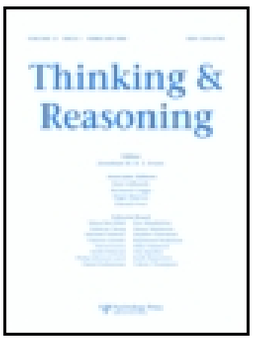

Thinking & Reasoning

Routledge
Taylor & Francis Group

ISSN: 1354-6783 (Print) 1464-0708 (Online) Journal homepage: https://www.tandfonline.com/loi/ptar20

Overconfidently underthinking: narcissism negatively predicts cognitive reflection

Shane Littrell, Jonathan Fugelsang & Evan F. Risko

To cite this article: Shane Littrell, Jonathan Fugelsang & Evan F. Risko (2019): Overconfidently underthinking: narcissism negatively predicts cognitive reflection, Thinking & Reasoning, DOI: 10.1080/13546783.2019.1633404

To link to this article: https://doi.org/10.1080/13546783.2019.1633404

THINKING & REASONING
https://doi.org/10.1080/13546783.2019.1633404

Overconfidently underthinking: narcissism negatively predicts cognitive reflection

Shane Littrell, Jonathan Fugelsang and Evan F. Risko

Department of Psychology, University of Waterloo, Waterloo, Ontario, Canada

ABSTRACT

There exists a large body of work examining individual differences in the propensity to engage in reflective thinking processes. However, there is a distinct lack of empirical research examining the role of dispositional factors in these differences and understanding these associations could provide valuable insight into decision-making. Here, we examine whether individual differences in cognitive reflection are related to narcissism (excessive self-focused attention) and impulsiveness (trait-based lack of inhibitory control). Participants across three studies completed measures of narcissism, impulsiveness and cognitive reflection. Results indicate that grandiose and vulnerable narcissists differ in their performance on problem-solving tasks (i.e., Cognitive Reflection Test [CRT]) and preferences for intuitive thinking, as well as the degree to which they reflect on and understand their own thoughts and enjoy cognitively effortful activities. Additionally, though impulsiveness was significantly related to self-report measures of cognitive reflection (i.e., metacognitive reflection, metacognitive insight, and need for cognition), it showed no association with a behavioural measure of cognitive reflection (i.e., CRT scores). Our results suggest that certain individual differences in dispositional and personality characteristics may play important roles in the extent to which individuals engage in certain forms of reflective thinking.

ARTICLE HISTORY Received 31 October 2018; Accepted 12 June 2019

KEYWORDS Cognitive reflection; narcissism; impulsiveness; insight; need for cognition

Introduction

Though people often rely, with varying degrees of success, on heuristic thinking and intuitive "gut feelings" when making decisions (Gigerenzer & Gaissmaier, 2011; Tversky & Kahneman, 1974), some people show a disposition for slower, more thoughtful deliberation – commonly known as cognitive reflection (Pennycook, Fugelsang, & Koehler, 2015). To date, much of

CONTACT Shane Littrell sslittrell@uwaterloo.ca

Supplemental data for this article is available online at https://doi.org/10.1080/13546783.2019.1633404.

the research on cognitive reflection has focused mainly on characterising its cognitive and behavioural correlates. For example, propensity to engage in cognitive reflection is associated with a decreased susceptibility to both pseudo-profound bullshit (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2015) and partisan fake news headlines (Pennycook & Rand, 2018). In addition, a greater propensity to be reflective is positively associated with cognitive ability (Frederick, 2005) and logical reasoning (Pennycook, Cheyne, Koehler, & Fugelsang, 2013). Through understanding the factors associated with cognitive reflection, we have come to a deeper understanding of both the basic mechanisms supporting it and the diverse ways in which it colours our day-to-day cognitive lives. This general approach, however, has largely ignored how more traditional dispositional traits (e.g., personality) might contribute to the propensity to cognitively reflect. This seems a missed opportunity as a number of personality traits appear to overlap conceptually with the propensity to reflect and, by examining these potential links, we could come to a deeper understanding of both cognitive reflection and personality (e.g., Petty & Cacioppo, 1986; Strack & Deutsch, 2004). The present investigation takes a step in this direction by examining how two such traits, narcissism and impulsiveness, relate to the propensity to reflect, broadly speaking, on our cognitions.

Dual process theories

One of the oldest ideas in cognitive research – and the current dominant model in the reasoning literature – is that we rely on two types of thinking: one that is fast, automatic, associative, and intuitive and another that is slower, analytic, rational, and reflective (e.g., Kahneman, 2003; Pacini & Epstein, 1999; Sloman, 1996; Strack & Deutsch, 2004). *Dual process theory* (DPT) provides a useful framework for conceptualising these differences by distinguishing between Type I (intuitive) thinking, which is autonomous and does not require working memory, and Type II (reflective) thinking that is cognitively decoupled and utilises working memory (Evans & Stanovich, 2013). For example, most models suggest that when a person encounters a stimulus, characteristics of that stimulus may cue intuitive, affective, or heuristic Type I responses that are acted on quickly (i.e., "going with your gut") but can be overridden by slower, more deliberative Type II rationalising (Pennycook et al., 2015). The degree to which these cognitively reflective Type II processes will be engaged can be influenced by top-down factors such as congruency of the stimulus information (Pennycook et al., 2015), metacognitive confidence that the intuitive response is correct (i.e., Feeling of Rightness; Thompson, Prowse Turner, & Pennycook, 2011), and

time allotted to process the information before making a decision (Strack & Deutsch, 2004).

Dual processing and individual differences in personality

As noted above, the bulk of dual processing research has focused on various cognitive and behavioural correlates of the propensity to engage in Type II reflective thinking (e.g., Evans & Stanovich, 2013; Noori, 2016). Research in personality and social psychology, however, has demonstrated the utility of relating these dual processes to personality variables (e.g., Petty & Cacioppo, 1986; Strack & Deutsch, 2004). For example, a Type I, intuitive thinking style has been positively linked to emotional expressivity as well as the Big Five personality traits extraversion and agreeableness (Epstein, Pacini, Denes-Raj, & Heier, 1996; Pacini & Epstein, 1999), while a reflective thinking style has been positively associated with the Big Five traits openness and conscientiousness and negatively related to neuroticism (Pacini & Epstein, 1999; Sadowski & Cogburn, 1997).

