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The metacognitive abilities of narcissists: Individual differences between grandiose and vulnerable subtypes

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ABSTRACT

Understanding individual differences in metacognitive ability is vital to gaining a better understanding of how we think about our own thinking. Past research has shown that individual differences in grandiose and vulnerable narcissism are related to overconfidence and self-reported metacognitive insight. Building off this work, we present results from an online study of 208 adults (recruited from the U.S. and Canada) examining the relations of trait grandiose and vulnerable narcissism with metacognitive variables related to memory and intelligence. Results indicate that while grandiose and vulnerable narcissism are similarly related to performance on tasks measuring recall, verbal intelligence, and numeracy, only grandiose narcissism was significantly related to metacognitive performance. Specifically, trait grandiose narcissism was positively associated with overconfidence (bias) for performance on memory and verbal intelligence tasks and negatively associated with the ability to discern correct from incorrect responses on the verbal intelligence task (i.e., discrimination index). Our findings suggest that the two types of narcissism differ not only dispositionally but metacognitively in important ways and provide a deeper understanding of the extent to which individual differences in personality attributes may be related to metacognitive abilities.

1. Introduction

Previous research has shown that individual differences in dispositional and personality attributes are associated with performance on measures both of cognitive abilities, such as critical thinking and verbal intelligence, and metacognitive abilities, which are involved in monitoring and evaluating one's own thought processes (Littrell et al., 2020b; Stanek & Ones, 2023). For example, individuals who score higher on measures of trait impulsiveness tend to score lower on measures of analytic thinking such as the Cognitive Reflection Test (Littrell et al., 2020a, 2020b). Additionally, people with greater levels of dispositional impulsiveness report experiencing less *metacognitive clarity* – that is, they experience more confusion when attempting to reflect on and evaluate their thoughts, feelings, and decisions (Littrell et al., 2020b). Similarly, Erbas and Bas (2015) found that self-reported metacognitive ability is related to the Big Five personality traits of extraversion (positively) and neuroticism (negatively). Critically, extraversion and neuroticism are core components of narcissism, a personality cluster associated with exaggerated self-admiration and distorted self-perceptions that is consistently related to various types of overconfidence, a type of metacognitive bias (e.g., Meisel et al., 2016). For example, Littrell et al. (2020b) found that grandiose narcissism was positively related to overconfidence for measures of numeracy and verbal intelligence and negatively related to measures of analytic thinking style such as Need for Cognition and the Cognitive Reflection Test (CRT).

Much of the prior work examining the associations between narcissism and metacognition has relied largely on self-report measures, while studies linking narcissism and various cognitive abilities have focused mostly on measures of crystallized intelligence (both self-reported and objective) such as vocabulary and geographical knowledge (e.g., Given-Wilson et al., 2011). This leaves open the question of whether narcissism is also related to more objective measures of metacognitive performance and other cognitive processes such as recall and numeric reasoning. As such, the goal of the present study was to examine the extent to which grandiose and vulnerable narcissism are associated with objective measures of metacognitive monitoring (i.e., bias, discrimination) and measures of recall, numeracy, and verbal intelligence.

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1.1. Narcissism and metacognition

Narcissism represents a personality cluster composed of varying levels of agentic extraversion, neuroticism, and antagonism that is associated with exaggerated self-admiration and distorted self-perceptions (e.g., Meisel et al., 2016; Miller et al., 2013). Though originally believed to represent a single construct, personality researchers have identified two types of narcissism: grandiose and vulnerable (Miller et al., 2013, 2018). Grandiose narcissism is the arguably more prototypical type, characterized by high levels of agentic extraversion and antagonism and low levels of neuroticism, and reflects a person who is exploitative, domineering, and prone to high self-esteem and grandiosity (Miller et al., 2013). Vulnerable narcissism combines high levels of neuroticism and antagonism with low levels of agentic extraversion and is characterized by a sense of entitlement, need for admiration, shame, distrust, and low self-esteem (Miller et al., 2018).

Research has shown that narcissism is significantly associated with several cognitive and metacognitive abilities. For example, Giacomin et al. (2021) found that people higher in grandiose narcissism displayed weaker recognition memory ability both for faces and non-social stimuli than those lower in narcissism. Other research has found that grandiose narcissism is positively associated with three types of overconfidence – overestimation, overplacement, and overprecision (Meisel et al., 2016). However, it is important to note that the bulk of this work has focused on grandiose narcissism and, currently, little data exists on vulnerable narcissism's putative associations with these cognitive and metacognitive measures.

