When the Going Gets Tough, Who Gets Going? An Examination of the Relationship Between Narcissism, Effort, and Performance

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Abstract

Individuals high in narcissism excel when opportunities for personal glory are evident, and they disappoint when no such opportunity exists. However, the mechanisms underlying these performance effects are unknown. Across two studies, we provide the first evidence that changes in effort explain narcissists' performances. In Study 1 (*n* = 120) participants performed a dart-throwing task under high and low self-enhancement opportunity and self-rated their effort. In Study 2 we used an endurance task, again performed under low and high self-enhancement opportunity, but supplanted self-report measures of effort with psychophysiological measures. In both studies narcissism had a significant positive indirect effect on performance via effort when self-enhancement was high, but a negative indirect effect on performance when self-enhancement was low. Moreover, in Study 2 (*n* = 63) we tested an efficiency-based explanation of effort, to examine whether individuals high in narcissism performed better under pressure because they "try harder" or because they "try smarter". Results supported the "try harder" explanation. These data demonstrate that individuals high in narcissism excel when opportunity for success exists thanks to their greater investment in the task.

Keywords: Narcissist, performance, self-enhancement, grandiosity, psychophysiology

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Individuals high in narcissism believe they are exceptional. Indeed, previous literature demonstrates such people consider themselves as superior to others (Gabriel, Critelli, & Ee, 1994), rate themselves as effective leaders (see Campbell, Hoffman, Campbell, & Marchisio, 2011) and report high levels of confidence (Campbell, Goodie, & Foster, 2004). Empirical support, however, suggests that the basis for such self-inflation is largely delusory. For example, despite evaluating their performances favorably, individuals high in narcissism often perform no better than their low narcissistic counterparts. This discrepancy has been demonstrated in tests of intelligence (Gabriel et al., 1994), group interaction tasks (John & Robins, 1994), oral presentations (Robins & John, 1997), and supervisor ratings of work performance (Judge, LePine, & Rich, 2006).

Although these studies paint a picture of narcissistic beliefs at odds with reality, other work presents a more nuanced view, and demonstrates that context influences the quality of performance for individuals high in narcissism. More specifically, because such individuals are highly motivated by opportunities for self-enhancement (Morf & Rhodewalt, 2001), their performance should be dependent on the self-enhancement opportunity afforded by a situation or task (Wallace & Baumeister, 2002). Across four laboratory experiments, Wallace and Baumeister (2002) demonstrated that individuals high in narcissism (compared to those low in narcissism) performed well in situations where the potential for self-enhancement was high (e.g., pressured or difficult tasks, presence of an audience or public recognition) and poorly when it was low. More recently these effects have been replicated and extended in a variety of settings. For example, in the sporting domain, handball players high in narcissism performed better on a throwing task when under pressure (i.e., in the presence of 1000 spectators while also being videoed) than when in training (Geukes, Mesagno, Hanrahan, & Kellmann, 2012, 2013). Similarly, narcissism predicted performance improvements from training to competition in a sample of high-level figure skaters (Roberts, Woodman, Hardy, Davis, & Wallace, 2013). Laboratory experiments involving a variety of cognitive (Nevicka, Baas, & Ten Velden, 2015) and motor tasks (Roberts, Callow, Hardy, Woodman, & Thomas, 2010; Woodman, Roberts, Hardy, Callow, & Rogers, 2011) and different manipulations (e.g., increasing pressure through monetary rewards and negative feedback, increasing the identifiability of individual performances) have replicated this basic pattern. In summary, individuals high in narcissism excel when the situation allows them the chance to show their talents to the world, but perform poorly when such chances are not available.

While these performance effects are consistent, the underlying mechanisms are poorly understood. Wallace and Baumeister (2002) suggested that improved performance for individuals high in narcissism might be a result of increased effort. Because of their zealous pursuit of self-enhancement, individuals high in narcissism would likely invest effort in situations where they believe an opportunity for personal glory exists, as increasing effort maximizes the chance of gaining glory, and provides confirmation of their, somewhat delusory, self-beliefs. Conversely, these individuals may withdraw effort when no such opportunity is apparent. The role of effort as a performance-enabling mechanism is also evident within anxiety and performance research. For example, Attentional Control Theory (e.g., Eysenck, Derakshan, Santos, & Calvo, 2007) suggests that performance can be maintained, or even improved, under anxiety as a result of increased effort, and considerable evidence exists supporting the tenets of this theory (for recent examples, see Oudejans & Pijpers, 2010; Nibbeling, Oudejans, & Daanen, 2012). Further, anxiety theorists (Eysenck, 1982) have proposed that effort might only aid performance when one is confident of being successful. In this regard, it is easy to see how the lower levels of reported anxiety (Sedikides, Rudich, Gregg, Kumashiro, & Rusbult, 2004), and higher levels of confidence (Campbell et al., 2002) reported by individuals high in narcissism, would strengthen their belief that increases in effort would improve performance.

Although increases in effort seem a worthy explanation for the narcissism-performance relation, the evidence base for this effect is weak. To date, only one study has examined the role of effort within this relationship. In a team cycling task, Woodman et al. (2011) asked participants (n = 42) to cycle as far as possible for 10 minutes in two counterbalanced conditions, one where individual performance was identifiable and one where it was not. When identifiability was high, individuals high in narcissism cycled over a kilometer farther compared to when it was low, and this performance increase was mirrored by increases in physical effort (i.e., heart rate and ratings of perceived exertion). However, although these findings indicate parallel increases in effort and performance, they are limited as they offer no direct evidence that effort is the causal mechanism behind narcissistic performance increments under increased self-enhancement. They are also based on rather crude effort measures. For example, absolute heart rate measured during whole-body aerobic exercise will primarily reflect the physical demands of the task rather than psychological factors (Mazenc, Malisoff & de Querioz, 2011). Thus, at present the reasons why narcissists perform well in some situations and poorly in others is unknown (Roberts & Woodman, 2017).