When considering the dual process framework in the context of work on personality traits, several theoretically interesting intersections present themselves. In the present research, we focus on narcissism and impulsiveness. First, higher levels of narcissism are characterised by domineering, excessive egocentrism and self-admiration with two commonly recognised sub-types: (1) *grandiose* narcissism, expressed through grandiosity, entitlement, aggression, superiority, and self-enhancement and; (2) *vulnerable* narcissism, which is more insecure, introverted, hypersensitive, and defensive (Jauk, Weigle, Lehmann, Benedek, & Neubauer, 2017; Miller, Lynam, Hyatt, & Campbell, 2017). Additionally, narcissism appears to share characteristics associated with cognitive reflection (e.g., Grijalva & Zhang, 2016; Miller et al., 2009; Vazire & Funder, 2006). Engaging in cognitive reflection seemingly (and expressly in many of the models discussed above) requires a level of inward criticality that might be less available in individuals higher in narcissism, particularly given their propensity for biased introspection and exaggerated self-assessment (Carlson, Vazire, & Oltmanns, 2011; Morf & Rhodewalt, 2001). For example, inhibiting a fast, intuitive response requires a willingness to consider our minds as fallible and, in particular, capable of generating incorrect responses. That individuals higher in narcissism lack this capability (or the willingness to engage it) draws some support from the relations between narcissism and overconfidence (Macenczak, Campbell, Henley, & Campbell, 2016), feelings of intellectual superiority (Gabriel, Critelli, & Ee, 1994), distorted self-insight (Carlson, 2013; Grijalva & Zhang, 2016), and biased reasoning (Freis, Brown, Carroll, & Arkin, 2015). When narcissism is viewed within a dual processing framework, it reflects a

disposition toward decreased engagement in Type II processes (i.e., cognitive reflection).

Decreased engagement in cognitive reflection also appears to share deep similarities with trait impulsiveness. For example, trait impulsiveness reflects a proclivity toward reacting to internal and external stimuli in ways that are rapid, unplanned, and with little thought given to the consequences (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). Consistent with this description, impulsivity has been associated with a number of variables putatively related to the tendency to engage in cognitively reflective activities such as increased risk-taking (Kahn, Kaplowitz, Goodman, & Emans, 2002) and poorer probabilistic decision-making (Cáceres & San Martin, 2017). As with narcissism, when viewed through a dual processing lens, impulsive individuals can be appropriately described as having a propensity to avoid engaging in cognitive reflection. In the present investigation, we sought to examine these potential relations using a broad swath of measures of cognitive reflection.

Dimensions of cognitive reflection

The construct of cognitive reflection can be approached from various directions. Recent research in dual processing theory has focused on individual differences in behavioural performance on problem-solving tasks as an indicator of propensity to engage in Type II, reflective thinking processes. The most widely used behavioural measure of reflective thinking is the Cognitive Reflection Test (CRT; Frederick, 2005). The original CRT comprises three logical reasoning questions designed to elicit intuitive, incorrect responses that immediately jump to mind or reflective, correct responses which require more thoughtful engagement and intentional deliberation. Consider the following example:

> *A bat and a ball cost $1.10. The bat costs $1.00 more than the ball. How much does the ball cost?*

Many people quickly and confidently give the intuitive, but incorrect, answer of 10 cents, never aware that a better alternative exists. Many others, however, give the correct answer of 5 cents, which generally requires a more thoughtful, reflective approach. Research has shown that these more reflective CRT responders not only arrive at the correct answer, but are also aware of the intuitive, incorrect response and, realising that it is wrong, deliberate further until arriving at the best solution (Mata, Ferreira, & Sherman, 2013). Additionally, though it is one of the most frequently used measures of analytic thinking (thus, potentially at an increased risk of diminished effectiveness from overexposure), CRT performance has been shown to be relatively stable across time (Stagnaro, Pennycook, &

Rand, 2018) and its associations with other cognitive reflection variables have been shown to be robust to multiple exposures (Bialek & Pennycook, 2018).

In addition to the CRT's behavioural approach to measuring engagement in cognitive reflection, there exist dispositional measures of reflective thinking. For instance, Pacini and Epstein (1999) developed the Rational-Experiential Inventory (REI) to distinguish individual differences in preferences for intuitive-experiential processing ("faith in intuition") and analytic-rational processing ("need for cognition"). People who favour a "faith in intuition" thinking style are more spontaneous, quick to trust others, and more likely to make decisions based on "gut feelings" or instinct (Epstein et al., 1996; Pacini & Epstein, 1999). Conversely, a person who favours a "need for cognition" thinking style is said to be better able to resist impulsive behaviour, tends to enjoy engaging in challenging mental tasks, and takes more time to mentally strategise when solving problems (Pacini & Epstein, 1999).

Another important aspect of reflective thinking that has gained traction of late is the metacognitive activity represented by self-reflection and insight, as measured by the Self-Reflection and Insight Scale (SRIS; Grant, Franklin, & Langford, 2002). To keep our terminology consistent, we refer to these concepts as *metacognitive reflection* and *metacognitive insight* throughout this article. *Metacognitive reflection* describes the need and frequency with which one analyses and evaluates his or her thoughts, feelings, and behaviours. Likewise, *metacognitive insight* represents the degree to which one clearly understands the thoughts, feelings, and behaviours they have reflected on (Grant, 2001). Put another way, *metacognitive reflection* represents one's self-reported engagement in cognitive reflection whereas *metacognitive insight* represents one's self-reported clarity in understanding the components and outcomes of that reflection. These metacognitive processes are thought to be centrally important in modulating purposeful cognitive and behavioural change and have been associated with increased self-regulation, motivation, job performance, and subjective well-being (Lyke, 2009; Roberts & Stark, 2008; Silvia & Phillips, 2011).

While each of these constructs assesses cognitive reflection in a different way and, to date, have largely been examined separately, they nevertheless potentially index aspects of the same core construct. Thus, to understand the relations among narcissism, trait impulsiveness, and cognitive reflection, we examined each of these different dimensions of reflective thinking. Not only does this allow us to develop a more diverse understanding of any such relations with narcissism and trait impulsiveness, it also provides the opportunity to better understand the relations between these various measures of cognitive reflection.

Present investigation

Here, we report three large sample size studies investigating the relation between narcissism, impulsiveness, and cognitive reflection, broadly construed. In Study 1 and Study 2a, we assess two types of narcissism – grandiose and vulnerable – and trait impulsiveness in relation to measures of five dimensions of cognitive reflection: engagement in cognitive reflection (as measured by the CRT), self-reported engagement in reflection (i.e., metacognitive reflection), metacognitive insight, need for cognition, and faith in intuition. In Study 2b, we repeat these assessments while also examining associations with a measure of overconfidence in cognitive ability. Given the above, narcissism and impulsiveness should be negatively related to measures of cognitive reflection (i.e., CRT, metacognitive reflection, metacognitive insight, and need for cognition) and positively related to intuitive thinking (i.e., faith in intuition).

Study 1

Method

Participants

One hundred participants were recruited via Amazon's Mechanical Turk (MTurk) and paid $5 each for their participation. Selection was restricted to participants in the United States who had a 95% MTurk HIT (Human Intelligence Task) approval rating.

Materials

Participants completed the following measures in randomised order:

Narcissism personality inventory. Grandiose narcissism was measured using the 13-item, forced-choice version of the Narcissism Personality Inventory (NPI-13; Gentile, Miller, Hoffman, Reidy, Zeichner, & Campbell, 2013). The NPI-13 measures the extent to which a person's self-concept is marked by entitlement, dominance, and self-aggrandisement. It demonstrated good internal reliability when originally validated ($\alpha = .82$) and contains items such as, "I find it easy to manipulate people" and "I like having authority over other people."