Though the ways in which metacognitive factors have been measured in the narcissism literature have varied (e.g., Carlson, 2013; Grijalva & Zhang, 2016), a consistent pattern of findings has emerged that strongly suggests narcissism is associated with a disconnect between a person's actual performance and their metacognitive assessments. For example, narcissism has been positively linked to various aspects of distorted metacognitive insight. Indeed, while people higher in narcissism possess a level of self-insight sufficient to be aware of their own narcissistic tendencies (Carlson et al., 2011), they continue to engage in positively biased self-talk aimed at maintaining or enhancing their self-esteem and feelings of superiority (i.e., self-enhancing cognitions) despite poor performance on a variety of reasoning and decision-making tasks (e.g., Grijalva & Zhang, 2016; O'Reilly & Hall, 2021). Moreover, recent work has shown that grandiose narcissists are also more susceptible to hindsight biases and engage in less effective forms of counterfactual thinking (Howes et al., 2020), further supporting the idea that narcissism involves biased reasoning processes (Freis et al., 2015).

However, recent studies have begun to include vulnerable narcissism when examining associations with important cognitive and metacognitive factors to help elucidate potential differences with grandiose narcissism. For instance, Littrell et al. (2020b) found that vulnerable narcissism predicts lower self-reported metacognitive insight (i.e., clarity in understanding one's own thinking processes), lower scores on measures of analytic thinking style, and a greater affinity for an intuitive thinking style. Crucially, the same study found that grandiose (but not vulnerable) narcissism was significantly, negatively correlated with performance on tests of numeracy and verbal intelligence but was a significant positive predictor of overconfidence for performance on those same tests. These and similar findings underscore the idea that grandiose and vulnerable narcissism not only represent differences in disposition, temperament, and behavior, but may reflect key differences in cognitive and metacognitive activity as well.

1.2. Individual differences in metacognition

In broad terms, metacognition refers to a spectrum of activities that involve the ability to monitor, evaluate, and control one's own cognitive processes. Though metacognition, as a concept, might arguably be traced back to Plato's idea of "cognizing about cognitions" (Moritz & Lysaker, 2018), it received relatively little research attention until the late 1970s when Flavell (1979) first coined the term "metacognition" and described what he felt were its four unique yet interactive components: 1) knowledge, 2) experiences, 3) goals, and 4) actions (Flavell, 1979; Moritz & Lysaker, 2018). In the decades since, both research into and definitions of metacognition have expanded to encompass a wide range of skills and judgments that can be operationalized in a variety of ways (e.g., Fleming & Lau, 2014; Schraw, 2009). For example, the ability to monitor and evaluate one's cognitive activity might be examined using self-report measures of "metacognitive awareness" (Schraw & Dennison, 1994) or metacognitive reflection and insight (Grant et al., 2002). Other types of metacognitive judgments include confidence in performance on a knowledge task (Moore & Dev, 2018; Rouault et al., 2018), familiarity in remember/know tasks (Migo et al., 2012), or the fluency of "feelings of knowing" (Schwartz, 1994).

Some research has suggested that individual differences in metacognition might emerge from a domain-general ability (Carpenter et al., 2019; Schraw, 1998), while other work argues that differences in metacognitive performance are more heavily task and domain-specific. For instance, Carpenter et al. (2019) found experimental evidence that an adaptive feedback intervention could improve performance on tasks that implicate metacognitive monitoring (e.g., confidence judgments for perception and memory tasks). They argue that these results provide support for the idea that certain metacognitive abilities rely on a shared "generic neurocognitive resource" (i.e., a higher-order, domain-general source). However, work from Kelemen et al. (2000) showed that while confidence judgments for different tasks were positively correlated with each other across several domains, they were weakly and unreliably correlated with measures of relative accuracy for those same domains. The authors argued that such results suggest the involvement of multiple metacognitive processes rather than the control of a single, domain-general ability or trait (Kelemen et al., 2000).

Indeed, even highly similar types of confidence judgments have shown inconsistent associations. For example, research by Moore and Dev (2018) has identified three distinct types of overconfidence (overestimation, overplacement, and overprecision). Though overconfidence (a metacognitive bias reflecting a confidence judgment that is disproportionally large relative to actual task performance) is often thought of as a domain-general metacognitive bias (that is, some people are generally more overconfident than others), some studies have found that different types of overconfidence (e.g., overestimation vs overprecision) are only marginally related for various tasks or to other variables of interest (Moore & Healy, 2008; Moore & Schatz, 2017). In light of these inconsistent results, Moore and Dev (2018) argue that overconfidence reflects task and domain specific metacognitive activity rather than being suggestive of a higher-order or trait-level ability.

