schmidt & DeShon, 2010; Vancouver et al.,
16 2001). Miscalibration is demonstrated when individuals display a bias (positive or negative)
17 in their self-efficacy *beliefs* in comparison to their performance *skills*. For example, Beattie et
18 al. (2011) found that participants repeatedly over-estimated their golf putting performance
19 skills (positive miscalibration) by consistently overrating how many putts they thought they
20 could achieve on an upcoming trial. Thus, the results of Beattie et al. add to the speculation
21 that miscalibrated self-efficacy beliefs may lead to negative within-person self-efficacy and
22 performance relationships (Vancouver et al., 2001; Vancouver & Kendal, 2006). Research
23 has often shown that self-views are fraught with error and contain a positive bias that reflects
24 overconfidence (Dunning, Heath, & Suls, 2004). Further, research also suggests that

1 narcissistic individuals (Roberts, Woodman, & Sedikides, 2017; Robins & Beer, 2001) are
2 more prone to such positive self-bias effects.

3 Narcissism comes in two guises: grandiose and vulnerable. Grandiose narcissism
4 (examined within the current study) primarily reflects traits related to “grandiosity,
5 aggression, and dominance” (Miller et al., 2011, p. 1013). This is in contrast to vulnerable
6 narcissism (not examined within the current study), that is associated with “a defensive and
7 insecure grandiosity that obscures feelings of inadequacy” (Miller et al., 2011, p. 1013).
8 Grandiose narcissism is a personality disposition where individuals with high levels of
9 narcissism often display exceptional positive self-bias.

10 Narcissism could account for the negative self-efficacy and performance relationship
11 in a number of ways. For example, previous research has shown that individuals scoring
12 higher on narcissism tend to report overly positive self-bias through optimistic views
13 regarding past performances, and consistently overrate their current performance (Robins &
14 Beer, 2001). Further, over a series of studies, Farwell and Wohlwend-Lloyd (1998) found
15 that narcissism correlated with overly positive assessments of current performance (believing
16 you performed better than you did), and self-enhancing attributions of past events. In
17 addition, Campbell, Goodie, and Foster (2004) examined the relationship between narcissism,
18 overconfidence, and decision making on a general knowledge-betting quiz. Campbell et al.
19 found that narcissism positively related to overconfidence, and that overconfidence stemmed
20 from an inflated sense of self and a perceived grand ability. Individuals with high levels of
21 narcissism were also more willing to bet on their answers (due to greater overconfidence and
22 a greater willingness to bet), and based their future performance predictions on performance
23 expectations rather than past performance. That is, individuals scoring higher on narcissism
24 partially base their ability estimates on factors not grounded in actual performance levels.
25 Thus, we can predict that narcissism will moderate the robust finding that past performance

1 has a strong and positive relationship with self-efficacy beliefs. That is, individuals who score
2 high in narcissism may demonstrate a weaker or no relationship between past performance
3 and self-efficacy.

4 There is also evidence to suggest that high levels of narcissism may contribute to the
5 negative relationship between self-efficacy and subsequent performance for reasons
6 mentioned above. Research demonstrates that individuals scoring higher on narcissism have a
7 selective memory for self-flattering past events (Rhodewalt & Eddings, 2002) and hold
8 overly optimistic views of current performance and performance achievements (Farwell &
9 Wohlwend-Lloyd, 1998; Robins & Beer, 2001), it is possible that individuals scoring higher
10 on narcissism will report inflated levels of self-efficacy. Based on control theory's prediction
11 that increasing levels of self-efficacy may induce complacency, and due to an inflated sense
12 of self (Campbell et al., 2004), narcissism may partly explain the negative relationship often
13 observed between self-efficacy and performance. For individuals with high levels of
14 narcissism, self-efficacy may have no relationship or even a negative relationship with
15 subsequent performance. Conversely, the performance of individuals with low levels of
16 narcissism will likely benefit from their self-efficacy as their beliefs may be more grounded
17 than that of individuals with high levels of narcissism.

18 A second purpose of the study was to examine what role narcissism played in the
19 relationship between self-efficacy and effort, and between effort and performance. Research
20 has demonstrated that the more efficacious an individual is, the more effort they invest in
21 their given task (e.g., Krishnan, Netemeyer, & Boles, 2002). Further, according to Vancouver
22 et al. (2001, 2008) self-efficacy should have a positive relationship with goal choice and
23 motivation. Specifically, high levels of self-efficacy may lead one to revise, set and pursue
24 goals that are more difficult. However, once goals are accepted, high levels of self-efficacy
25 may have a negative relationship to resource allocation. For example, Vancouver and Kendal

1 (2006) examined the reciprocal relationship between self-efficacy, motivation (effort) and
2 exam performance over five repeated assessments on an undergraduate introductory course in
3 industrial/organizational psychology. Results revealed a negative relationship between self-
4 efficacy, performance and self-reported effort. That is, as self-efficacy for the students
5 increased by a grade (e.g., B to B+), actual grade performance decreased by a quarter and
6 self-reported study time decreased by 15 minutes.