Hypersensitive narcissism scale. Vulnerable narcissism was assessed with the 10-item Hypersensitive Narcissism Scale (HSNS; Hendin & Cheek, 1997). The HSNS measures a type of narcissism that in some individuals is associated with hypersensitivity, feelings of shame, and desire for approval rather than with grandiosity. Items are rated on 5-point Likert scale and include

statements like, "My feelings are easily hurt by ridicule or the slighting remarks of others." Hendin and Cheek (1997) reported an average reliability of α =.71 across four samples in their original validation study.

Barratt impulsiveness scale. Impulsiveness was assessed with the 30-item Barratt Impulsiveness Scale (BIS-11; Patton, Stanford, & Barratt, 1995). The BIS-11 measures a self-reported pattern of behaviour reflecting quick, unplanned reactions to stimuli accompanied by a decreased sensitivity to the negative consequences of such disinhibitory actions (Moeller et al., 2001). Participants used a 4-point frequency scale (1 = Rarely, 4 = Almost always) to rate themselves according to items such as, "I do things without thinking." The BIS-11 comprises three subscales that can be scored individually or as a composite score. To capture overall dispositional impulsiveness, we used the overall composite score in our analyses. When originally created, the BIS-11 showed good average internal reliability (α = .81, across four samples).

Cognitive reflection test – long (CRT-L). To assess propensity to engage in analytic thinking processes, participants completed the Cognitive Reflection Test – Long (CRT-L; Primi, Morsanyi, Chiesi, Donati, & Hamilton, 2016). The CRT-L is a measure of one's ability to inhibit quick, intuitive responses and engage in reflective, analytic thinking when solving problems (Campitelli & Gerrans, 2014). It consists of three mathematical word problems from Frederick's (2005) original CRT and three items added by Primi et al. (2016). The CRT-L showed an acceptable average reliability of α = .74 across three samples when originally constructed.

Rational-experiential inventory. Intuitive thinking (α = .87 in the original sample), which encompass one's preference for utilising intuitive, "gut feelings" when making decisions, was assessed using the REI's 20-item Experiential subscale (Pacini & Epstein, 1999), commonly referred to as faith in intuition (FI). Participants answered questions such as, and "I believe in trusting my hunches," by rating them according to a 5-point Likert scale.

Participants' preference for engaging in effortful cognitive endeavours, or need for cognition (NFC), was assessed using the 20-item Rationality subscale of Pacini and Epstein's (1999) Rational-Experiential Inventory (REI). Participants rated statements about themselves such as, "I enjoy solving problems that require hard thinking" on a 5-point Likert scale. Pacini and Epstein (1999) reported excellent reliability (α = .90) for the NFC scale when it was constructed.

Self-reflection and insight scale. Twelve items from Grant, Franklin, and Langford's (2002) 20-item Self-Reflection and Insight Scale (SRIS) were used

to measure *metacognitive reflection (MR)*, which describes the self-reported need and propensity to metacognitively reflect on and evaluate one's thoughts, feelings, and behaviours. Participants used a 6-point scale to rate themselves on items such as, "I frequently take time to reflect on my thoughts." The remaining 8-items measured *metacognitive insight (MI),* which is the degree to which a person clearly understands his or her thoughts, feelings, and behaviours. Participants used the same 6-point scale to rate themselves on items such as, "Thinking about my thoughts makes me more confused." Both scales showed excellent reliability in Grant, Franklin, and Langford's (2002) original validation research (MR, $\alpha = .91$; MI, $\alpha = .87$).

Procedure

The survey was developed and managed through Qualtrics online survey platform and participants were recruited via Amazon's Mechanical Turk (MTurk) website. Participants were presented with an informed consent page to read and agree to before responding to the survey. Demographics questions consisted of age ("Please enter your age") and gender ("What is your gender"). Finally, participants completed the remaining survey scales, which were presented in random order. The survey concluded with an informational feedback form which contained researcher contact information if participants desired future communication. The survey took approximately 20 min to complete.

Results

Table 1 lists descriptive statistics and Pearson's *r*-values for all variables. Linear regression models were created to test the predictive value of narcissism (grandiose and vulnerable) and impulsiveness for each of the cognitive reflection measures (see Table 2). Mahalanobis distances were calculated and revealed no outliers. We focus our discussion of the results first on

Table 1. Study 1 descriptive and correlational data for all study variables.

		M	*SD*	1	2	3	4	5	6	7	8
1	Grandiose narcissism	2.62	3.11	*(.85)*							
2	Vulnerable narcissism	28.32	8.48	.12	*(.81)*						
3	Impulsiveness	1.86	.40	.07	.40**	*(.90)*					
4	CRT-L	4.26	1.82	-.21*	-.02	-.08	*(.79)*				
5	Metacognitive Reflection	4.13	1.28	-.02	.19	.05	-.07	*(.97)*			
6	Metacognitive Insight	4.77	0.94	-.07	-.45**	-.54**	.04	.08	*(.90)*		
7	Need for cognition	3.79	0.81	.01	-.32**	-.58**	.06	.29**	.31**	*(.95)*	
8	Faith in intuition	3.18	.86	.03	-.17	-.10	-.34**	.22*	.26**	.10	*(.96)*

Note: $N = 100$.
CRT: Cognitive Reflection Test - Long.
Cronbach's coefficient scale reliabilities are italicised diagonally.
**$p < .01$; *$p < .05$.

Table 2. Multiple linear regressions for each cognitive reflection outcome variable.

	CRT-L	Metacognitive reflection	Metacognitive insight	Need for cognition	Faith in intuition
Grandiose narcissism	-.21*	-.01	-.00	.06	.05
Vulnerable narcissism	.05	.21	-.28**	-.11	-.15
Impulsiveness	-.09	-.03	-.42**	-.54**	-.05
Adjusted R^2	.02	.00	.33	.33	.00
F	1.75a	1.27a	17.53**	17.34**	1.04a

Note: $N = 100$. Standardised beta coefficients listed.
CRT-L: Cognitive Reflection Test - Long.
[a]Overall model is non-significant.
**$p < .01$; *$p < .05$.

informative bivariate correlations followed by the linear regression analyses. All data for this and Study 2a and 2b were analysed using SPSS (version 25).

Bivariate correlations

Grandiose narcissism was significantly and negatively associated with only one of our cognitive reflection measures; CRT scores, $r(98) = -.21$, $p = .04$. Vulnerable narcissism was negatively correlated with both metacognitive insight, $r(98) = -.45$, $p < .01$, and need for cognition, $r(98) = -.32$, $p < .01$, and positively associated with metacognitive reflection, $r(98) = .19$, $p = .054$, though this latter relation was only marginally significant. The intercorrelations between our predictors revealed that vulnerable narcissism and impulsiveness were correlated, $r(98) = .40$, $p < .001$, while grandiose narcissism was not significantly correlated with either vulnerable narcissism, $r(98) = .12$, $p = .23$, or impulsiveness, $r(98) = .07$, $p = .50$.