In the current report, we provide the first formal test of the hypothesis that effort underlies the narcissism-performance relationship across two studies. In Study 1 individuals self-reported their effort after performing a fine motor task (dart throwing) under both mastery and performance motivational climates, which provide different opportunities for self-enhancement (Roberts, Woodman, Lofthouse, & Williams, 2015).

Stemming from Achievement Goal Theory (Ames, 1992; Nicholls, 1989) motivational climate refers to an individual's perception of situational cues and structures that are evident within an achievement setting (Ames, 1992). A mastery climate is characterized by the demonstration of task mastery and by rewarding effort more than ability (Nicholls, 1989). Conversely, performance climates underscore the importance of outperforming others. In performance climates, learning is seen as a means to an end, and success is evaluated via interpersonal comparison (Nicholls, 1989). The competitive nature of performance climates provides a clear opportunity for glory, and as such, would be expected to promote greater levels of effort and performance for individuals high in narcissism (for an overview, see Roberts, Woodman, & Sedikides, 2017).

In Study 2, we used a team based physical endurance task and utilized objective physiological markers of effort. In addition, we used a different self-enhancement manipulation to Study 1, by altering the identifiability of individual performances, to increase the generalizability of our findings. In both studies, we hypothesized that effort would mediate the narcissism-performance relationship. More specifically, we hypothesized that effort would mediate the narcissism-performance relationship when self-enhancement was high but not when it was low.

STUDY 1

Method

Participants

Power analysis for detecting mediating effects using MedPower (Kenny, 2017) indicated that 109 participants were required for detecting a moderate indirect effect (partial *r* for all paths = .3, alpha = .05 and power = .80). Consequently, we recruited 120 participants from the UK (n = 60 men, 60 women, M_{age} = 20.74, SD = 3.67) to provide adequate power. All participants were novice dart players and provided written informed consent to take part. We obtained institutional ethical approval before the study.

Task and Experimental conditions

We measured performance using a dart-throwing task (Wallace & Baumeister, 2002; Woodman, Barlow, & Gorgulu, 2015). Two regulation dart boards were placed on a laboratory wall at 1.73m, with a throwing line, or “oche”, placed 2.37m away. We removed the standard wireframes from each dartboard and placed a coversheet (matching the size of the dartboard) with nine concentric circles over the dartboard. Darts landing in the bullseye scored 10 points and darts landing in the next concentric circle scored nine points. This scoring system continued with each subsequent concentric circle being worth one point less with the outermost circle being worth one point. Darts that failed to hit the board received 0 points. Participants completed the task in same-sex pairs with the dart boards separated by an opaque screen. Each participant performed nine practice throws before completing 30 throws in a mastery climate condition and 30 throws in a performance climate condition. We counterbalanced the conditions.

In each condition participants listened to audiotaped instructions that we developed based on examples in the literature (Standage, Duda, & Pensgaard, 2005). The instructions for the mastery climate were as follows: "During this task, we want you to try your best. It is not a competition. We just want you to try your best and aim to improve. We will write down your overall score but no one will see it. Remember the most important thing is just to try your best.”

The instructions for the performance climate were as follows: “During this task, the most important thing is the amount of points you score. This task is a competition. Your score is very important because you firstly will be competing against the other person in the study here today to get the highest score, and your score will also be used to rank you in order of highest to lowest in the whole study. We will announce your score to everyone here today and we will also post your score on the School television for the whole School to see. The person with the highest score in the study will win a cash prize; remember this task is a competition, try and win".

Measures

Narcissism. We assessed narcissism using the Narcissistic Personality Inventory (NPI; Raskin & Hall, 1979). The NPI is a 40-item forced-choice inventory and measures the grandiose component of narcissism. For each item, participants are asked to choose between a narcissistic and a non-narcissistic statement. The number of narcissistic responses is summed to give a total narcissism score (range 0–40).

Effort. We used Zijlstra's (1993) Rating Scale of Mental Effort (RSME). The RSME is essentially a single-item visual analog scale whereby participants rate the level of mental effort that they have expended during a task using a vertical scale ranging from 0–150, with increments of 10 shown on the left edge of the scale and nine category anchors shown on the right edge of the scale. These include *no mental effort at all* (3 on the scale), *a fair amount of mental effort* (58 on the scale), and *extreme mental effort* (114 on the scale). The scale has acceptable test-retest reliability, with a correlation coefficient of 0.78 (Zijlstra, 1993), and is often used in laboratory and field-based research to assess mental effort during competition or the performance of various tasks (e.g., Manley, Beattie, Roberts, Lawrence, & Hardy, 2017).

Manipulation check. After each condition participants completed a nine-item climate manipulation check adapted from Standage et al. (2005). The inventory assessed the degree to which participants agreed that each experimental condition reflected a mastery climate (four items, e.g., *trying hard was important*) and a performance climate (five items, e.g., *the focus was on being the best*). Each question was scored on a five-point Likert scale from 1 (*Strongly disagree*) to 5 (*Strongly agree*).

Procedure

Participants entered the laboratory in same-sex pairs and then sat at desks where they completed the consent form and read information about the task that they were about to complete. More specifically, we explained that they would be completing the dart throwing task under two different learning conditions, and would be completing 30 throws per condition. We also asked them to refrain from speaking to each other during the trials. Participants then threw nine practice darts before receiving the standardized instructions for the first condition. They then proceeded to throw the 30 darts for that condition. Following the last dart, participants completed the RSME and the manipulation check. On completion of the measures, participants listened to the instructions for the second condition. As before, participants then completed the 30 throws for the second condition followed by the RMSE and the manipulation check. Finally, they completed the NPI. On completion of all the measures we debriefed participants as to the nature of the study and thanked them for their participation.

Analysis

We tested our central hypothesis that effort would mediate the narcissism-performance relationship with PROCESS (Hayes, 2013). PROCESS is a flexible regression-based package that tests a variety of mediation- and moderation-based hypotheses, and employs bootstrapping and confidence intervals to assess the size and significance of any effects produced. Lower- and upper-bound 95% confidence intervals that do not encompass zero indicate significance at the .05 level. PROCESS confers evidence of mediation when the indirect effect of the mediator (i.e., the product of the a and b paths) is significant. Although, historically, approaches to mediation have focused on testing the separate effects of the constituent paths of a mediation model and require each individual path to be significant, such an approach has been criticized in the literature for some time and is now considered outdated. More pertinently, in contemporary approaches to mediation the effect of interest is the indirect effect rather than whether the individual a and b paths are significant (for more detail, see Hayes, 2013; Hayes & Rockwood, 2016).