7 Research on narcissism may also help to explain the above findings. For example, in
8 order to promote a positive self-image, people with high levels of narcissism may also choose
9 goals that are more difficult. However, research shows that individuals with higher levels of
10 narcissism may engage more in self-handicapping activities (Feick & Rhodewalt, 1997) if
11 goal progress is not going to plan. Self-handicapping is an obstacle “created (or claimed) by
12 the individual in anticipation of a failing performance” (Feick & Rhodewalt, 1997, p. 147).
13 Here, individuals with high levels of narcissism can protect their image in the event of
14 failure. For example, high levels of narcissism may lead one to under report the amount of
15 effort invested following a poor performance, which allows failure to be attributed to a lack
16 of effort rather than to a lack of ability. Conversely, individuals might enhance their image
17 following success because under-reporting the amount of effort invested will make a good
18 performance appear more impressive. Research demonstrated that individuals with high
19 levels of narcissism self-handicapped more than individuals with low levels of narcissism and
20 that, self-handicapping was motivated by self-protection concerns such as to discount failure
21 rather than to augment success (Rhodewalt, Tragakis, & Finnerty, 2006). Finally, individuals
22 with high levels of narcissism are generally overconfident (e.g., Campbell et al., 2004), tend
23 to rely on external validation to feed their positive self-image, and seek to deny negative
24 experiences and overemphasize positive experiences (Tracy, Cheng, Martens & Robins,

1 2011; Rhodewalt & Morf, 1995). Thus, narcissism may moderate the relationships between
2 self-efficacy and self-report effort, and between self-report effort and performance.

3 One caveat to the above argument is that individuals with high levels of narcissism
4 may only report that they are investing less effort but in reality, they may invest just as much
5 effort as everyone else. Therefore, we supplemented our self-report measure of effort with a
6 measure of heart rate variability (HRV). HRV is influenced by sympathetic and
7 parasympathetic branches of the autonomic nervous system, with several studies associating
8 an increase in mental effort and workload with decreases in HRV (e.g., Aasman, Mulder &
9 Mulder, 1987; Capa, Cleeremans, Bustin, Bouquet, & Hensenne, 2011; De Rivecourt,
10 Kuperus, Post, & Mulder, 2008; Mulder, 1992). Importantly, the measurement of HRV
11 should verify whether individuals with high levels of narcissism accurately report the amount
12 of effort they claim to invest.

13 To summarise, the main aim of the present study was to examine the potential
14 moderating role of narcissism on the reciprocal relationship between self-efficacy and
15 performance. The first hypothesis was that narcissism would moderate the relationship
16 between performance and self-efficacy. Specifically, individuals with low levels of
17 narcissism will demonstrate a positive relationship between performance and subsequent self-
18 efficacy, and individuals with high levels of narcissism will demonstrate a weak or no
19 relationship between performance and subsequent self-efficacy (cf. Campbell et al., 2004).

20 The second hypothesis was that narcissism would moderate the relationship between
21 self-efficacy and performance. Specifically, we predicted that individuals with high levels of
22 narcissism would display a negative relationship between self-efficacy and performance, and
23 individuals with low levels of narcissism would demonstrate a positive relationship between
24 self-efficacy and performance (cf. Campbell et al., 2004; Farwell & Wohlwend-Lloyd, 1998;
25 Robins & Beer, 2001).

1 longest straight section was 0.48 miles (0.77 km) and had seven corners of varying
2 difficulty¹. No other cars were on the track.

3 We measured heart rate variability via an electrocardiogram using silver/silver
4 chloride electrodes (Blue Sensor SP, Ambu, Cambridgeshire, UK) positioned on the right
5 clavicle, left clavicle, and lower left rib. The electrocardiographic signal was digitized at
6 1000 Hz with 16-bit resolution (PowerLab 16SP, AD Instruments, Dunedin, New Zealand),
7 and filtered (0.3 – 50 Hz) using LabChart7 software (AD Instruments).

8 **Procedure**

9 *Pilot testing.* In order to instil a sense of competition and motivation for the
10 participants, we partly fabricated a leader board where participants could win cash prizes
11 depending upon performance (see below). We piloted the study with five volunteers (who
12 were not part of the final study). These five volunteers completed five trials of the racing
13 circuit, with the fastest driver occupying the number one position (with a trial time of 251
14 seconds) on the leader board. The worst driver occupied position ten (with a trial time of 280
15 seconds). We then fabricated five further track times and inserted them between the top and
16 bottom positions on the leader board. The leader board was on display to the participants at
17 all times, where the names and times changed accordingly.

18 *Main study.* Participants attended one testing session. Upon arrival, we informed
19 participants of the study procedure and obtained consent. Before the testing began,
20 participants completed the NPI-16 (see below for measures). Next, we attached the three
21 electrodes to the participant. They then sat in the driving simulator, made any necessary
22 adjustments to the positions of the foot pedals and steering wheel to ensure they were
23 comfortable. Participants received instructions of how to use the equipment, including the
24 brake pedal, accelerator pedal, and reverse button.

¹ The circuit can be obtained from the 2nd author.

1 We introduced the participants to the leader board displayed on the wall above the TV
2 screen. To motivate the participants, we then stated that the top ten fastest trials would win a
3 cash prize (£50 for first place, £40 for second place, £30 for third place, £20 for fourth place,
4 and £10 for fifth to tenth place). We then briefed participants on how to use the mental effort
5 and self-efficacy scales (see below), after which they were ready to commence driving.

6 *Practice trials.* In order for participants to familiarise themselves with the procedure
7 and gain some experience of the equipment and track, participants completed three practice
8 trials. We recorded heart rate as soon as the participant crossed the start line and paused it
9 when participants crossed the finishing line. On completion of the first trial (and all
10 subsequent trials), the game stopped whereupon the participants immediately completed the
11 mental effort scale (RMSE; Zijlstra, 1993). After completing the RMSE, we told the
12 participants their race time after which they completed the self-efficacy questionnaire. We
13 reset the game and the whole cycle started again. The whole procedure in between trials
14 lasted for about 1 minute.