Though the debate of whether overconfidence, specifically, is a general trait or specific to the domain/task at hand currently remains unsettled, recent research suggests that at least some metacognitive activity may incorporate both domain-general and domain-specific abilities (Morales et al., 2018; Rouault et al., 2018). Though much of this work has focused on associations between cognitive and metacognitive factors, recent studies have found that some cognitive and metacognitive abilities are significantly related to dispositional and personality characteristics. For instance, Littrell et al. (2020a, 2020b) have demonstrated that both trait impulsiveness and grandiose narcissism are negatively related to performance on measures of intelligence and analytic thinking but positively related to various measures of overconfidence. Such results suggest that individual differences in metacognitive performance may be related, at least partially, to aspects of personality, which could lend support to arguments that privilege trait-level explanations for certain metacognitive processes. Thus, the present study aims to examine metacognitive performance as it relates to measures of grandiose and vulnerable narcissism, specifically.

1.3. Present investigation

Here we report results from an exploratory examination of the associations between metacognition and two types of narcissistic personality attributes. This work is driven by the following research question: Given previously identified differences in the associations between both types of narcissism and self-reported metacognition (e.g., Littrell et al., 2020b), in what ways might grandiose and vulnerable narcissism also differ on more objective measures of cognitive and metacognitive performance. Critically, previous work has failed to include vulnerable narcissism in these types of investigations and the implementation of objective (rather than self-report) measures of metacognition has been inconsistent. Therefore, the present study seeks to build on and expand this work by elucidating the associations between several objective measures of metacognition – specifically, judgments of learning (JOLs), overconfidence, and discrimination – and two types of narcissism (i.e., grandiose and vulnerable). All experiments reported here received committee approval from the Office of Research Ethics at the University of Waterloo (Ontario, Canada). All data files, materials, and pre-registration information for the study can be found here: https://osf.io/a3nwr/.

2. Method

2.1. Participants

We recruited 315 adult participants from the United States and Canada from Amazon's Mechanical Turk (MTurk) participant pool using the crowdsourcing platform, Cloudresearch (Litman, Robinson, & Abberbock, 2017). To meet our goal of achieving at least 0.80 power to detect an effect of $r = 0.20$ at $\alpha = 0.05$, an a priori power analysis indicated that we would need a sample of 191, which our final sample exceeded (g*power; (Faul et al., 2009). Participation was restricted to those who had completed a minimum of 100 surveys and had at least a 95 % MTurk HIT approval rating. Data for 49 participants was removed for answering "yes" to a question asking if they had written down any of the word-pairs to help them during the recall task. An additional 58 were removed for failing attention checks leaving us with data for 208 participants to consider in the final analyses[1] (122 male, 86 female, $M_{age} = 38.49$, $SD_{age} = 11.86$, bachelor's degree or higher = 42.3 %).

2.2. Procedure

We preregistered our hypotheses and methods (available here: https://osf.io/z2m7k) on the Center for Open Science's "Open Science Framework" (OSF). After reading an informed consent form, those who agreed to participate answered three demographic questions (i.e., age, biological sex, and level of education), after which they completed the remainder of the survey which included the measures in the order that they are listed below. The survey was hosted on Qualtrics online survey platform. Participants were paid $3.50 USD based on an estimated completion time of approximately 25 min.

2.3. Materials

Grandiose and vulnerable narcissism were measured using the short form of the Five Factor Narcissism Inventory (FFNI-SF; Sherman et al., 2015), a 60-item self-report measure which assesses traits related to narcissism from a Five-Factor personality model perspective. The FFNI-SF also allowed us to separately examine the three core personality attributes thought to represent both types of narcissism (antagonism, agentic extraversion, neuroticism). To measure memory performance, participants completed a 30-word-pair recall task. Intellectual ability was represented by a mean score calculated from participant performance on separate measures of numeracy (numeric reasoning) and vocabulary (verbal intelligence). Metacognitive bias (overconfidence) was calculated from confidence scores participants provided for their performance on each memory and intelligence item. Confidence for recall performance was given *prospectively* (judgments-of-learning predictions before completing the recall task) while confidence for intelligence performance was given *retrospectively* (i.e., after completing the numeracy and vocabulary items). Finally, we calculated separate discrimination index scores for recall performance and intelligence performance by subtracting participants' average confidence/probability ratings for incorrect responses from their average confidence/probability ratings for correct responses (Schraw, 2009). Positive scores indicate that a person is better able to discern when they have given a correct answer versus when they have given an incorrect one. A full description for each measure used can be found in the Supplementary Materials.