Turning to the intercorrelations between the cognitive reflection variables, metacognitive reflection was significantly correlated with need for cognition, $r(98) = .29$, $p = .004$; and faith in intuition, $r(98) = .22$, $p = .03$. Metacognitive insight was also significantly correlated with need for cognition, $r(98) = .31$, $p = .002$; and faith in intuition, $r(98) = .26$, $p < .01$. CRT scores were only significantly correlated with faith in intuition, $r(98) = -.34$, $p < .001$.

Regressions

We next created separate multiple linear regression models with each of our cognitive reflection measures (i.e., CRT, metacognitive reflection, metacognitive insight, need for cognition, and faith in intuition) as outcomes predicted by both narcissism measures and impulsiveness. Table 2 presents standardised beta coefficients and model fit information for each regression analysis performed.

Narcissism. Grandiose narcissism significantly and negatively predicted CRT scores, $\beta = -.21$, $p = .04$. Vulnerable narcissism significantly and negatively predicted metacognitive insight, $\beta = -.28$, $p = .002$. Additionally, while vulnerable narcissism trended toward positively predicting metacognitive reflection, the significance of this association was marginal, $\beta = .21$, $p = .06$. No other cognitive reflection variables were significantly predicted by either narcissism measure, all βs $< .15$, all ps $> .17$.

Impulsiveness. Impulsiveness significantly predicted both metacognitive insight, $\beta = -.42$, $p < .01$, and need for cognition, $\beta = -.54$ $p < .01$. No other cognitive reflection variables were significantly predicted by impulsiveness, βs $< .09$, all ps $> .43$.

Discussion

Consistent with our hypothesis, grandiose narcissism was a significant negative predictor of CRT scores. That is, individuals higher in grandiose narcissism were more likely to rely on the more intuitive response when problem-solving. Additionally, vulnerable narcissism significantly and negatively predicted metacognitive insight. In other words, people higher in vulnerable narcissism feel like they have less clarity in understanding their own thoughts. Also as expected, there were significant associations between the different cognitive reflection variables. Overall, the self-report measures correlated more strongly with one another than they did with the CRT. Indeed, faith in intuition, was the only self-report reflection measure to show an association (negative) with the CRT.

However, contrary to expectations, grandiose narcissism did not significantly predict any self-report measures of cognitive reflection. Additionally, vulnerable narcissism showed no relation to CRT performance and its ability to positively predict metacognitive reflection was non-significant. Surprisingly, impulsiveness did not predict CRT scores but individuals scoring higher in impulsiveness did score lower on metacognitive insight and need for cognition. Thus, individuals scoring higher in impulsiveness were not more likely to rely on more impulsive, intuitive responses though they did report experiencing less clarity from their self-reflection and less enjoyment from engaging in intellectually reflective activities. A thorough discussion of the implications of the relations found (and not) will be taken up following Study 2a and 2b.

Studies 2a and 2b

In Experiment 2a and 2b, we replicated and extended Study 1 with a larger sample. This was important given that, in many cases, the reported

associations are the first to be reported in the literature. In addition, some of the associations were small, thus a larger sample would provide a clearer picture of the relations between measures.

Additionally, previous research has found significant associations between measures of cognitive reflection and cognitive ability. For instance, some researchers have suggested that the CRT and measures of numeracy are largely isomorphic (Sinayev & Peters, 2015; Welsh, Burns, & Delfabbro, 2013), while other researchers have consistently found that CRT scores remain uniquely predictive for various outcomes after controlling for cognitive ability, including numeracy (Bialek & Domurat, 2018; Campitelli & Gerrans, 2014; Pennycook & Ross, 2016). Therefore, in order to ensure that we better isolated the relations between narcissism and our measures of cognitive reflection, we added measures of numeracy and verbal intelligence as covariates in Studies 2a and 2b. This allows for a clearer consideration of the cognitive reflection measures (i.e., as measures of a propensity to reflect as opposed to the ability to do so) and our expectations were that the negative associations between narcissism, impulsiveness, and cognitive reflection found in Study 1 would remain in Study 2a and Study 2b after controlling for these cognitive ability measures.

Finally, previous work has shown significant relations between narcissism and overconfidence (Macenczak et al., 2016) and CRT scores and overconfidence (Bialek & Domurat, 2018; Noori, 2016). Crucially, research has found that individuals who score higher on the CRT demonstrate greater accuracy in self-assessment (Hoppe & Kusterer, 2011). Viewing these previous research findings in relation to our own results from Study 1, this led us to predict a positive association between narcissism and overconfidence. Therefore, in Study 2b, we had participants indicate their level of confidence that the answers they gave to the cognitive ability items were correct which, when contrasted with their objective performance, provided a measure of overconfidence (i.e., calibration). This offered a measure of participants' metacognitive ability (i.e., the accuracy with which they can assess their cognitive performance), which provided an opportunity to investigate an aspect of cognitive reflection not captured by our other measures.

Method

Participants

Based on an a priori power analysis using results from Study 1, the goal was to achieve approximately .80 power to detect an effect of $r = .20$ at $\alpha = .05$ (g*power; Faul, Erdfelder, Buchner, & Lang, 2009). Therefore, 200 participants were recruited for Study 2a and 202 for Study 2b via Amazon's Mechanical Turk. Participant recruitment procedures and restriction criteria

were identical to those of Study 1 with the additional restriction of excluding individuals who had participated in the previous study.

Materials

Participants completed all scales from Study 1 as well as the following additional measures[1]:

Berlin numeracy test

Participants also completed the 4-item Berlin Numeracy Test which assesses one's ability to perform basic probability and mathematical operations (Cokely, Galesic, Schulz, Ghazal, & Garcia-Retamero, 2012). In Study 2b, participants also indicated their confidence, on a 0 to 100% sliding scale, that their responses were correct.

In study 2a, participants completed a multiple-choice version and in Study 2b they completed an open-ended version. While the original validation study of the Berlin Numeracy Test did not report alpha reliability for the multiple-choice (MC) version, the authors did report a Cronbach's alpha reliability of .59 for the open-ended version and stated that the MC version was an acceptable substitute (Cokely et al., 2012). For Study 2a, the multiple-choice version demonstrated a low Cronbach's alpha reliability of $\alpha = .57$, therefore the response format was changed in Study 2b to the more traditional open-ended format which yielded an acceptable internal reliability ($\alpha = .71$). Other than response format, test items were identical in both versions.

Wordsum

To measure verbal intelligence, participants completed the 10-item version of the "Wordsum" test (Malhotra, Krosnick, & Haertel, 2007; Thorndike, 1942). Participants in Study 2b also indicated the likelihood of their response being correct. Each Wordsum item had five response options, so confidence scales ranged from 20 to 100, with selection of the 20% indicating that the participant's answer to the item was a guess.