15 *Competitive trial.* Before commencing with 10 competitive trials, we told the
16 participants their best practice trial time. Participants used this time as a standard that they
17 should improve upon over the coming competitive trials. The competitive trials procedure
18 was identical to the practice trial procedure. In order for participants to judge their efficacy
19 beliefs accurately, we provided them with a performance log of each trial time (combined
20 time of two consecutive laps) up to that point (Beattie, Woodman, Fakehy, & Dempsey,
21 2016). In other words, participants had access to feedback for each previous trial before they
22 completed the self-efficacy questionnaire for the subsequent trial. The competitive trials
23 followed the same procedure as the practice trials. Each trial lasted an average of 4 minutes
24 and 39 seconds (ranging from 4 minutes and 17 seconds to 5 minutes and 9 seconds), during
25 which the recording of HRV was continuous. Following the final trial, participants completed

1 the mental effort scale, thanked for their time, and informed that we would contact them if
2 they had won a cash prize. The whole procedure (including practice and competitive trials)
3 lasted approx. 1 hour and 45 minutes.

4 **Measures**

5 *Performance improvement.* We recorded performance as the improvement (in
6 seconds) from baseline to the current trial. For example, a baseline time of 300 seconds and a
7 current trial time of 290 seconds would yield a performance improvement of 10. We recorded
8 performance improvement across trials 1-10.

9 *Past performance.* We recorded past performance in the same way as above and used
10 it as a predictor variable in hypothesis 1, and a control variable in hypotheses 2, 3, and 4. Past
11 performance is derived from performance improvement across trials 1-9 (i.e., trial 9 is the last
12 past performance trial that can be used as past performance).

13 *Self-efficacy.* Following Beattie et al. (2011), we assessed self-efficacy magnitude by
14 asking participants to answer *yes* or *no* to 20 statements: “I have the skills and resources to
15 improve my baseline performance by one second”, “I have the skills and resources to
16 improve my baseline performance by two seconds”, up to “I have the skills and resources to
17 improve my baseline performance by 20 seconds.” Participants were also given the
18 opportunity to continue the scale if they wished (e.g., 21 seconds, 22 seconds, etc.). The total
19 magnitude score was obtained by summing the number of ‘yes’ answers (e.g., if the
20 participant answered ‘yes’ up to 15 seconds and “no” thereafter, his/her self-efficacy
21 magnitude score was 15). Self-efficacy strength was recorded by asking participants to rate
22 their degree of confidence in their ability to achieve that time (0-100%) for each magnitude
23 level to which participants had answered ‘yes’. Total self-efficacy strength score for each trial

1 was obtained by summing the strength percentages for every magnitude level that was
2 answered with a ‘yes²’.

3 *Self-report effort.* We used Zijlstra’s (1993) Rating Scale Mental Effort (RSME) to
4 assess the level of mental effort exerted. Participants rated the effort that they invested by
5 marking a cross on a continuous 150mm line along which there was an anchor point every
6 10mm indicating their effort from “no effort at all” (0mm) to “extreme effort” (150mm). We
7 asked participants ‘how much mental effort did you exert during the trial that you have just
8 completed?’ The scale has a test-retest reliability correlation coefficient of .78 (Zijlstra,
9 1993).

10 *Heart rate variability.* Heart rate variability (HRV) was calculated as the standard
11 deviation of the R-wave to R-wave intervals (SDNN) of the electrocardiogram. SDNN is a
12 time domain index of the spectral power in the 0.04 Hz to 0.15 Hz frequency band (Carrasco,
13 Gaitan, Gonzalez, & Yanez, 2001) and has been used as a psychophysiological marker of
14 effort in previous research (e.g., Cooke et al., 2010; Mulder, 1992), where decreases in
15 SDNN have been associated with increases in cognitive effort. We retained for analysis the
16 mean heart rate variability for each trial.

17 *Narcissism.* We used the Narcissistic Personality Inventory-16 (NPI-16; Ames, Rose,
18 & Anderson, 2006) to assess narcissism. The NPI-16 is a shorter version of the NPI-40
19 (Raskin & Terry, 1988) and comprises 16 pairs of items. For each pair of statements,
20 participants are required to choose which statement (A or B) more closely matches their
21 personality. For example, Item 1 asks participants to choose between (A) ‘I really like to be
22 the center of attention’ or (B) ‘It makes me uncomfortable to be the center of attention’. In
23 this example, participants would score 1 point if they chose Statement A or no points if they

² The current data set demonstrated almost identical results when using self-efficacy magnitude or strength in the analysis. Thus, for ease of interpretation, we present self-efficacy magnitude results.

1 chose Statement B. As such, the range of possible scores is 0-16. Jones and Figueredo (2013)
2 reported an alpha coefficient of .77 for the scale. Cronbach's alpha in the current study was
3 .80. Following recommendations by Ames et al. (2006), we rescaled the mean narcissism
4 scores to the level of the item by dividing participant totals by 16. Specifically for the current
5 study, we rescaled the mean NPI score of 3.68 ($SD = 3.32$; range 0-16) to $M = 0.23$ ($SD =$
6 0.21 ; range 0-1).

7 **Results**

8 We used Hierarchical Linear Modeling Version 7 (HLM; Raudenbush & Bryk, 2002)
9 to examine the within-person level effects. In this case, HLM allows us to examine whether
10 there is a change in the relationships between the Level 1 variables (past performance,
11 performance improvement, trial, self-efficacy, mental effort and SDNN) due to the Level 2
12 variable (narcissism). All Level 1 variables (past performance, performance improvement,
13 trial, self-efficacy, mental effort and SDNN) are examined at a within-person level of
14 analysis. For example, we are able to examine the relationship (e.g., positive or negative)
15 between past performance and self-efficacy (or vice versa). We assessed all these variables
16 across time (trials 1-10). When examining within-person relationship it is often noted that
17 trends in the data (i.e., in the current study self-efficacy and performance significantly
18 increase across time) could have a spurious effect on the results. Controlling for trial removes
19 this possibility. Hence, trial is controlled for in all subsequent analyses.