Because of the repeated-measures nature of our design we ran separate mediation analyses for each experimental condition and controlled for individual differences in performance and effort by using the performance and effort variables from the non-analyzed condition as covariates (i.e., in the analysis of whether effort mediated the narcissism – performance relationship in the performance climate, we included effort and performance in the mastery climate as covariates). Before running the analyses, we checked for multicollinearity by examining variance decomposition proportions and the condition index (cf. Belsley, Kuh, & Welsch, 1980). Belsey et al. (1980) recommend that independent variables with condition indices above 30 and variance decomposition proportions of .5 or above on two or more regression coefficients (indicating that this variable is contributing to 50% or more of the variance in two or more regression coefficients) should be removed. All independent variables satisfied these criteria.

Results

Preliminary Analyses

Descriptive statistics, Cronbach alphas, and Pearson correlations are presented in Table S1 in the supplementary information. We tested the effectiveness of our motivational climate manipulation with a 2 (experimental condition: mastery/performance climate) × 2 (climate questions: mastery/performance) fully repeated measures ANOVA. The ANOVA revealed a significant main effect for condition, F (1, 119) = 42.70, $p < .001$, $\eta_p^2 = .26$, 1-β = 1.00, no main effect for question, F (1, 119) = 1.71, $p = .19$, $\eta_p^2 = .01$, 1-β = .25, and most importantly a condition-by-question interaction, F (1, 119) = 221.20, $p < .001$, $\eta_p^2 = .65$, 1-β = 1.00. Follow-up tests to the interaction revealed that participants rated the mastery climate as having a significantly higher mastery focus, and the performance climate as having a significantly higher performance focus (see Table S1), suggesting the manipulation was successful.

Main analyses

The regression model for the performance climate explained 78% of the variance in performance F (4,115) = 100.98, $p < .001$. We obtained a significant, and positive, indirect effect of narcissism on performance via effort (Indirect Effect = 0.13, 95% CI [.004, .34], standardized indirect effect = .02). Narcissism was positively associated with effort (β = .11, B = 0.41, 95% CI [-.03, .85]), and effort significantly predicted performance (β = .21, B = 0.30, 95% CI [.11, .49]). The direct effect was non-significant (β = .01, B = 0.08, 95% CI [-.39, .55]

The mastery climate regression model also explained 78% of the variance in performance, F (4,115) = 100.54, $p < .001$. In this analysis we obtained a significant, negative indirect effect of narcissism on performance (Indirect Effect = -.14, 95% CI [-.36, -.01] standardized indirect effect = -.03). Narcissism negatively predicted effort (β = -.12, B = -0.44, 95% CI [-.89, .71]) and effort significantly predicted performance (β = .22, B = .32, 95% CI [.12, .51]). The direct effect was non-significant (β = .03, B = .16, 95% CI [-.32, .64]

The details of each regression analysis are presented in Table S2.

Discussion

The aim of this first study was to examine effort as a mediator of the relationship between narcissism and performance. In support of the hypothesis, there was a positive indirect effect in the performance climate condition and a negative indirect effect in the mastery climate condition. While the performance climate effect was as hypothesized, our hypothesis for the mastery climate was simply that effort would not mediate the narcissism-performance relationship. However, the negative indirect effect is consistent with Wallace and

Baumeister's (2002) theorizing that narcissists withdraw effort when opportunities for self-enhancement are unavailable.

While these effects are clear, they warrant replication for several reasons. First, our effects may be an artefact of task and/or manipulation constraints as the positive relation we obtained between narcissism, effort and performance may be specific to dart throwing and the manipulation of motivational climates (as previous work shows that individuals high in narcissism respond differently in different motivational climates, see Roberts, et al., 2015). Second, our assessment of narcissism in the present study came at the end of testing. Thus, it is possible that narcissism ratings reflected state-like confirmation or experimental biases, at least to an extent. Third, relying solely on self-report measures of effort may be problematic. Although measuring effort via self-report is commonplace in psychology research, those high in narcissism may not respond accurately when asked to self-report effort in order to protect their ego (cf. Beattie, Dempsey, Roberts, Woodman, & Cooke 2017; Morf & Rhodewalt, 2001), As such, more objective measures of effort that are less immune to response bias (e.g., psychophysiological indices) may provide a more comprehensive understanding, especially if multiple measures are used that go beyond the rather one dimensional approach offered by the RSME. Further, because the assessment of effort came at the end of testing it is possible, at least in principal, that performance-related attribution processes may have influenced effort ratings, at least to a degree. By adopting a different task and manipulation, replacing our self-report measure of effort with objective psychophysiological indices that were measured continuously (Borg et al., 1987; Mulder, 1992), and moving our assessment of narcissism to the beginning of testing, we address these issues in Study 2.

We also aimed to test a possible alternative effort-based mechanism in Study 2. Our initial theorizing and the findings from Study 1 suggest that individuals high in narcissism perform better because they try harder. However, these performance benefits might be explained by how efficiently they invest their effort, rather than simply how much effort they invest (Roberts et al., 2017). For instance, Bray and colleagues (2008) reported considerable variations in efficiency on a muscular endurance task, with participants who were in a state of self-regulatory depletion requiring more muscle activity to maintain an equivalent level of force on a handgrip dynamometer than their non-depleted counterparts. Bray et al.’s research demonstrates that some individuals can invest effort more efficiently (i.e., less physiological resource expended to achieve the same outcome) than others. Thus, although the results of Study 1 could be explained by individuals high in narcissism investing more effort, it is also possible that such individuals invested their effort more efficiently in the performance climate condition than they did in the mastery climate condition. However, as we did not measure efficiency in Study 1 this efficiency perspective remains speculative. By adopting a psychophysiological approach and an isometric handgrip endurance task (Bray et al., 2008) in Study 2, we compared these putative “trying harder” versus “trying smarter” mechanisms to explain the narcissism-performance relationship for the first time. In accord with an effort-based account, we hypothesized indirect effects of narcissism on performance via effort (positive effect when self-enhancement was high and negative effect when self-enhancement was low). Alternatively, in accord with an efficiency-based account, the above hypothesis would see efficiency replace effort as the mediator variable.