For each item, participants were presented with a word and then asked to select from a list another word that most closely matches its meaning. For example, ALLUSION was presented with the words "reference," "dream," "eulogy," "illusion," and "aria." Though Thorndike (1942) did not report a

[1]Participants also completed the Big Five Mini Marker Scale (Saucier, 1994). Initially, this was included due to concerns about potential covariation. However, prevailing literature conceptualizes narcissism as a cluster of Five Factor Model (FFM) and other personality traits (Miller et al., 2010; Sherman et al., 2015). Thus, it was decided that including the Big Five variables in our model in addition to our narcissism measures which already account for these traits would be redundant. Therefore, Big Five Mini Marker results are not reported here and were not included in our model.

Cronbach's reliability coefficient when the Wordsum was originally created, past research has shown it to have an acceptable reliability of $\alpha = .64$ (Pennycook et al., 2015).

Results

The following results are from analyses performed on the combined 2a and 2b data sets except where otherwise indicated. This gave us a large sample to consider ($N = 402$). Table 3 lists descriptive statistics and Pearson's *r*-values for all variables. Descriptive statistics, bivariate correlations, and regression coefficients for the individual Study 2a and Study 2b data sets can be found in the supplementary materials.

Mahalanobis distances were calculated revealing 10 outliers which were excluded from the overall data set. Another 14 participants were excluded due to random response sets all originating from the same geolocation. Reliability analyses for these data points revealed consistent negative alphas for all standardised scales (-.015 to -2.9), suggesting a strong possibility that these responses either came from "imposter" accounts utilising VPS ("virtual private server") technology or were generated from malicious computer-generated survey response software (Dennis, Goodson, & Pearson, 2018; Dupuis, Meier, & Cuneo, 2018). Thus, these participants were excluded from analysis, leaving data for 378 participants used in our final analyses.

Table 3. Studies 2a and 2b combined descriptive and correlational data for all study variables.

		M	*SD*	1	2	3	4	5	6	7	8	9	10
1	Grandiose narcissism	2.29	2.71	*(.81)*									
2	Vulnerable narcissism	28.90	8.25	.30**	*(.81)*								
3	Impulsiveness	1.93	0.40	.26**	.43**	*(.88)*							
4	CRT-L	3.84	2.04	-.19*	-.18**	-.26**	*(.83)*						
5	Metacognitive reflection	4.14	1.20	.01	.19**	-.27**	-.04	*(.96)*					
6	Metacognitive insight	4.69	0.89	-.22**	-.40**	-.58**	.27**	.11*	*(.87)*				
7	Need for cognition	3.68	0.85	-.01	-.23**	-.56**	.36**	.35**	.39**	*(.95)*			
8	Faith in intuition	3.22	0.76	.03	.15**	.11*	-.18**	.14**	.06	-.12*	*(.93)*		
9	Numeracy	47.49[a]	33.38	-.04	-.02	-.17**	.56**	.00	.13*	.28**	-.19**	*(.64)*	
10	Verbal intelligence	71.77[a]	19.78	-.35**	-.12**	-.27**	.44**	.03	.31**	.27**	-.19**	.39**	*(.71)*

Note: $N = 378$.
CRT-L: Cognitive Reflection Test - Long.
[a]Percent correct score.
Cronbach's coefficient scale reliabilities are italicised diagonally.
$^{**}p < .01$; $^{*}p < .05$.

As in Study 1, we first briefly report the bivariate correlations followed by the regression analyses with narcissism and impulsiveness predicting the cognitive reflection variables (i.e., CRT, metacognitive reflection, metacognitive insight, need for cognition, faith in intuition) controlling for cognitive ability (i.e., numeracy and verbal intelligence). Finally, we report the results of our analyses from Study 2b of the associations between narcissism, impulsiveness, and overconfidence.

Bivariate correlations

The bivariate correlations (Table 3) between the narcissism and impulsivity measures and the cognitive reflection measures are largely what would be expected given the Study 1 results with a few notable exceptions. Grandiose narcissism was significantly and negatively correlated with metacognitive insight, $r(376) = -.22$, $p < .001$, which was not the case in Study 1. Vulnerable narcissism was significantly and positively correlated with faith in intuition, $r(376) = .15$, $p = .004$.

Impulsiveness was significantly and negatively correlated with CRT scores, $r(376) = -.26$, $p < .001$, and metacognitive reflection, $r(376) = -.27$, $p < .001$, although these associations were not significant in Study 1. Impulsiveness was significantly and positively correlated with faith in intuition, $r(376) = .11$, $p = .04$, which is consistent with results from Study 1.

With respect to the intercorrelations between the cognitive reflection variables, CRT scores were significantly and positively related to metacognitive insight, $r(376) = .27$, $p < .001$, and need for cognition, $r(376) = .36$, $p < .001$, but were uncorrelated to those variables in Study 1. Also, metacognitive insight was uncorrelated with faith in intuition, $r(376) = .06$, $p = .27$, which is inconsistent with Study 1, where it was positively and significantly related, $r(98) = .26$, $p < .001$.

Regressions

We first replicated our regression analyses from Study 1 by creating separate multiple linear regression models with each of our cognitive reflection outcomes (i.e., CRT, self-reflection, insight, need for cognition, faith in intuition, confidence, overconfidence) predicted by both narcissism measures and our impulsiveness measure only. Our results were largely similar to what was found in Study 1, with the exception that impulsiveness was a significant predictor both of CRT scores, $\beta = .20$, $p < .001$, and metacognitive reflection, $\beta = .41$, $p < .001$, which was not the case in Study 1 (full results from this analysis can be found in Table S1 of the Supplementary Materials).

Table 4. Multiple linear regressions for each cognitive reflection outcome variable.

	CRT-L	Metacognitive reflection	Metacognitive insight	Need for cognition	Faith in intuition
Predictor variables					
Grandiose narcissism	-.05	.00	-.01	.21***	-.08
Vulnerable narcissism	-.11*	.37***	-.19***	-.05	.15**
Impulsiveness	-.06	-.43***	-.45***	-.43***	-.00
Covariates					
Numeracy	.47***	-.06	-.02	.14**	-.13*
Verbal intelligence	.21***	-.02	.17***	.14**	-.15*
Adjusted R^2	.39	.17	.38	.38	.06
F	48.67***	16.36***	46.52***	47.04***	5.96***

Note: $N = 378$.
CRT-L: Cognitive Reflection Test - Long.
Standardised beta coefficients listed.
***$p < .001$; **$p < .01$; *$p < .05$.

We next created separate multiple linear regression models with each of our cognitive reflection outcomes (i.e., CRT, self-reflection, insight, need for cognition, faith in intuition, confidence, overconfidence) predicted by both narcissism measures and our impulsiveness measure while controlling for numeracy and verbal intelligence. Standardised beta coefficients and model fit information for each regression analysis performed are listed in Table 4.