20 The Level 2 variable (narcissism) is recorded once and is used as a between-person
21 variable. In other words, we are able to examine whether the Level 1 within-person
22 relationships differ as a result of narcissism. We used a full random intercept and slopes
23 model. As data were nested within individuals across time (i.e., 10 competitive trials), we
24 used group mean centering (data was centered on the individual) for all Level 1 variables
25 (i.e., past performance, performance improvement, trial, self-efficacy, effort and SDNN).

1 Conversely, the Level 2 variable (narcissism) was grand mean centered (data were centered
2 on the group mean). While checking for outliers, we removed 14 laps out of 870 (1.45% of
3 the total data) where participants had large crashes. Table 1 displays the means, standard
4 deviations, intraclass correlations³, and bivariate interclass correlations for the Level 1
5 variables (all scores represent the mean score across the 10 trials).

6 Considering the within-person set of analyses, self-efficacy magnitude significantly
7 increased over time ($b_{10} = .10, p = .05$). Performance also significantly improved across time
8 ($b_{10} = .43, p < .01$), indicating the change in the estimate of performance improvement over
9 time was just under half of a second. We further examined whether narcissism (Level 2
10 variable) had a significant relationship (main effect) with any of our Level 1 outcome
11 variables (i.e., past performance, performance improvement, self-efficacy, mental effort and
12 SDNN). Narcissism did not significantly relate to any Level 1 variable: past performance (b_{11}
13 $= -.67, p = .80$), performance improvement ($b_{11} = -.53, p = .86$), self-efficacy ($b_{11} = .83, p =$
14 $.83$), mental effort ($b_{11} = -23.39, p = .14$), and SDNN ($b_{11} = -8.80, p = .53$).

15 The first hypothesis predicted that narcissism would moderate the relationship
16 between past performance and subsequent self-efficacy. Past performance had a significant
17 and positive relationship with subsequent self-efficacy magnitude ($b_{20} = .18, p < .001$) whilst
18 controlling for trial (supporting previous research e.g., Vancouver et al., 2001). Further,
19 results supported the moderating effect of narcissism ($b_{21} = -.21, p = .08$; see Figure 1⁴).
20 Simple slopes analysis⁵ (e.g., Preacher, Curran, & Bauer, 2006) revealed that the slope for

³ To examine independence across participants, we calculated intraclass correlations (ICC) for all Level 1 variables that we used in the analysis (i.e., past performance, performance improvement, self-efficacy magnitude, SDNN and mental effort). The ICC, which represents the variance that was accounted for by the between-group effect (across Level 2 units, i.e., participants), ranged from .46 to .77, showing that between 46% and 77% of variance was associated with the between-group level. Multilevel modelling would be inappropriate if the ICC had been close to zero, because it would indicate that all participants behaved in a similar fashion.

⁴ Following the recommendations of Snijders and Bosker (1999), cross-level interactions were accepted at $p < .1$ due to reductions in parameter reliability in multilevel modelling.

⁵ Thank you to an anonymous review for suggesting these follow-up tests. The interested reader can perform these tests online at <http://www.quantpsy.org/interact/hlm2.htm>.

1 high narcissism was not significant ($b = .09, p = .13$) but the slope for low narcissism was
 2 positive and significant ($b = .17, p < .001$). This indicates that there is a positive relationship
 3 between past performance and subsequent self-efficacy for low narcissism only (see top tier
 4 of Table 2).

5 Hypothesis 2 predicted that narcissism would moderate the relationship between self-
 6 efficacy and performance improvement. After controlling for trial, past performance, and
 7 self-report effort (see 2nd tier of Table 2), the model revealed a significant negative
 8 relationship between self-efficacy magnitude and performance improvement ($b_{40} = -.21, p =$
 9 $.002$). That is, as self-efficacy increased by 1, driving performance worsened on average by a
 10 fifth of a second per trial. Narcissism did not moderate this relationship ($b_{41} = .15, p = .64$).

11 Hypothesis 3 predicted that narcissism would moderate the relationship between self-
 12 efficacy and self-reported mental effort. After controlling for trial and past performance, self-
 13 efficacy had no significant relationship with self-reported effort ($b_{30} = -0.36, p = .07$). In
 14 other words, as self-efficacy increased, self-reported effort did not significantly change.
 15 However, narcissism significantly moderated this relationship ($b_{31} = -1.75, p = .075^4$). Simple
 16 slopes analysis revealed that the high narcissism slope was significant and negative ($b = -$
 17 $1.11, p = .03$) and the slope for low narcissism was not significant ($b = -.37, p = .08$); see
 18 Figure 2 and 3rd tier of Table 2). This indicated that self-efficacy had a significant negative
 19 relationship with self-report effort when narcissism was high. When self-report effort was
 20 replaced with HRV (SDNN⁶), and controlling for trial and past performance, the relationship
 21 between self-efficacy and effort (SDNN) remained non-significant ($b_{30} = .22, p = .26$).
 22 Further, narcissism did not moderate the relationship between self-efficacy and HRV (SDNN;
 23 $b_{31} = -1.50, p = .22$) (see 4th tier of Table 2).

⁶ Due to the availability of equipment, we were only able to obtain complete HRV data for 66 participants; hence analyses involving HRV used a sub-sample of 66. Independent t-tests revealed no difference on any of the dependent variables between the HRV subsample and the main sample.

1 Hypothesis 4 predicted that narcissism would moderate the relationship between self-
2 report effort and performance improvement. After controlling for trial and past performance,
3 self-reported effort had a significant positive relationship with performance improvement (b_{30}
4 = 0.16, $p < .001$). Narcissism significantly moderated this relationship ($b_{31} = -.18$, $p = .002$;
5 see 2nd tier of Table 2). Simple slopes analysis revealed that the high narcissism ($b = .09$, $p =$
6 $.003$) and low narcissism ($b = .17$, $p < .001$) slopes were positive and significant (Figure 3).
7 However, the slope for low narcissism was larger than high narcissism, indicating that self-
8 report effort had a significant positive relationship with performance improvement when
9 narcissism was low but to a significantly lesser extent when narcissism was high. When
10 replacing self-report effort with HRV (SDNN), the relationship indicated that increasing
11 effort was again related to an increase in performance improvement ($b_{30} = -.09$, $p < .001$).
12 However, narcissism did not moderate this relationship ($b_{31} = -.02$, $p = .75$) (see 2nd tier of
13 Table 2).