STUDY 2

Method

Participants

We recruited 63[1] participants from the UK (*n* = 24 men, 39 women, M_{age} = 22.14, *SD* = 4.43) for the study. All participants provided written informed consent to take part. We obtained institutional ethical approval before the study.

Task & Experimental Conditions

We measured performance using a hand grip muscular endurance task (Cooke, Kavussanu, McIntyre, & Ring, 2011; 2013). Participants were seated and used their dominant hand to squeeze a handgrip dynamometer (Model 76618, Lafayette Instrument, Lafayette, IN) at a force of at least 30% of their maximum voluntary contraction (MVC) for as long as possible. Their grip force was displayed on a 19 inch screen positioned directly in front of them, in the form of a green line that moved up or down as grip force was increased or decreased, respectively, and a fixed black line to indicate 30% of their MVC. We instructed participants to keep their green force line above the fixed black line for as long as possible (for an illustration of the task see Figure S1). The task was set to terminate automatically if grip force fell below 30% MVC for more than 2 s (Cooke et al., 2011). Force data were acquired by an analog-to-digital convertor (Power 1401, Cambridge Electronic Design, Cambridge, UK) and digitized at 2500 Hz with 16-bit resolution. Force was recorded and endurance time was calculated by a computer running Spike2 software (Cambridge Electronic Design).

In accord with Woodman et al. (2011), we scheduled participants to attend the experiment in same-sex teams of three, and each participant completed the task in each of two counterbalanced conditions, a low-identifiability condition, and a high-identifiability condition. In each condition, participants listened to audiotaped instructions. The initial task instructions were the same in both conditions:

“This is an endurance task. You will see a black minimum force line on the computer screen. When you squeeze the handgrip dynamometer you will produce a green force line. Your task is to keep your green force line above the black minimum force line for as long as possible. If your green force line falls below the black minimum force line the task will be terminated.” This initial passage was then followed by additional instructions. In the low identifiability condition the instructions were as follows: “In this task we are interested in your *team* performance. Your overall *team* performance time will be obtained and compared to the other teams and made publicly visible. Your individual times will not be recorded in this task as *we are only interested in the team*".

The high identifiability instructions were as follows: "In this task we are interested in your *individual* performance. Your *individual* performance time will be obtained and compared to the others and made publicly visible. Your team time will not be recorded in this task as *we are only interested in you as an individual*."

Measures

Narcissism. We assessed narcissism using the Narcissistic Personality Inventory as described in Study 1.

Cardiac Activity. To provide some objective physiological insight into effort, efficiency and performance-related mechanisms underpinning physical endurance, we measured heart rate and heart rate variability via electrocardiogram (ECG). We placed disposable silver/silver chloride electrodes (Blue sensor, Ambu, St Ives, UK) on the right and left clavicles and on the lowest left rib. An amplifier (Bagnoli-4, Delsys, Boston, MA) connected to a 16-bit digital-to-analog convertor (Power1401, Cambridge Electronic Design) and a computer running Spike2 software (Cambridge Electronic Design) were used to acquire the ECG signals, from the onset to the termination of each endurance task. We then imported recordings into Kubios HRV version 2.2 software (Tarvainen, Niskanen, Lipponen, Ranta-aho & Karjalainen, 2014) for offline analyses. Specifically, we computed heart rate as a percentage of the predicted maximum heart rate (220 – age) for each participant (Astrand & Rodahl, 1986)[2]. We also calculated the standard deviation of R-wave to R-wave intervals (SDNN) and the root mean square of successive R-R intervals (r-MSSD), as two time-domain measures of heart rate variability. Heart rate and SDNN have both been argued to reflect objective measures of effort during physical tasks (Borg, Hassmen & Lagerstrom, 1987;

Mulder, 1992). We expected heart rate to increase and SDNN to decrease to reflect increasing effort (e.g., Cooke et al., 2011). Conversely, r-MSSD provided a means of examining our “trying-smarter” hypothesis. r-MSSD has a positive relationship with physiological efficiency during endurance performance (Achten & Jeukendrup, 2003). This is likely underpinned by increased r-MSSD reflecting more activation of the pre-frontal cortex, and better executive function (Thayer, Hansen, Saus-Rose, & Johnsen, 2009). Thus, if participants are to efficiently invest resources to avoid excessive muscle activity and premature fatigue (see section below on Muscle Activity), one would expect them to activate their pre-frontal cortex (e.g., apply some self-regulation) and thereby demonstrate relatively greater r-MSSD (cf. Thayer et al. 2009).

Muscle activity. To provide some further objective insight into performance efficiency, we recorded muscle activity in the dominant forearm. We placed a differential surface electrode (DE 2.1, Delsys) over the belly of the extensor carpi radialis muscle that is used for gripping (Cooke et al., 2011; 2013), and a reference electrode (Blue sensor, Ambu, St Ives, UK) on the left clavicle. The signal was amplified (Bagnoli-4, Delsys) and then processed at a sample rate of 2500 Hz by a 16-bit data acquisition system (Power1401, Cambridge Electronic Design) connected to a computer running Spike2 software (Cambridge Electronic Design). In accord with Bray et al. (2008), we expressed in-task muscle activity as a percentage of muscle activity recorded during a 1 s window around each participant’s MVC. We focused our analyses on muscle activity during the first half of the total endurance time in each condition. We interpret elevated muscle activity in the first half of the contraction to reflect inefficient performance (e.g., over-squeezing; excessive stress / tension), which should accelerate muscular fatigue and result in lower endurance (Voor, Lloyd, & Cole, 1969). We avoided psychological interpretation/analysis of muscle activity recorded in the second half of endurance time because muscle activity increases exponentially in the latter portion of isometric contractions and thus becomes increasingly clouded by the physical demands of the exercise (Cooke et al., 2011; Voor et al., 1969).