Narcissism

Grandiose narcissism significantly and positively predicted need for cognition, $\beta = .21$, $p < .001$. While it significantly, negatively predicted CRT scores in Study 1, grandiose narcissism did not significantly predict CRT in the combined Study 2 data, $\beta = .05$, $p = .25$, once cognitive ability covariates were included in the model. This makes sense given the significant, negative bivariate correlation between narcissism and verbal intelligence, $r(376) = -.35$, $p < .001$, found in Study 2.

Vulnerable narcissism significantly and negatively predicted CRT scores, $\beta = -.11$, $p = .02$. Vulnerable narcissism also significantly and positively predicted faith in intuition, $\beta = .15$, $p = .007$, and metacognitive reflection, $\beta = .37$, $p < .001$, and negatively predicted metacognitive insight, $\beta = -.19$, $p < .001$. No other cognitive reflection variables were significantly predicted by either narcissism measure, all βs $< .05$, all ps $> .18$.

Impulsiveness

Impulsiveness was a significant, negative predictor of metacognitive reflection, $\beta = -.43$, $p < .001$; metacognitive insight, $\beta = -.45$, $p < .001$; and need for cognition, $\beta = -.43$, $p < .001$. No other cognitive reflection variables were significantly predicted by impulsiveness scores, all βs $< .06$, all ps $> .17$.

Cognitive ability

Numeracy significantly and positively predicted CRT, $\beta = .47$, $p < .001$; and need for cognition, $\beta = .14$, $p = .01$. It also significantly and negatively predicted faith in intuition, $\beta = -.13$, $p = .02$.

Verbal intelligence significantly, positively predicted CRT scores, $\beta = .21$, $p < .001$, metacognitive insight, $\beta = .17$, $p < .001$, and need for cognition, $\beta = .14$, $p = .004$, and negatively predicted faith in intuition, $\beta = -.15$, $p = .01$. Finally, though not a focus of our main analyses, it is interesting to note that when considering our personality variables as predictors of cognitive ability, verbal intelligence was significantly and negatively predicted by grandiose narcissism, $\beta = -.32$, $p < .001$, and impulsiveness, $\beta = -.22$, $p < .001$, but numeracy was only significantly predicted by impulsiveness, $\beta = -.20$, $p < .001$.

Overconfidence (study 2b)

In Study 2b, overconfidence scores were calculated using participants' ($N = 190$) objective cognitive ability scores and their self-reported confidence ratings. Total raw scores on both the Berlin Numeracy Test and the Wordsum were converted to percentages and then subtracted from the average confidence score for each test to give an index of *overconfidence*. A score of zero would indicate that a person's metacognitive judgements are perfectly calibrated (i.e., non-biased). Scores below zero indicate *underconfidence* while scores above zero indicate *overconfidence*.

As with previous analyses, bivariate correlations and linear regression were used to investigate the relations among overconfidence and our other study variables of interest. We first focus on the notable bivariate correlations followed by a discussion of the regression analyses. Descriptives and *r*-values for narcissism, impulsiveness, and cognitive reflection variables with measures of overconfidence are listed in Table 5.

Bivariate correlations

Of our predictor variables, only grandiose narcissism was significantly and positively related to numeracy overconfidence, $r(190) = -.29$, $p < .01$, and verbal intelligence overconfidence, $r(190) = -.29$, $p < .01$. The intercorrelations between the cognitive reflection and overconfidence variables are also worth noting. Only CRT scores were negatively associated with both numeracy overconfidence, $r(190) = -.27$, $p < .01$, and verbal intelligence overconfidence, $r(190) = -.29$, $p < .01$. Metacognitive insight was significantly and positively correlated with overconfidence for verbal intelligence, $r(190) = -.21$, $p < .01$. However, no other cognitive reflection measure was

Table 5. Study 2b descriptive and correlational data for overconfidence measures.

		Numeracy over-confidence	Verbal over-confidence
	M	12.74	10.09
	SD	25.68	17.70
	Correlations		
1	Grandiose narcissism	.27**	.38**
2	Vulnerable narcissism	.05	.05
3	Impulsiveness	.10	.13
4	CRT-L	-.27**	-.29**
5	Metacognitive reflection	-.02	.02
6	Metacognitive insight	-.13	-.21**
7	Need for cognition	-.08	-.12
8	Faith in intuition	.00	.05
9	Numeracy	-.65**	-.32**
10	Verbal intelligence	-.43**	-.80**

Note: $N = 190$.
**$p < .01$.

Table 6. Multiple linear regressions for overconfidence predicted by narcissism and impulsiveness.

	Numeracy overconfidence	Verbal overconfidence
Predictor variables		
Grandiose narcissism	.19***	.15***
Vulnerable narcissism	.01	-.02
Impulsiveness	-.09	-.07
Covariates		
Numeracy	-.60***	.04
Verbal intelligence	-.11	-.78***
Adjusted R^2	.47	.65
F	34.20***	70.39***

Note: $N = 190$.
***$p < .001$.

significantly associated with either overconfidence variable, all *rs* $< .12$, *ps* $> .09$.

Regressions

We next created separate multiple linear regression models with overconfidence for both numeracy and verbal intelligence as outcomes predicted by our measures of narcissism and impulsiveness while controlling for numeracy scores and verbal intelligence scores. Standardised beta coefficients and model fit information can be found in Table 6.[2]

Narcissism

Only grandiose narcissism positively predicted overconfidence both for numeracy, $\beta = .19$, $p < .001$, and verbal intelligence, $\beta = .15$, $p < .001$.

[2]Removing the cognitive ability measure used to derive the overconfidence measure in each regression (e.g., numeracy score from the numeracy overconfidence regression) yielded the same pattern of results.

Impulsiveness

Impulsiveness did not significantly predict either overconfidence measure.

Discussion

Consistent with predictions, higher grandiose narcissism predicted greater intellectual overconfidence, vulnerable narcissism predicted greater metacognitive reflection and less metacognitive insight, and impulsiveness negatively predicted metacognitive reflection, metacognitive insight, and need for cognition. In addition, while overall the results across studies were consistent, there were exceptions. While the latter is to be expected given the much larger samples in Study 2 and the controlling of cognitive ability, it is nonetheless worth noting. Below we summarise the results of Study 2 together with Study 1, then discuss these results further in the "General Discussion" section.

In Study 2, like Study 1, grandiose narcissism did not predict metacognitive reflection, metacognitive insight, or faith in intuition. Likewise, grandiose narcissism significantly and negatively predicted CRT scores in Study 1 and Study 2; however, this relation became non-significant in Study 2 once cognitive ability was included in the model. In addition, the bivariate correlation between grandiose narcissism and CRT was negative across all samples. Thus, taken together, the general trend potentially suggests a negative association between grandiose narcissism and CRT scores, though it would clearly be small in magnitude and modulated by cognitive ability.