3. Results

Descriptive statistics and intercorrelations for all variables can be found in Table S1 of the Supplementary Materials. Bivariate correlations between grandiose and vulnerable narcissism and each variable of interest are displayed in Fig. 1. Grandiose narcissism was significantly and negatively associated with intelligence, $r(206) = -0.34$, $p < .001$, and the intelligence discrimination index, $r(206) = -0.19$, $p < .01$, and significantly and positively associated with bias for JOLs, $r(206) = 0.32$, $p < .001$, and intelligence, $r(206) = 0.33$, $p < .001$. Vulnerable narcissism was significantly associated (negatively) only with intelligence, $r(206) = -0.27$, $p < .001$. Interestingly, neither grandiose ($r = -0.04$, $p = .548$) nor vulnerable ($r = -0.03$, $p = .656$) narcissism was significantly associated with recall performance ($M = 10.59$, $SD = 6.97$). Scatterplots of linear associations (with distributions) between both types of narcissism and the metacognitive variables are displayed in Fig. 2.

Finally, as an exploratory analysis, we examined to what extent each of the three Five Factor traits of narcissism (i.e., agentic extraversion, antagonism, and neuroticism) contribute to the overall variance in associations between both types of narcissism and the metacognitive variables (Fig. 3). We conducted separate partial correlation analyses between our two narcissism measures and the metacognitive variables while controlling for each Five Factor component of narcissism separately. We took this approach with the recognition that each type of narcissism is defined as a combination of various levels of agentic extraversion, antagonism, and neuroticism (together) which renders analyses of the separate Five-Factor traits on an individual level less informative. That said, a full listing of intercorrelations between the cognitive and metacognitive variables and the three Five-Factor narcissism components (individually) can be found in Table S3 of the Supplementary Materials.

When controlling for *agentic extraversion*, the positive correlations between grandiose narcissism and both types of metacognitive bias (JOL bias, $r(205) = 0.09$, $p = .20$; intelligence bias, $r(205) = 0.12$, $p = .08$) were reduced and became non-significant. This was not the case when controlling for *antagonism* or *neuroticism*. Furthermore, controlling for agentic extraversion had no significant effect on the associations between vulnerable narcissism and our metacognitive bias measures. Given these results, it appears that some aspect of *agentic extraversion* may underlie the associations between grandiose narcissism and metacognitive bias (overconfidence).

When controlling for *antagonism,* the associations between both

[1] The exclusion criteria listed in our pre-registration also allowed for the removal of any participants who scored "0" or "greater than 25" on the recall task. However, these exclusions occurred organically when we removed those participants who failed attention checks and/or admitted to using a written list of the word pairs during the recall task, therefore no additional exclusions for this specific criterion were necessary.

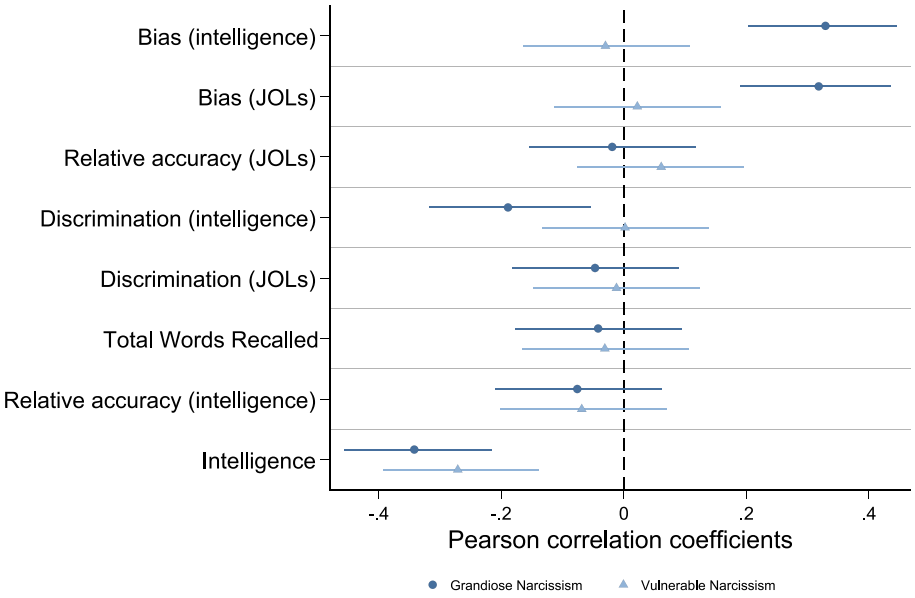

Fig. 1. Bivariate correlations between grandiose and vulnerable narcissism scores and all variables of interest. Error bars indicate 95 % confidence intervals.