Procedure

Participants entered the lab in same sex teams of three and then sat at desks where we briefed them about the experiment. They then completed the consent form and the NPI. We then randomly selected one of the three participants to complete the tasks first, while the other two participants were escorted to an adjoining room, where they were unable to see or hear the performing participant, to await their turn. We next used exfoliant gel (NuPrep, Weaver, Aurora, CO) and alcohol wipes (Uni-Wipe, Universal, Middlesex, UK) to prepare the electrode sites for psychophysiological measurements. The participant was then seated, the electrodes were attached, and we checked the signals to verify that all our measures were recording. At all times, the researcher was present but remained out of sight from participants so as not to influence or impede them. We then began the MVC assessment by asking the participant to squeeze the dynamometer as hard as they could with their dominant hand for 3 s. We repeated this procedure between four and six times, with a 1-minute rest between each maximal squeeze, to help ensure that the MVC recorded was accurate. Specifically, we determined that the two highest forces recorded out of the first four attempts should be within 5% of one another to indicate a true maximum, if this criterion was not met additional contractions were required (Cooke et al., 2013); no participant required more than six attempts to satisfy this criterion. Next, we set the force requirement for the subsequent endurance tasks (30% of MVC), highlighted this minimum force line on the feedback screen, and gave the participant a 30 s familiarization period to practice squeezing at the required force level. The participant then proceeded to complete the endurance task in each of the low- and high-identifiability conditions as described above in a counterbalanced order. Importantly, each condition was preceded by a fixed 5 min rest period, and followed by a fixed 5 min recovery period, to ensure that cardiac and muscle activity measures could recover after the MVC, and between the endurance tasks (Cooke et al., 2013). When the first team member had completed both tasks we removed the electrodes and invited the second team member into the lab, where the above procedure was repeated. It was then repeated for the third team member. We then de-briefed all three participants and thanked them for their time. The entire procedure took approximately 150 mins to complete.

Results

Table S3 provides descriptive statistics and correlations between the measures used in Study 2. Consistent with Study 1, we employed PROCESS (Hayes, 2013) to examine our mediation hypotheses. We ran separate mediation analyses for each experimental condition and controlled for individual differences in performance, effort and efficiency, using the performance, effort and efficiency variables from the non-analysed condition as covariates. We again checked for multicollinearity, and using the same criteria as Study 1 all variables satisfied these criteria. See Table S4 for full details of each regression analysis.

The regression model for the high-identifiability condition explained 79% of the variance in performance F (6, 56) = 35.77, $p < .001$. We obtained a significant positive indirect effect of narcissism on performance via heart rate (Indirect Effect = 55.77, 95% CI [3.28, 149.72], standardized indirect effect = .12). No other indirect effects were significant. Examination of the separate effects indicated that narcissism was positively associated with heart rate (β = .11, B = 4.54, 95% CI [-.19, 9.26]). Moreover, heart rate (β = 1.02, B = 12.30, 95% CI [5.27, 19.32]), SDNN (β = -.34, B = -0.80, 95% CI [-1.64, .04]), r-MSSD (β = .75, B = 2.50, 95% CI [.78, 4.22]) and muscle activity (β = -.32, B = -2.67, 95% CI [-4.95, -.38]) displayed the expected relations with performance. The direct effect was non-significant (β = .09, B = 59.49, 95% CI [-53.22, 172.21]).

The regression model for the low-identifiability condition explained 59% of the variance in performance *F* (6, 56) = 13.37, *p* < .001. In this analysis we obtained a significant, and negative, indirect effect of narcissism on performance via heart rate (Indirect Effect = -46.99, 95% CI [-110.12, -10.76], standardized indirect effect = -.13). No other indirect effects were significant. Examining the separate effects, narcissism was significantly negatively associated with heart rate in this condition (β = -.14, B = -5.48, 95% CI [-9.73, -1.22]). Again, heart rate (β = -.45, B = 8.58, 95% CI [3.94, 13.22]), r-MSSD (β = -.62, B = 2.06, 95% CI [.74, 3.39]) and muscle activity (β = -.91, B = -2.29, 95% CI [-3.82, -.76]) displayed the expected relations with performance. The direct effect was non-significant (β = -.13, B = -60.92, 95% CI [-134.88, 13.04]).

Discussion

The aim of Study 2 was to re-examine effort as a mediator of the narcissism-performance relationship using psychophysiological indices, while also examining an alternative efficiency-based mechanism. In accord with our effort-based hypotheses and our findings in Study 1, we obtained an indirect effect of narcissism on performance through heart rate. This indirect effect was positive when identifiability was high and negative when identifiability was low. We interpret our standardized measure of heart rate as an objective physiological index of effort during local muscular endurance tasks. Thus, our results demonstrate that individuals high in narcissism excel because they invest more effort when self-enhancement opportunities are high, and perform poorly because they withdraw effort when self-enhancement opportunities are low.

The alternative efficiency-based explanation of the narcissism-performance relationship was not supported. That is, although r-MSSD had a positive relationship with endurance time, and muscle activity during the first half of each contraction had a negative relationship with endurance time (which justified our inclusion of these variables as indices of efficiency), they were not related to narcissism. Indeed, the negative muscle activity-endurance relation suggests that recruiting greater motor units than necessary in order to safely achieve the desired force, leads to a reduction in endurance time because of muscle fatigue. Thus, it seems that individuals high in narcissism perform well when the spotlight is on because they try harder, not because they try smarter.