14 Discussion

15 The purpose of the study was to examine the moderating role of narcissism on the
16 reciprocal relationship between self-efficacy and performance. Results for the first hypothesis
17 revealed that performance had a positive relationship with self-efficacy (better performance
18 led to higher efficacy beliefs). This result supports the vast majority of within person self-
19 efficacy research (Sitzman & Yeo, 2013). Further, narcissism moderated the relationship
20 between performance and self-efficacy in that, when narcissism was high, performance had
21 no relationship with self-efficacy, but when narcissism was low, performance had a
22 significant and positive relationship with self-efficacy.

23 The second hypothesis examined self-efficacy's relationship with performance
24 improvement, which has demonstrated positive, negative, and null relationships in the past
25 (e.g., Beattie et al., 2016; Richard et al., 2006; Vancouver & Kendall, 2006). Results found

1 support for a control theory perspective (Powers, 1991) where self-efficacy had a negative
2 relationship with performance. However, there was no support for narcissism as a moderator
3 of this relationship.

4 Research tends to focus upon the second half of the reciprocal self-
5 efficacy/performance relationship (i.e., self-efficacy's relationship with performance) at the
6 expense of the first half of the relationship (past performance effects upon subsequent self-
7 efficacy) (Sitzman & Yeo, 2013). This is perhaps not surprising, as psychologists tend to be
8 more interested in performance effects. The finding that performance had no relationship
9 with subsequent self-efficacy for individuals with high levels of narcissism is an interesting
10 finding. For example, in their meta-analysis of reciprocal self-efficacy/performance
11 relationships, Sitzman and Yeo (2013) found that performance had a strong and positive
12 relationship with subsequent self-efficacy. In fact, this positive relationship is a robust finding
13 in studies examining the reciprocal relationship between self-efficacy and performance.
14 Results seem to suggest that individuals high in narcissism pay little regard to current
15 performance standards and supports previous research that individuals with high levels of
16 narcissism may, in part, base their future performance expectations on aspirations rather than
17 actual past performances (e.g., Campbell et al., 2004).

18 Regarding the second hypothesis, it is well documented that individuals with high
19 levels of narcissism are overconfident (e.g., Campbell et al., 2004), and hold overly
20 optimistic views of past performance accomplishments (Robins & Beer, 2001). However,
21 narcissism did not moderate the relationship between self-efficacy and performance. Perhaps
22 one reason why narcissism did not moderate this relationship is that task engagement for
23 individuals with high levels of narcissism is partly dependent on the opportunity for self-
24 enhancement (e.g., Woodman et al., 2011). The current study did not set out to test such a
25 moderator and used only a leader board to promote an opportunity for glory. Further, results

1 of the first hypothesis show that individuals with high levels of narcissism did not rely on
2 past performances in order to judge subsequent efficacy beliefs. As narcissistic traits come to
3 the foray under higher opportunities for self-enhancement, it is possible that the negative
4 relationship between self-efficacy and performance for individuals with high levels of
5 narcissism would occur (i.e., they may be more likely to report inflated levels of self-
6 efficacy).

7 One final consideration that is worthy of note is that, despite providing participants
8 with all their past performance times on which they could base self-efficacy judgments upon,
9 the more efficacious the individual was, the less performance improvement they made. This
10 finding goes against current research where task feedback positively moderated the self-
11 efficacy and performance relationship (e.g., Beattie et al., 2016). That is, when task feedback
12 was low, self-efficacy had a negative relationship with performance. However, when task
13 feedback was high, self-efficacy had a positive relationship with performance. The only
14 difference between the current study and that of Beattie et al. (2016) is that the track changed
15 and participants performed three extra laps in the experimental condition. It may have been
16 that the track specifically designed for the current study was too easy and induced a sense of
17 complacency or a performance ceiling effect. This would support Beattie et al.'s (2014)
18 findings that task complexity moderates the relationship between self-efficacy and
19 performance. That is, higher levels of performance are easier to obtain on easy tasks,
20 therefore, subsequent performance improvements are harder to come by. This would limit
21 any beneficial effect of self-efficacy upon subsequent performance (see also Beck &
22 Schmidt, 2012). However, this is a speculative comment, as we did not assess task
23 complexity in the current study. A further reason is that the participants (as a group) did not
24 choose to use the information available to them.

1 A second purpose of the study was to examine what role narcissism had on the
2 relationship between self-efficacy and effort, and between effort and performance
3 improvement. We predicted that narcissism would moderate the relationship between self-
4 efficacy and self-reported effort. In the present study, self-efficacy had no relationship with
5 self-report effort (although the coefficient was negative and approached significance $p = .07$).
6 Nevertheless, this finding fails to support previous research where self-efficacy had a
7 significant negative relationship with exam study time (e.g., Vancouver & Kendal, 2006).
8 Further, narcissism moderated this relationship. That is, individuals with high levels of
9 narcissism demonstrated a significant negative relationship between self-efficacy and self-
10 report effort, which would support a control theory perspective (Powers, 1991; Vancouver et
11 al., 2001, 2002). Further, individuals with low levels of narcissism demonstrated a non-
12 significant relationship between self-efficacy and self-report effort. Therefore, the current
13 findings fail to support Social Cognitive Theory (Bandura, 1986) in that self-efficacy is
14 positively related to effort. Finally, there was no relationship between self-efficacy and HRV
15 and narcissism had no moderating effect.