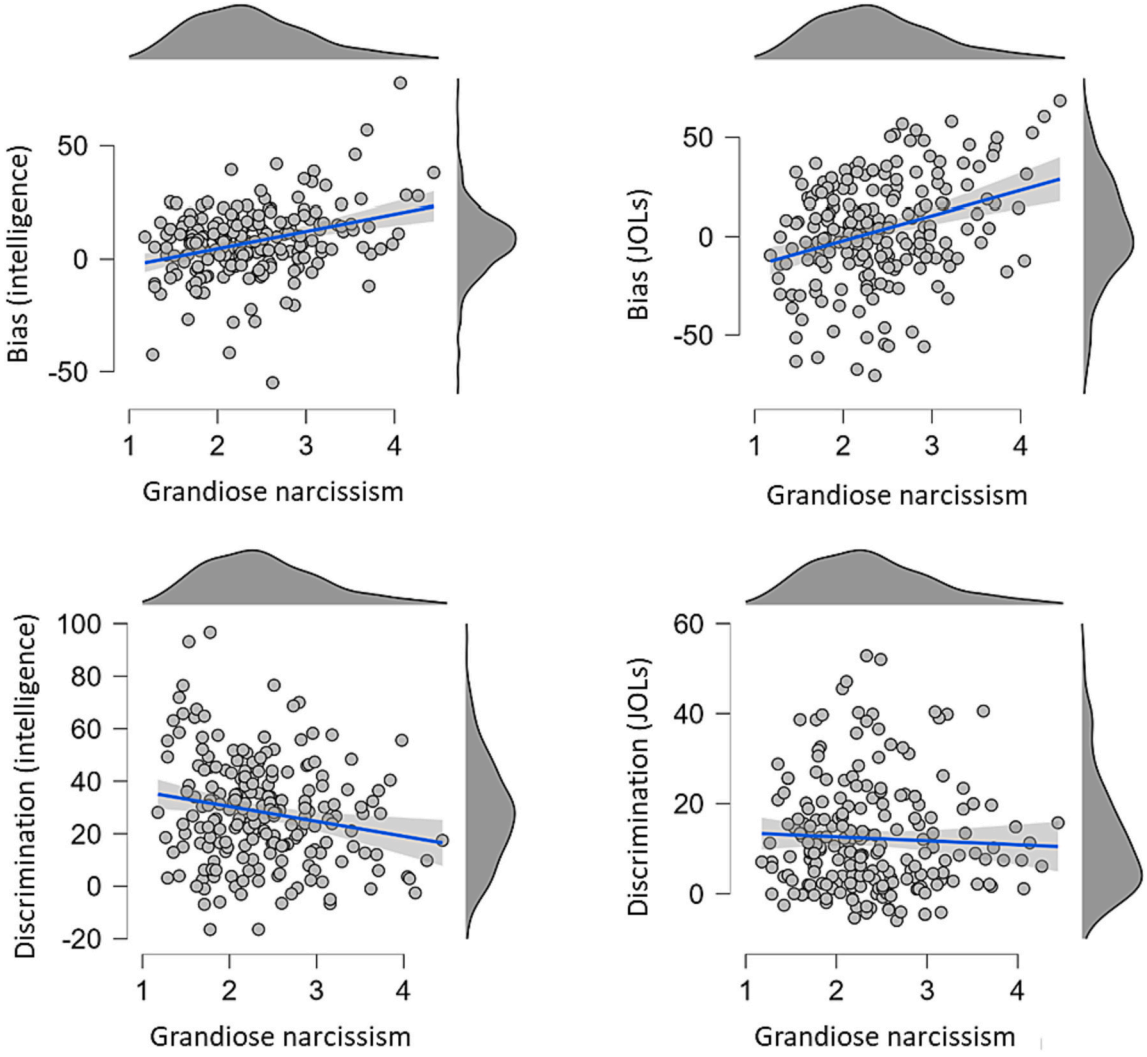

Fig. 2. Scatterplots of bivariate relations between grandiose narcissism scores (x-axis) and: 1) bias measures for intelligence and JOLs (top row), and 2) discrimination indexes for intelligence and JOLs (bottom row). Error bands indicate 95 % confidence intervals.