GENERAL DISCUSSION

The aim of this research was to provide the first direct test of effort as a mechanism in the narcissism-performance relationship. Across both studies, our results were consistent with our, and others' (Roberts et al., 2017; Wallace & Baumeister, 2002), theorizing that effort would be responsible for the improved performances of individuals high in narcissism when the opportunity for self-enhancement was high. In this regard, it is noteworthy that effects were consistent across studies even when we utilized different measures and conceptions of effort (i.e., self-report vs. psychophysiological, mental vs physical effort), and tested our effects in two markedly different tasks: a perceptual motor skill and an endurance task. Despite the differences in studies, we regard the consistency of our effects as sound evidence of the generalizability of the effect.

In Study 2, we also tested an efficiency-based mechanism, based on the premise that the improved performances of individuals high in narcissism might be a result of "trying smarter" as opposed to "trying harder". The psychophysiological data from Study 2 failed to support the efficiency explanation. Greater muscle activity and lower r-MSSD were associated with poorer endurance, but there was no indirect effect of narcissism on performance via these variables. Thus, taken together the results from these two studies support a "trying harder" perspective on the role of effort. This is not to say that an efficiency mechanism should be dismissed, as there may be tasks and conditions where narcissistic individuals are prompted to increase their efficiency. This possibility should be investigated by future research.

Another consistent finding across both studies was the precise nature of our mediation effects. Indeed, in both studies, effort was consistently positively related to performance in all conditions. However, the narcissism-effort relation was dependent on self-enhancement. More specifically, narcissism was positively related to effort when self-enhancement was high in both studies but negatively related when self-enhancement was low. Further, none of the direct effects were substantially changed by self-enhancement condition. Thus, it appears that opportunities for self-enhancement have a greater influence on the level of effort invested by individuals high in narcissism, as opposed to more direct effects on performance. However, we concede that our analyses may not have been entirely optimal to test for where exactly in the narcissism-effort-performance relation self-enhancement has its effects (we return to the issue of analysis later in the General Discussion). As such, more work in this area would be worthwhile.

While our effects appear clear, some issues and limitations are noteworthy. First, researchers may wish to replicate these effects with more culturally diverse samples (Heinrich, Heine, & Norenzayan, 2010) to increase generalizability. For example, it is unclear whether the same effects reported here would extend to interdependent cultures that place less value on individual achievement. In addition, using larger sample sizes and including participants with a wider range of NPI scores would also be worthwhile to increase statistical power. Although testing indirect effect hypotheses does not necessarily require substantial sample sizes, because the power of the indirect effect is usually much greater than the direct effect (Kenny & Judd, 2014), nonetheless replicating these effects in larger samples would help to determine more accurately the size of the effect,. Second, heart rate is an admittedly crude measure of effort that can be confounded by the physical demands of exercise (Woodman et al., 2011). However, there are a number of features of our endurance task that increase confidence in our interpretation of heart rate as reflecting psychological rather than physical factors. Indeed, we adopted a local muscular endurance task rather than aerobic exercise; such tasks place relatively fewer demands on the cardiovascular system, with heart rates typically less than 100 beats per minute (Smolander et al., 1998) compared to the near maximum heart rates observed during maximal aerobic exertion (Woodman et al., 2011). Further, our task allowed us to standardize the demands, in terms of the relative force requirement, across all participants. Thus, any between-subject variability in heart rate should not be attributable to participants operating at different physical workloads. Additionally, we expressed heart rate as a percentage of maximum, thereby controlling for age-related differences in maximum heart rate across the sample (Astrand & Rodahl, 1986). Finally, and importantly, Table S3 reveals that heart rate was not positively correlated with muscle activity. If heart rate were simply a reflection of physical exertion, it would be expected to show strong positive correlations with this direct measure of physical output.

That said, we did not provide unequivocal support for our effort hypothesis in Study 2, as there was no evidence of SDNN mediating the relation between narcissism and performance. It is possible that the sensitivity of this measure to changes in effort was clouded by a combination of the relatively brief recording epochs, and any task-induced changes in respiration, which we did not assess. Future studies could use different tasks and measures to control for these potential shortcomings in the current study. For instance, measures including blood pressure, pulse wave amplitude and event-related potentials have all been employed as psychophysiological indices of effort in studies using cognitive tasks (Iani, Gopher & Lavie, 2004) and are worthy of consideration in future work.

Another issue to consider is our choice of analysis. Conceptually speaking, our data support a multilevel moderated mediation model where the indirect effect of narcissism on performance via effort is moderated by condition, and effort and performance are nested within subjects. Thus, our covariate based approach to analysing the data could be considered sub optimal. However, while SEM approaches to multilevel moderation have been established in the literature (Preacher, Zhang, & Zyphur, 2016), as well as Bayesian approaches to moderated mediation (Wang & Preacher, 2015), extensions of these processes to enable such multilevel moderated mediation analyses to be conducted are not yet available. While our covariate based approach does not allow for modelling of the multi-level effects, it does at least control for them. Developing appropriate analyses to support these sorts of multilevel data is clearly a research priority so that optimal analyses can be performed in future studies of this sort.

We must also concede that our results are only relevant to the grandiose and agentic form of narcissism. It is well established that narcissism contains two facets often termed grandiose and vulnerable, although the precise interplay between these two aspects of narcissism is of some debate (Krizan & Herlache, 2017; Roberts & Woodman, 2015). Regardless, researchers wanting to understand more fully the relationship between narcissism and performance would do well to consider measures of vulnerability as well as grandiosity in their studies. In addition, exploring the nature (additive or interactive) of the relationships between grandiosity and vulnerability in relation to performance would be worthwhile. Indeed, evidence suggests grandiosity and vulnerability interact to predict persistence such that persistence is highest when both aspects of narcissism are high (Manley, Roberts, Beattie, & Woodman, 2018), and the same effects may be expected in relation to performance (for more detail on this issue, see Roberts et al., 2017). Further, another form of grandiose narcissism exists to the agentic form that we measured here, namely communal narcissism (Gebauer, Sedikides, Verplanken, & Maio, 2012). Communal narcissists are driven by the same core motives as agentic (NPI) narcissists, but seek self-enhancement through communal means by being the most caring and most helpful people. The effects of communal narcissism on performance have yet to be investigated, yet it seems plausible to expect the exact opposite effects to what we found in this study. Communal narcissists gain glory by being good team players, and so are likely to invest more effort and perform better in team settings. This suggestion is certainly worthy of investigation in the future.