16 Hypothesis 4 predicted that narcissism would moderate the relationship between self-
17 reported effort and performance improvement. That is, if individuals with high levels of
18 narcissism tend to under report effort exerted, then there should be no or a negative
19 relationship between effort and performance for individuals with high levels of narcissism.
20 As noted in the results, higher levels of self-reported effort were associated with better
21 performance. Narcissism significantly moderated this relationship. That is, the relationship
22 between self-reported effort and performance was significant and positive for individuals
23 with low levels of narcissism. However, this relationship was also significant and positive for
24 individuals with high levels of narcissism, albeit to a lesser extent. The significant interaction
25 shows tentative support for our hypothesis that individuals high in narcissism under report

1 effort exerted than individuals with low levels of narcissism. Similar to the self-efficacy and
2 effort hypothesis above, the interaction was present for self-reported effort but not HRV.

3 Since self-report measures are susceptible to self-presentation bias (Rhodewalt &
4 Fairfield, 1991), we measured HRV to give a multidimensional account of on-task effort to
5 supplement the self-report measure of effort. The moderating effect of narcissism for self-
6 reported effort but not HRV may be evidence that individuals with high levels of narcissism
7 fabricated their self-report effort responses. As mentioned, individuals higher in narcissism
8 are more likely to engage in self-handicapping than those low in narcissism (e.g., Rhodewalt
9 et al., 2006). Previous research has shown that individuals are willing to use self-
10 handicapping techniques (such as under reporting the amount of effort invested in a task) to
11 protect themselves from failure, but are less willing to employ such techniques to enhance
12 success (Rhodewalt, Morf, Hazlett & Fairfield, 1991). Thus, if individuals with high levels of
13 narcissism have performed lower than expected on a given trial, they have the opportunity
14 post-trial to claim that they did not invest as much effort as they actually did. Therefore, they
15 are able to attribute their poor performance to a lack of effort rather than a lack of ability. If
16 we interpret HRV as a measure of effort, then the results demonstrate that although
17 individuals with high levels of narcissism claim to invest less effort than individuals with low
18 levels of narcissism, they are in fact investing the same amount of effort as low narcissists.

19 Although the above explanation makes theoretical sense, the results should be
20 interpreted with caution for the following reasons. When mental effort is invested, a number
21 of cardiovascular characteristics demonstrate changes, for example, heart rate and blood
22 pressure increase, and a more regular heart beat (decreased HRV) is observed (Fairclough &
23 Mulder, 2012). Although a decrease in HRV has been associated with increased effort (e.g.,
24 Aasman et al., 1987; Capa et al., 2011; De Rivecourt et al., 2008; Mulder, 1992), a reduction
25 in HRV is not perfectly correlated with a reduction in effort. For example, Veldhuizen van

1 Zanten, De Boer, Harrison, Carroll, and Willemsen (2002) measured HRV at rest and during
2 a competitive remote control car-racing task, and demonstrated that the competitive trials had
3 lower heart rate variability than the less competitive trials. However, the decrease in HRV
4 was also associated with increases in self-report competitiveness, level of excitement, and
5 task difficulty. Further, Laborde, Furley, and Scenempp, (2015) found that resting HF-HRV
6 and not task related HF-HRV predicted performance on a working memory task. Thus, it is
7 somewhat difficult to confidently infer the HRV results of the current study as a pure
8 measure of effort, and further research is needed to conclude this interpretation.

9 There are some limitations to the current study. First, the opportunity for self-
10 enhancement may not have been enough to motivate those high in narcissism to invest effort.
11 Although there was an opportunity to win a cash prize and earn a place on the leader board,
12 the results of the fastest trial times did not appear publically. Narcissists are motivated to
13 invest more effort when their performance is going to be publically evaluated (e.g., Roberts,
14 Callow, Hardy, & Woodman., 2010; Roberts, Woodman, Hardy, Roberts, & Wallace., 2013;
15 Wallace & Baumeister, 2002; Woodman et al., 2011). Thus, future research may wish to
16 consider re-testing the potential moderating effect of narcissism on the relationship between
17 self-efficacy and performance with a more pronounced opportunity for self-enhancement in a
18 two-condition design (high and low opportunity for glory). Second, we concede that HRV is
19 not a strong measure of on task mental effort, and we therefore encourage future research to
20 explore additional psychophysiological measures of mental effort. For example, it is thought
21 that changes in mental effort are more accurately measured via sympathetic nervous system
22 mechanisms such as pre-ejection period and systolic blood pressure (Wright, 1996). Pupil
23 dilation also indicates on task effort (Kahnemann, 1973; Alnaes, Sneve, Espeseth, Endestad,
24 van de Pavert, Laeng, 2014) and absolute heart rate indicates an increase in on task effort in
25 physical tasks (Greenlees, Graydon, & Maynard, 1999). Thus, we recommend that future

1 studies measuring cognitive effort via a psychophysiological approach, should avoid the self-
2 presentation bias in self-report measures by adopting some of these measures to shed further
3 light on this finding.

4 To conclude, results revealed that narcissism moderated the relationship between
5 performance and self-efficacy. In addition, narcissism moderated the relationships between
6 self-efficacy and effort, and between effort and performance improvement, but only when
7 using self-report effort, and not heart rate variability. Thus, we present tentative evidence that
8 individuals high in narcissism may have engaged in ego-protecting strategies, such as
9 attributing poor performance to a lack of effort rather than a lack of ability (Feick &
10 Rhodewalt, 1997). Therefore, when one is working with an individual high in narcissism
11 (e.g., as a coach to an athlete or a superior in the workplace), it may be beneficial to
12 encourage them to consider all objective feedback, in order to potentially improve self-
13 regulation and discourage the attribution of sub-par performances to effort rather than ability.
14 Indeed, if individuals disregard poor performance as a lack of effort rather than ability, there
15 may be no motivation to invest resources in improving ability. We hope that future research
16 will adopt a superior psychophysiological measure of mental effort, in order to solidify (or
17 refute) the tentative conclusions around the moderating effect of narcissism upon the
18 relationships between self-efficacy and effort, and between effort and performance. Finally,
19 we recommend that future research examine these relationships in a different context in order
20 to determine the generalizability and robustness of the results.