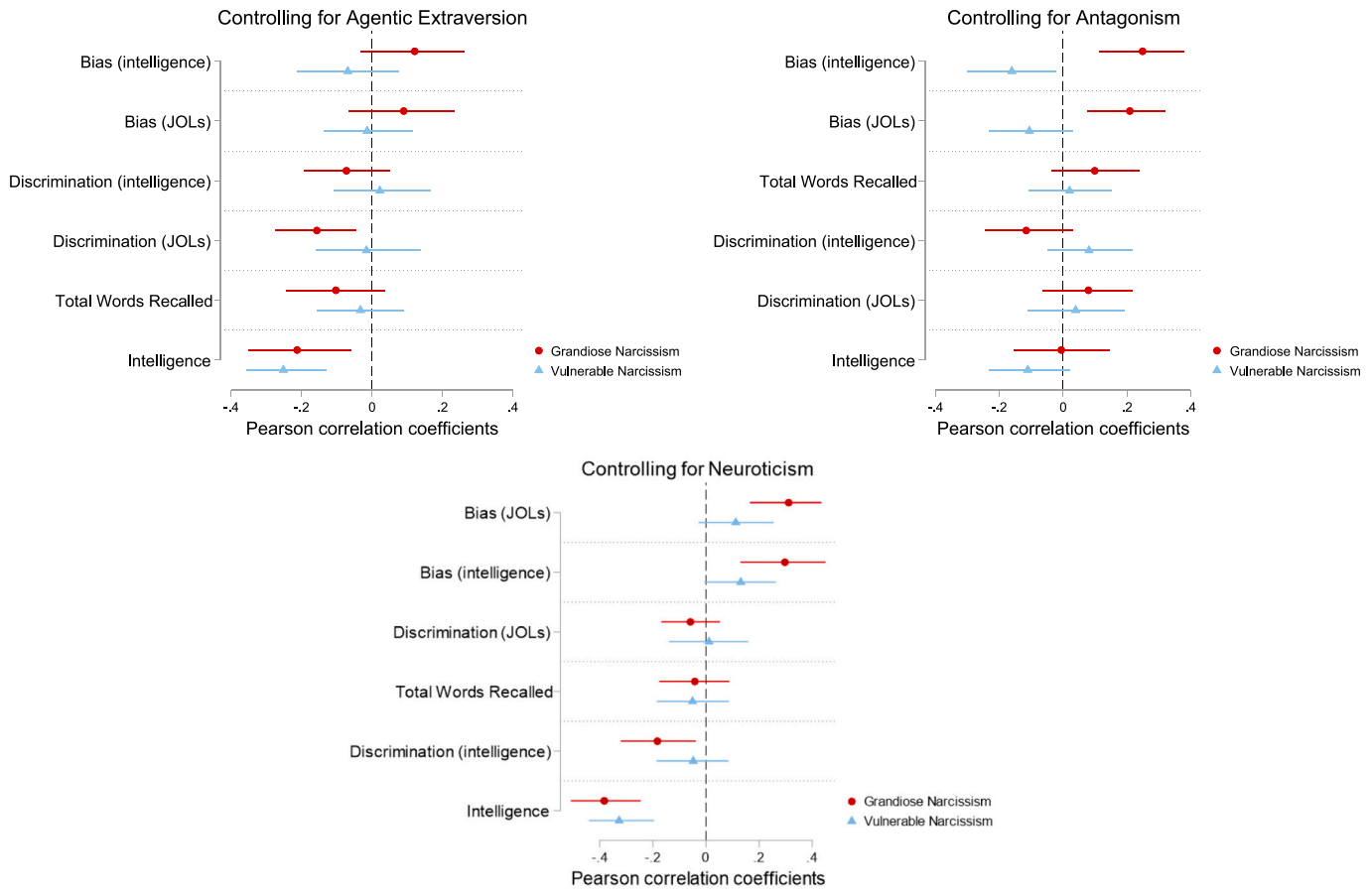

Fig. 3. Partial correlations between grandiose and vulnerable narcissism scores and all variables of interest, controlling for Antagonism (top-right), Agentic Extraversion (top-left), and Neuroticism (bottom). Error bars indicate 95 % confidence intervals.