To conclude, our data provide the first evidence that effort explains the relationship between narcissism and performance and that individuals high in narcissism perform better when self enhancement is available due to the effort that they invest. More work that extends our mechanistic understanding to other variables, and considers other components of narcissism will help researchers to more fully understand why individuals high in narcissism perform as they do in different settings.

Footnote

1. We again used Medpower to perform power analyses. First, we used an effect size similar to Study 1 (partial r = .30) and second with a larger effect size than in Study 1(partial r = .35), because psychophysiological indices of effort are continuous, covert, and online (Blascovich, 2006) and typically display large statistical effects (e.g., Cooke Kavussanu, McIntyre & Ring, 2013). These power analyses indicated that between 79 and 120 participants would be required to have .80 power to detect an indirect effect. Consequently, we acknowledge that, due to the demands of data collection, our final sample was slightly underpowered. but also note that it is large in comparison to most psychophysiology studies, especially those requiring participants to be recruited and scheduled for participation in groups rather than as individuals.

2. Importantly, by expressing heart rate in relative terms rather than in absolute terms, and by adopting a local muscular endurance task rather than whole-body aerobic exercise, we reduced the likelihood of any psychological effects on heart rate being confounded by physical demands (cf. Woodman et al., 2011).

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Table S1. Descriptive Statistics and correlations between variables in Study 1

Measure	1	2	3	4	5	6	7	8	9
1.Narcissism	-	-.01	-.14	.20*	.18	.05	.03	-.10	-.22*
2.Effort (PC)		-	.76**	-.11	-.17	.14	.15	.21*	.12
3.Effort (MC)			-	-.18*	-.12	.17	.06	.13	.06
4.Performance (PC)				-	.87**	.18	.19*	.10	.12
5.Performance (MC)					-	.13	.17	.05	.05
6.MCPC (PC)						-	.87**	-.14	-.02
7.MCMC (PC)							-	-.06	.07
8.MCPC (MC)								-	.53**
9.MCMC (MC)									-
Mean	11.98	65.67	56.05	175.25	173.6	19.93	15.30	11.16	15.08
SD	7.10	26.01	26.94	37.01	37.94	6.77	5.19	5.36	5.00
Alpha	.87	-	-	-	-	.81	.70	.71	.63

Note: (PC) and (MC) refer to the performance and mastery climates respectively. MCPC (PC) = manipulation check performance climate questions in performance climate, MCMC (PC) = manipulation check mastery climate questions in performance climate, MCPC (MC) manipulation check performance climate questions in mastery climate, MCMC(MC) = manipulation check mastery climate questions in mastery climate. * $p < .05$, ** $p < .001$.

Table S2. Regression analysis results from Study 1.

	Performance Climate					Mastery Climate				
				95% CI					95% CI	
	B	SE	β	LL	UL	B	SE	β	LL	UL
Narcissism to Effort	.44	.22	.11	-.03	.85	-.44	.23	-.12	-.89	.01
Effort to Performance	.30	.10	.21	.11	.49	.31	.10	.22	.12	.51
	Eff					Eff				
Direct Effect	.08	.24	.01	-.39	.55	.16	.24	.03	-.32	.64
Indirect Effect	.13	.08	.02	.00[a]	.32	-.14	.09	-.03	-.36	-.01

Note: B = unstandardized regression coefficients; LL = lower limit of 95% confidence interval; UL = upper limit of 95% confidence interval; SE = Standard Error, β = standardized regression coefficient

[a] = this value is .004 (positive)

Table S3. Descriptive Statistics and correlations between variables in Study 2

Measure	1	2	3	4	5	6	7	8	9	10	11
1.Narcissism	-	.02	-.26*	.19	.15	.23	.23	-.07	-.21	.16	.18
2.Time (Ind.)		-	.63**	.04	.07	.08	.04	-.01	-.08	-.05	-.02
3.Time (Team)			-	-.01	.07	.18	.00	-.09	-.02	.05	-.11
4.rMSSD (Ind.)				-	.88**	.55**	.49**	-.66**	-.56**	.15	.13
5.rMSSD (Team)					-	.54*	.58**	-.68**	-.66**	.22	.26*
6.SDNN (Ind.)						-	.75**	-.44**	-.48**	.16	.08
7.SDNN (Team)							-	-.44**	-.49**	.10	.18
8.HR (Ind.)								-	.90**	-.25*	-.28*
9.HR (Team)									-	-.26*	-.29
10.MA (Ind.)										-	.78**
11. MA (Team)											-
Mean	10.73	185.36	179.85	40.62	39.44	74.41	73.11	41.88	42.06	42.19	43.43
SD	5.81	80.11	61.63	22.34	18.40	29.82	27.46	5.81	5.58	10.73	10.94
Alpha	.82	-	-	-	-	-	-	-	-	-	-

Note. Time = measure of endurance task performance; r-MSSD = root mean square of successive R-R intervals; SDNN = standard deviation of R-wave to R-wave intervals. HR = heart rate; MA = muscle activity indicated by activation of the extensor carpi radialis. Values are presented for performance in the high identifiability (Ind.) and low identifiability conditions (Team). * $p < .05$, ** $p < .001$

Table S4. Regression analysis results for Study 2

	High Identifiability					Low Identifiability				
				95% CI					95% CI	
	B	SE	*β*	LL	UL	B	SE	*β*	LL	UL
Narcissism to Mediators										
rMSSD	8.23	10.09	.05	-.11.99	28.46	-2.58	7.96	-.02	-18.53	13.36
MA	4.73	6.39	.06	-8.07	17.52	6.19	6.36	.06	-6.56	18.93
HR	4.54	2.36	.11	-.19	9.26	-5.48	2.12	-.14	-9.73	-1.22
SDNN	23.67	18.00	.11	-12.38	59.72	12.56	16.94	.06	-21.37	46.49
Mediators to Performance										
rMSSD	2.49	0.86	.75	.78	4.22	2.06	0.66	.62	.74	3.39
MA	-2.67	1.14	-.32	-4.95	-0.38	-2.29	0.76	-.91	-3.82	-.76
HR	12.29	3.50	1.02	5.27	19.32	8.58	2.31	-.45	3.94	13.22
SDNN	-0.80	0.42	-.34	-1.64	0.04	-0.44	0.29	-.16	-1.03	.14
	Eff					Eff				
Direct Effect	59.49	56.17	.09	-53.22	172.21	-60.92	36.86	-.13	-134.88	13.04