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1 Table 1

2 *Means, standard deviations, intraclass correlations (ICC), and bivariate correlations of all Level-1 variables and narcissism.*

Variable	Mean⁷ (SD)	Actual Range	ICC	1	3	4	5	6
1. Past performance	2.92 (7.13)	-19 - 24	.46					
2. Performance improvement	.73 (6.34)	-24 - 21	.51	.63**	-			
3. Self-efficacy magnitude	7.77 (5.74)	0 - 27	.74	.51**	.40**	-		
4. SDNN	64.37 (25.79)	20.15 - 207	.69	-.02	.13*	-.10*	-	
5. Mental Effort	81.88 (27.86)	5 - 150	.77	.13*	.24**	.05	-.20**	-
6. Narcissism	0.23 (0.21)	0 - .81	-	-.02	-.02	.04	-.07	-.12*

3 Notes: * $p < .05$; ** $p < .01$.

4

⁷ All scores represent the mean score across the 10 trials

1 Table 2
 2 *Main and moderating effects between Level-1 and Level-2 variables.*

	b ⁸ Unstand	SE (robust)	β STND	SE (robust)	Total Variance %
DV = Self-efficacy					
Level 1					
Trial number	.10	.05*	.00	.00	46.94
Past performance	.18	.02**	.18	.00*	62.10
Level 2 Interaction					
Narcissism × Past performance	-.21	.12a	-.05	.03a	62.17
DV = Performance improvement					
Level 1					
Trial number	.43	.08**	.06	.01**	22.02
Past performance	.03	.03	.03	.03	22.68
Self-efficacy	-.21	.06**	-.16	.04**	41.61
Self-report mental effort	.16	.01**	.59	.05**	40.99
SDNN	-.09	.02**	-.32	.05**	30.50
Level 2 Interaction					
Narcissism × Self-efficacy	.15	.31	-.02	.05	41.62
Narcissism × Self-report mental effort	-.18	.06**	-.10	.04*	41.48
Narcissism × SDNN	-.02	.08	-.01	.05	30.61
DV = Self-report mental effort					
Level 1					
Trial number	.78	.25**	.02	.00**	20.91
Past performance	.01	.09	.01	.02	20.96
Self-efficacy	-.36	.20	-.07	.04	21.78
Level 2 Interaction					
Narcissism × Self-efficacy	-1.75	.97a	-.07	.04a	21.91
DV = SDNN					
Level 1					
Trial number	.84	.27**	.03	.01**	12.97
Past performance	.00	.12	.00	.03	13.57
Self-efficacy	.22	.19	.05	.04	13.91
Level 2 Interaction					
Narcissism × Self-efficacy	-1.50	1.22	-.07	.05	13.87

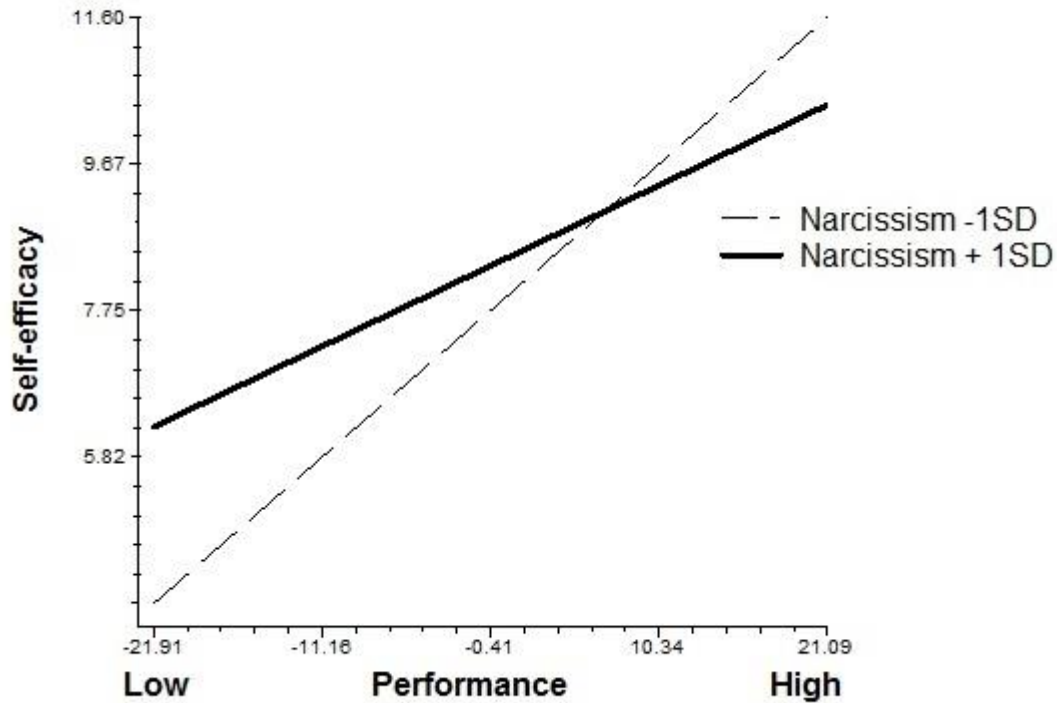
3 a $p < .1$; * $p < .05$; ** $p < .01$

4 Unstand = Unstandardized. STND = Standardised. DV = Dependent variable. Level 2
 5 variable is the moderator variable narcissism. Total Variance: Total variance accounted for is
 6 when a Level 1 predictor variable is added to the model. For example, in the top tier, trial
 7 number explains 46.94% of the variance in self-efficacy. The total variance that trial number
 8 and past performance accounts for is 62.10%. Therefore, the variance that past performance
 9 explains above that of Trial number is 15.16%.