Also inconsistent between studies was the relation between grandiose narcissism and need for cognition. Grandiose narcissism significantly, positively predicted need for cognition in Study 2 though this was not true for Study 1 (though the direction of the association was positive). Interestingly, the bivariate correlation between grandiose narcissism and need for cognition was not significant in either Study 1 or Study 2, suggesting that any relation between the variables at the bivariate level is being suppressed in the regression model. A follow-up analysis revealed that this apparent suppressor effect was due to vulnerable narcissism and impulsiveness. That is, if both vulnerable narcissism and impulsiveness are removed from the regression model in Study 2, the relation between grandiose narcissism and need for cognition disappears. However, if either is included (separately or together), the relation between grandiose narcissism and need for cognition becomes significant. It is not clear why this effect was present in Study 2 but not Study 1, but it should be noted that in the latter study there was no relation between grandiose narcissism and vulnerable narcissism but there was in the former.

Finally, grandiose narcissism was the only consistent (positive) predictor across all cognitive ability overconfidence measures in Study 2b. This supports prior research demonstrating a link between narcissism and overconfidence (Macenczak et al., 2016) and, at least in the case of verbal intelligence overconfidence, makes sense given our finding that grandiose narcissism negatively predicted verbal intelligence. Thus, while individuals higher in grandiose narcissism appear more likely to report engaging in and enjoying intellectually reflective endeavours (need for cognition), they are also overconfident in their own intellectual performance. Additionally, though grandiose narcissists may be less likely to give reflective responses while solving problems (CRT), their levels of metacognitive reflection, insight, and intuitive thinking are unrelated to their narcissism.

In both Study 1 and Study 2, vulnerable narcissism negatively predicted metacognitive insight and did not predict need for cognition. Vulnerable narcissism positively predicted metacognitive reflection in both studies though the relation was only marginally significant in Study 1 ($p = .06$). In Study 2, vulnerable narcissism emerged as a significant negative predictor of CRT performance. However, in Study 1, the association was non-significant and positive. Thus, like grandiose narcissism, if there is a relation between vulnerable narcissism and CRT it appears to be negative and small. Additionally, vulnerable narcissism was unrelated to overconfidence. Finally, vulnerable narcissism's most inconsistent result was its relation to faith in intuition. In Study 1, the relation was positive though not significant while in Study 2 it was negative and significant suggesting a difference between the samples. Taken together, this suggests that while people who are more vulnerably narcissistic report engaging in more reflection on their own thoughts (metacognitive reflection), they are less likely to clearly understand those thoughts (metacognitive insight), less likely to give reflective responses when solving problems (CRT), and (possibly) more likely to engage in intuitive reasoning processes.

Impulsiveness significantly and negatively predicted metacognitive insight and need for cognition across both Study 1 and Study 2 and did not significantly predict CRT scores or faith in intuition in either study. Impulsiveness significantly and negatively predicted metacognitive reflection in Study 2, though this was not true for Study 1. This inconsistent pattern was also present at the level of the bivariate correlations (i.e., significant and negative in Study 2; nonsignificant and positive in Study 1) suggesting a possible difference across samples. Finally, impulsiveness was not related to overconfidence. Taken together, these results strongly suggest that, while self-reported impulsiveness does not predict CRT performance, intellectual overconfidence, or preference for intuitive thinking (faith in intuition), people who are higher in impulsiveness are less likely to reflect

on their own thoughts (metacognitive reflection), less likely to enjoy engaging in intellectually reflective activities (need for cognition), and less likely to experience clarity of understanding when they do engage in reflection (metacognitive insight).

General discussion

Across three studies, we found evidence that both narcissism and trait impulsiveness are significantly associated with the propensity to engage in various aspects of cognitive reflection. Specifically, individuals who are higher in grandiose narcissism are more likely to report that they enjoy engaging in effortful cognitive endeavours yet also more likely to be overconfident in (i.e., overestimate) their own cognitive ability. We also found some (mixed) evidence that individuals higher in vulnerable narcissism may be less likely to engage in cognitive reflection when solving reasoning problems (i.e., the CRT) and may be more likely to prefer engaging in intuitive reasoning processes (though future research will need to be conducted to verify the strength of these associations). Additionally, though individuals higher in vulnerable narcissism are more likely to reflect on their own thoughts, feelings, and behaviours (i.e., metacognitive reflection), they are also significantly less likely to have a clear, coherent understanding of those thoughts, feelings, and behaviours (i.e., metacognitive insight). Finally, we found consistent evidence that individuals higher in trait impulsiveness are significantly less likely to reflect on their own thoughts, feelings, and behaviours, less likely to have a clear, coherent understanding of their own cognitive content, and less likely to engage in and enjoy cognitively effortful activities. In the following, we expand upon and provide broader context for these findings.

Narcissism and cognitive reflection

The present results offer new insights into the relations between dispositional characteristics and cognitive reflection (as articulated by contemporary dual process models of cognition). Specifically, despite grandiose narcissism negatively predicting verbal intelligence and appearing to have, at best, a small negative association with performance on reflective reasoning tasks (when controlling for cognitive ability), grandiose narcissists are significantly and consistently overconfident in their own cognitive ability. Indeed, people higher in grandiose narcissism are also more likely to claim that they engage in and enjoy intellectually effortful endeavours that require rational, logical thinking processes (i.e., they report a higher need for cognition). These findings support prior research highlighting grandiose

narcissists' proclivity to overestimate their intelligence (Gabriel et al., 1994), display more arrogance and feelings of superiority, and regulate their egos through self-enhancement and denial of weaknesses (Dickinson & Pincus, 2003; Miller et al., 2010).

This combination of overconfidence and superiority could be a key limiting factor in the propensity of individuals higher in grandiose narcissism to engage in Type II (reflective) processes. For instance, according to a reasoning model proposed by Thompson et al. (2011), quick, intuitive responses are accompanied by a metacognitive experience of confidence in the correctness of the answer, known as a "Feeing of Rightness" (FOR). Based on the results presented here, as well as past work showing consistent associations between grandiose narcissism and overconfidence (Macenczak et al., 2016), it could be the case that individuals higher in grandiose narcissism experience significantly and consistently biased FORs across a broad range of reasoning tasks. Additionally, separate lines of research have found that less awareness of the fallibility of one's own intuitive judgments as well as a greater tendency to reject corrective feedback are traits common both to narcissistic and to overconfident individuals (De Neys, Cromheeke, & Osman, 2011; Freis et al., 2015; Kahneman & Klein, 2009; Macenczak et al., 2016; Sieck & Arkes, 2005). Given this, it may be especially difficult for more narcissistic individuals to update and properly calibrate their FORs for certain reasoning tasks. When viewed through this lens, grandiose narcissists' seemingly contradictory perception that they are individuals who regularly engage in and enjoy intellectual, logical thinking activities – despite the miscalibration of their performance in such activities – may be either a reflection of their broader overconfidence or an overt, ego-driven self-enhancement strategy. Taken together, these results suggest that, while grandiose narcissists may view themselves as highly intellectual, critical thinkers, their excessive overconfidence in their own mental prowess is likely unwarranted.