Indirect Effects										
rMSSD	20.57	39.84	.04	-40.16	117.21	-5.33	23.32	-.01	-58.64	35.50
MA	-12.60	18.32	-.02	-63.16	12.40	-14.15	16.70	-.03	-52.14	12.41
HR	55.77	35.91	.12	3.28	149.72	-46.99	24.86	-.13	-110.14	-10.76
SDNN	-18.94	21.17	-.04	-92.02	3.10	-5.54	11.39	-.01	-39.77	9.53
Total Indirect effect	44.79	44.40	.10	-34.54	142.08	-72.02	31.82	-.18	-149.12	-21.91

Note: B = unstandardized regression coefficients; LL=lower limit of 95% confidence interval; UL= upper limit of 95% confidence interval; SE = Standard Error, β = Standardized regression coefficient

PROCESS syntaxes for main analyses

Study 1

Performance Climate

process vars = perf_pc perf_mc NPI effort_pc effort_mc/y=perf_pc/x=NPI/m=effort_pc/model=4/boot=5000

Mastery climate

process vars = perf_pc perf_mc NPI effort_pc effort_mc/y=perf_mc/x=NPI/m=effort_mc/model=4/boot=5000

Note: perf_pc = dart performance score in performance climate, perf_mc = dart performance score in mastery climate, effort_pc = effort in performance climate, effort_mc = effort in mastery climate, NPI = narcissism score.

Study 2

High identifiability condition

Process vars = I_time T_time NPI I_HR T_HR I_rMSSD T_rMSSD I_SDNN T_SDNN I_MA T_MA/y=I_time/x=NPI/m=I_HR I_rMSSD I_SDNN I_MA/model=4/boot=5000

Low identifiability condition

Process vars = I_time T_time NPI I_HR T_HR I_rMSSD T_rMSSD I_SDNN T_SDNN I_MA T_MA/y=T_time/x=NPI/m=T_HR T_rMSSD T_SDNN T_MA/model=4/boot=5000

Note: I and T denote individual (high identifiabitliy) and team (low identifiability) conditions respectively.

Figure S1

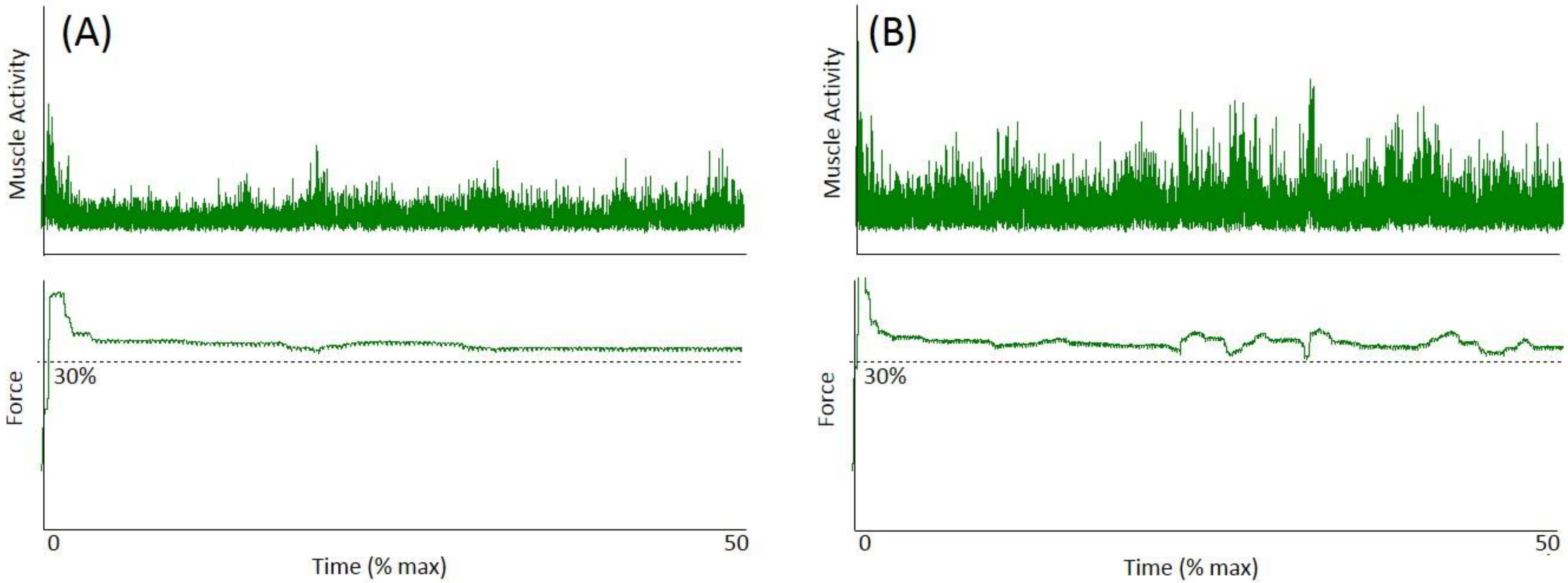

Figure S1. Example raw data recordings. These recordings are from the same participant in the High-Identifiability condition (Panel A) and the Low-Identifiability condition (Panel B). Scale axes are identical for each condition. Note that the force produced in each condition is very similar, just exceeding the 30% target, indicated by the dotted line. However, the muscle activity producing the force is noticeably different; muscle activity is greater in Panel B. Therefore, in this particular example, the required force was produced at a lower muscular cost in Panel A than in Panel B, indicating greater efficiency in Panel A.