10 As narcissism was unrelated to any of the outcome variables, it is not reported in this Table.

⁸ b = multilevel regression coefficients, which are sometimes referred to as gamma (γ) in multilevel modelling

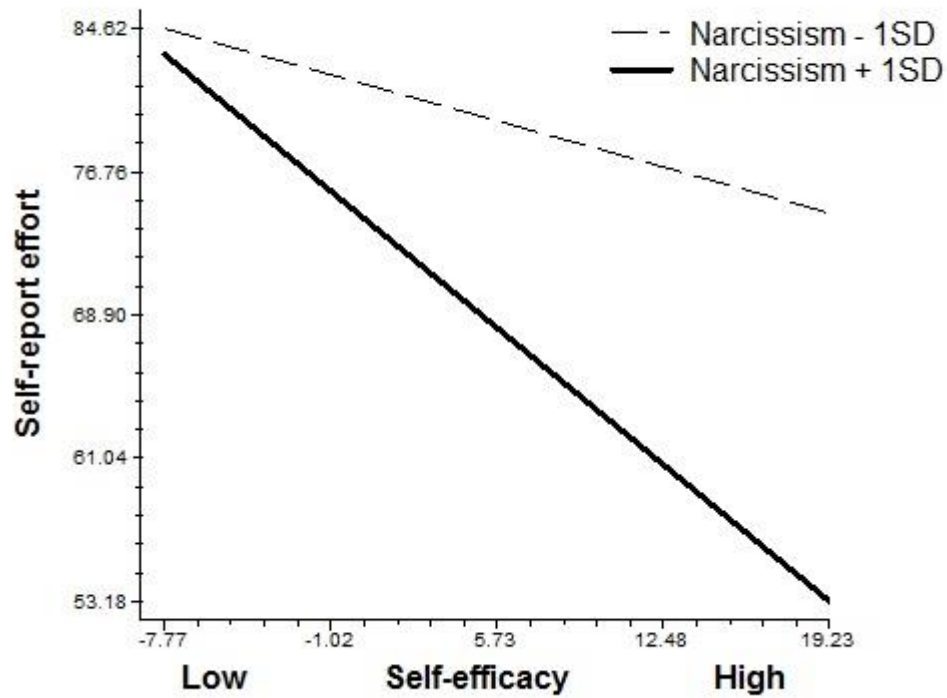
- 1 *Figure 1.* The moderating effect of narcissism on the relationship between past performance
 2 and subsequent self-efficacy⁹.



3

⁹ When plotting the interactions in Figures 1, 2, and 3, we used the full range of scores of the independent variable and plotted the moderator (narcissism) at 1 SD above the mean (i.e., $.23 + .21 = .44$) and 1 SD below the mean (i.e., $.23 - .21 = .02$).

- 1 *Figure 2.* The moderating effect of narcissism on the relationship between self-efficacy and
- 2 self-reported effort.

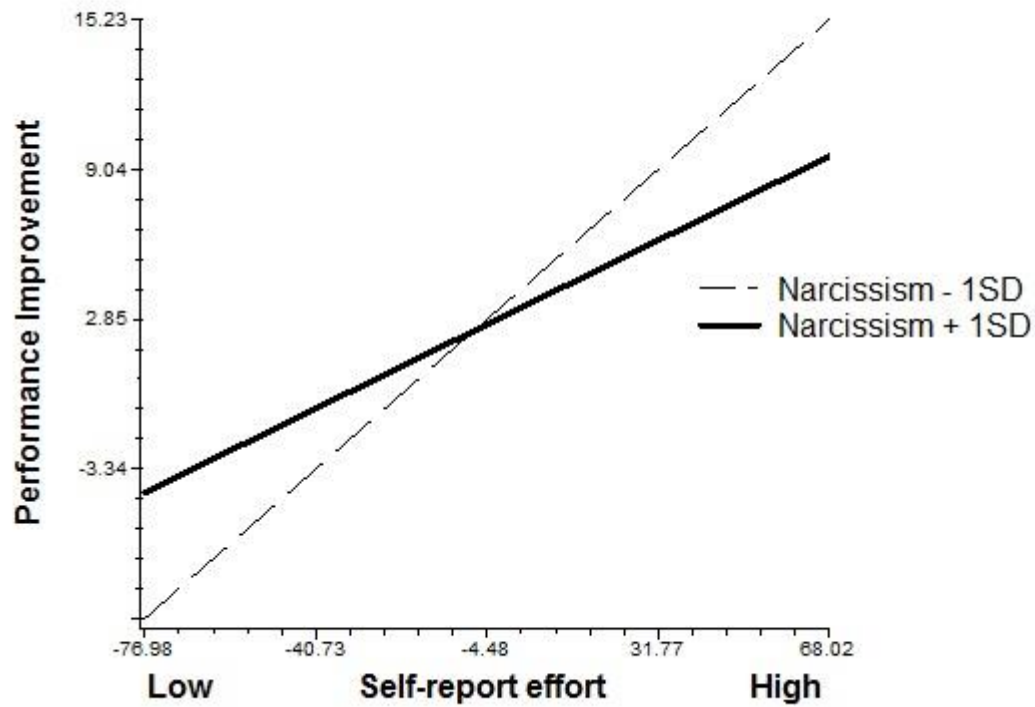


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- 1 *Figure 3.* The moderating effect of narcissism on the relationship between self-report effort and performance improvement.
- 2



3