types of narcissism and metacognitive bias (overconfidence) for intelligence trended in opposite directions, where grandiose narcissism remained positively correlated with overconfidence ($r(205) = 0.25$, $p < .001$), as it does in the main analysis, while vulnerable narcissism became negatively correlated with overconfidence ($r(205) = -0.16$, $p = .021$). This finding appears to underscore the hypersensitive, neurotic nature of vulnerable narcissism as it suggests that absent feelings of antagonism, vulnerable narcissists appear to significantly underestimate (rather than overestimate) their performance. Additionally, the associations between both types of narcissism and intelligence were reduced and became non-significant (grandiose, $r(205) = -0.006$, $p = .936$; vulnerable, $r(205) = -0.11$, $p = .110$). This was not the case when controlling for *agentic extraversion* (grandiose, $r(205) = -0.21$, $p = .002$; vulnerable, $r(205) = -0.25$, $p < .001$) or *neuroticism* (grandiose, $r(205) = -0.38$, $p < .001$; vulnerable, $r(205) = -0.33$, $p < .001$). This suggests that *antagonism* is likely the main personality attribute (of the three) underlying the negative associations with intelligence among grandiose and vulnerable narcissists. Additionally, controlling for *neuroticism* did not meaningfully affect any of the correlations between either type of narcissism and the cognitive and metacognitive variables. Finally, none of the Five Factor components of narcissism were significantly associated with cued recall performance.

4. Discussion

The goal of the present study was to investigate the extent to which metacognitive performance is associated with trait grandiose and vulnerable narcissism. We found that higher trait grandiose narcissism is associated with significantly decreased intelligence and significantly increased overconfidence (metacognitive bias) in one's performance on a metamemory task and an intelligence task. Additionally, higher grandiose narcissism was associated with decreased ability to distinguish between correct and incorrect responses on measures of intelligence. Conversely, vulnerable narcissism showed no significant associations with any metacognitive performance measures and was negatively associated only with intelligence scores. Critically, these findings expand on prior research showing that grandiose and vulnerable narcissism differ in their core dispositional attributes by providing empirical evidence that the two forms of narcissism also differ in their cognitive and metacognitive profiles.

The present results also expand on previous findings by Littrell et al. (2020b) which showed that grandiose and vulnerable narcissism differ in their associations with measures of a reflective, analytic thinking style (and beliefs which run contrary to performance on those measures), by demonstrating that they also differ on measures of metacognitive performance. Specifically, our results show that grandiose narcissism is associated with significantly greater overconfidence for memory performance (*prospectively* judged) and overconfidence for performance on an intelligence task (*retrospectively* judged). These findings align well with previous work establishing that grandiose narcissism is rooted in grandiose fantasies, entitlement, arrogance, and exaggerated self-confidence. Additionally, grandiose narcissism was associated with a significantly diminished ability to discriminate between correct and incorrect responses on intelligence tasks. These results not only help explain grandiose narcissists' *self-promoting* tendency to believe (or at least proclaim) that they are smarter or more clever than they actually are (e.g., Littrell et al., 2020b; Meisel et al., 2016), but also may provide a possible mechanism for Howes et al.' (2020) finding that grandiose narcissists have a greater proclivity for hindsight bias and resistance to corrective feedback, in that people higher in grandiose narcissism

appear to experience significantly greater difficulty recognizing that their perceptions and reasoning processes are flawed (Littrell et al., 2020b).

Interestingly, we failed to find any significant associations between vulnerable narcissism and our metacognitive measures. This may seem somewhat unexpected to some, given previous research findings. For example, Littrell et al. (2020b) found that higher vulnerable narcissism positively predicted engagement in metacognitive reflection but negatively predicted self-reported metacognitive clarity/insight. However, these results align well with what previous theory would predict. Narcissism, in general, involves biased introspection and distorted self-insight (e.g., Carlson, 2013; Grijalva & Zhang, 2016). Moreover, vulnerable narcissism is strongly rooted in neuroticism (Miller et al., 2018), which involves hypersensitivity to ego-threats, increased negative ruminations, negative perceptions of self-esteem and efficacy, and is negatively related to clarity in understanding one's own thought processes (Miller et al., 2018; Trapnell & Campbell, 1999). As such, and in contrast to grandiose narcissists, the relative fragility and self-doubt characteristic of more neurotic, vulnerable narcissists may lead them to experience negatively distorted perceptions of their own metacognitive performance exacerbated by their greater tendency to engage in anxiety-focused ruminations (Littrell et al., 2020b). This may help explain the disconnect between vulnerable narcissists' perceived lack of clarity and insight into their own metacognitive skills and their actual metacognitive performance.

Put another way, the fact that vulnerable narcissists' self-reported beliefs about their metacognitive performance do not align with their actual metacognitive performance, is positive evidence that their metacognitive insight abilities are, in fact, distorted in a *self-critical* way. Thus, while their actual metacognitive performance may be relatively average, their propensity toward more neurotic self-reflection leads them to believe otherwise. This diminished capacity for accurately monitoring one's cognitive and metacognitive activity may underlie vulnerable narcissists' difficulties with successfully navigating more complex social situations as such encounters often require a keen ability to monitor, evaluate, and adjust one's own thoughts and behaviors in response to rapidly shifting social demands.

Finally, while we found that controlling for grandiose and vulnerable narcissism did not significantly influence the intercorrelations between our metacognitive variables, we did find that controlling for specific aspects of narcissism – agentic extraversion and antagonism – influenced the extent to which these personality attributes were related to metacognitive performance. Specifically, controlling for agentic extraversion eliminated the association between grandiose narcissism and both types of bias. This suggests that the extent to which a person is assertive, authoritative, and motivated to seek praise and acclaim is a main driver of the association between metacognitive bias and grandiose narcissism (Miller et al., 2013). Additionally, controlling for antagonism eliminated the association between both forms of narcissism and intelligence, suggesting that a significant portion of the negative cognitive performance associated with narcissism can be explained by the degree to which a person is exploitative and manipulative of others, arrogant, and lacks empathy (Miller et al., 2013). Future research would benefit from a deeper exploration of the ways in which these personality attributes might be associated with performance on a wider variety of cognitive and metacognitive tasks or how the metacognitive activity of narcissists might underlie or otherwise contribute to the difficulties they often encounter in social decision-making and interpersonal interactions.

4.1. Limitations

Our memory task focused only on cued-recall and judgments-of-learning (JOL). Associations between narcissism and other memory tasks (e.g., free recall, recognition) and metacognitive judgments (e.g., feelings-of-knowing, feelings-of-rightness) could yield different results (e.g., Giacomin et al., 2021). Indeed, prior research has found that trait grandiose narcissism is associated with somewhat improved performance on tasks measuring creativity and certain motor/athletic activities. For example, performance on games of dart-throwing and basketball free throws increased for participants higher in grandiose narcissism for contexts in which potential ego-enhancing opportunities were present (Nevicka et al., 2016; Roberts et al., 2019; Wallace & Baumeister, 2002). Therefore, we cannot rule out the possibility that narcissism may provide benefits for, or at least be significantly associated with, enhanced performance for certain mental operations that were not measured in the present study. Additionally, some research has explored the effects of various types of motivation (e.g., intrinsic versus extrinsic motivation, achievement versus mastery focus, accuracy goals, etc.) on cognitive and memory performance. Given that our cognitive and metacognitive measures incorporated relatively low-stakes tasks, it could be the case that our findings are at least partially attributable to differences in motivation/effort rather than in intelligence or ability.

Finally, our sample was composed of people from the United States and Canada. In addition to genetic factors, culture is believed to play a large role in the ways in which personality attributes manifest and are judged by others (Twenge, 2011). We therefore urge caution against overgeneralizing the present results and encourage researchers to investigate the extent to which these types of effects might exist in non-Western cultures.

5. Conclusion

The present results provide empirical evidence that grandiose and vulnerable narcissism differ not only in relation to their dispositional and behavioural characteristics, but in their metacognitive performance as well. While higher levels of grandiose narcissism were associated with greater overconfidence and diminished ability to discriminate correct from incorrect responses, vulnerable narcissism was unrelated to performance on any of these metacognitive tasks. Moreover, levels of agentic extraversion almost completely explained the variance between grandiose narcissism and overconfidence while antagonism explained the majority of variance in intelligence scores for both grandiose and vulnerable narcissists. Importantly, these results deepen our understanding of the complex interplay between metacognition and personality and the extent to which individual differences in grandiose and vulnerable narcissism may be associated with optimal metacognitive performance.

CRediT authorship contribution statement

Shane Littrell: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jonathan A. Fugelsang:** Writing – review & editing, Writing – original draft, Supervision, Methodology. **Evan F. Risko:** Writing – review & editing, Writing – original draft, Supervision, Methodology.

Declaration of competing interest

None.

Data availability

All data files, materials, and pre-registration information for this study can be found here: https://osf.io/a3nwr/

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2024.112570.

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