Individuals higher in vulnerable narcissism performed significantly worse on a reflective reasoning task (i.e., CRT). One potential explanation for this finding is that vulnerable narcissism is strongly related to neuroticism (Miller et al., 2018). Neuroticism has been found to be strongly associated with impulsiveness (Lange, Wagner, Müller, & Eggert, 2017) and, as noted by Frederick (2005), CRT scores reflect one's ability to resist disinhibited responses. However, the relation between vulnerable narcissism and CRT scores was significant even when controlling for impulsiveness, and trait impulsiveness did not significantly predict CRT scores. That said, it is possible we are not exhaustively measuring "inhibitory control."

Additionally, though individuals higher in vulnerable narcissism were more likely to report that they reflect on their own thoughts and feelings,

they were also less likely to report clearly understanding those thoughts and feelings, and we found some evidence that they may be more likely to rely on intuitive thinking when making decisions. These results may seem counterintuitive but are again consistent with the idea that vulnerable narcissists tend to be highly neurotic (Miller et al., 2018), which is positively associated with more negative, ruminative aspects of self-reflection (Trapnell & Campbell, 1999) and negatively related to clarity in understanding certain self-reflective cognitions (i.e., insight; Campbell et al., 1996). Additionally, vulnerable narcissists tend to have lower self-esteem and lower perceptions of self-efficacy (Brookes, 2015). Therefore, it could be the case that when vulnerable narcissists detect conflict related to an intuitive response (Pennycook et al., 2015) and attempt to engage in cognitive reflection, they experience self-doubt in their own decisional competence, which prompts them to disengage from reflection and revert to their initial "gut instinct." Taken together, these results seem consistent with the more neurotic characteristics of rumination and appear to suggest that, while vulnerable narcissists may *report* that they reflect on their own thoughts, feelings, and actions, they often lack the metacognitive clarity to *understand* those reflective cognitions and, in some cases, may not possess sufficient self-confidence to effectively or consistently *engage* in cognitive reflection when faced with tasks that require it, instead relying on less rational, intuitive thinking processes.

Impulsiveness and cognitive reflection

Individuals scoring higher in impulsiveness were less likely to reflect on their own thoughts, feelings, and behaviours (i.e., metacognitive reflection), less likely to achieve clarity in understanding their own thoughts and behaviours (i.e., metacognitive insight), and less likely to enjoy engaging in cognitively effortful endeavours (i.e., need for cognition). The fact that higher trait impulsiveness was negatively associated with these three aspects of cognitive reflection seems consistent, at least conceptually, with the theoretical claims of DPT, which often associates Type I thinking with fast, impulsive processes and Type 2 with slower, more cognitively engaged processes requiring greater executive control (Evans & Stanovich, 2013). Consistent failure to engage in rational, Type II thinking processes has been associated with miserly information processing (Toplak, West, & Stanovich, 2014) and "lazy thinking" (Pennycook & Rand, 2018). This suggests, at least for certain aspects of cognitive reflection, that individuals higher in trait impulsiveness are either unable or unwilling to engage in cognitively demanding or challenging tasks.

It is also interesting to note that, across all studies, impulsiveness consistently failed to predict our behavioural measure of cognitive reflection (i.e., the CRT). As defined by Frederick (2005), CRT scores represent "the ability or disposition to resist reporting the response that first comes to mind" (p. 35). Indeed, recent research has shown that CRT scores are negatively related to delayed discounting measures of impulsivity (Bialek & Sawicki, 2018). Regardless, given that trait impulsiveness, as measured by the BIS-11, encompasses various aspects of the proclivity to act or make up one's mind "without thinking" (Patton et al., 1995), it is curious that it was unrelated to CRT scores in our sample. This seemingly counterintuitive finding could be the result of any of several factors. For instance, the Barratt Impulsiveness Scale (BIS-11) might not capture "cognitive impulsivity" (e.g., Jelihovschi, Cardoso, & Linhares, 2018; Patton et al., 1995). Additionally, given that impulsiveness was measured via self-report in our studies, there exists the possibility that an individual's *belief* that he/she is impulsive (in a general sense) is not necessarily indicative of *actual* cognitive or behavioural impulsivity when engaged in problem-solving tasks.

Interrelations between cognitive reflection measures

CRT scores were positively associated with need for cognition, and negatively correlated with faith in intuition. This lends support to the theoretical intent of the CRT, which was designed to measure the extent to which a person can override intuitive responses and engage in reflective thinking (Frederick, 2005), and matches prior research showing CRT scores positively related to need for cognition and negatively related to faith in intuition (Pennycook, Cheyne, Koehler, & Fugelsang, 2016). Interestingly, CRT scores were not significantly related to metacognitive reflection but were positively associated with metacognitive insight. This appears to suggest that an individual's perceived clarity of thought while engaged in reflection is more important for successful decision-making than that individual's belief that he or she is a reflective person. Additionally, metacognitive reflection and metacognitive insight were both positively related to need for cognition, which matches correlations found in past research (Roberts, Heritage, & Gasson, 2015) and underscores the idea that the ability to engage in clear, coherent, reflective thought plays an important role in the extent to which one enjoys engaging in intellectually rigorous pursuits. These results stand as further evidence that cognitive reflection is not a single, homogeneous process but, instead, is better conceptualised as an "umbrella term" encapsulating various correlated aspects of Type II thinking processes (Pennycook, De Neys, Evans, Stanovich, & Thompson, 2018). Future research might benefit from deeper analysis of this potential nomological framework.

Narcissism as predictor or as outcome of cognitive reflection

A final issue worth discussing is the directionality of our proposed model. Here, we have suggested that personality and dispositional attributes (e.g., narcissism, impulsiveness) can bias individuals with respect to their engagement in reflective thinking processes. An alternative view would be that a lack of cognitive reflection tends to lead to behaviour consistent with these dispositions. For example, an individual who (first) has a low propensity for engaging in cognitive reflection might later develop narcissistic traits. The present design, of course, cannot distinguish between these two alternatives and, at least in adults, it might be difficult to determine which (if either) came first. As such, developmental designs tracking the time course that these different personality and cognitive dispositions take would represent a valuable way forward.

That said, the general trend in the relevant literature has been to view dispositional and personality attributes as foundational influences on a wide range of subsequent cognitive and behavioural outcomes (e.g., Gabriel et al., 1994; Macenczak et al., 2016; Miller et al., 2009). Under this view, "engagement in cognitive reflection" would be a specific outcome that extant personality dispositions might reliably predict. Though the decision is ultimately an empirical one, in considering this "chicken and egg" dilemma, we felt it more plausible and likely that narcissistic eggs make unreflective chickens than the opposite being true.

Conclusion

The present results demonstrate clearly that narcissism and impulsiveness are significantly associated with distinct aspects of cognitive reflection. Notably, these associations seem to be unique to each type of narcissism. Indeed, grandiose and vulnerable narcissists differ in their performance on problem-solving tasks (i.e., CRT) and preferences for intuitive thinking, as well as the degree to which they reflect on and understand their own thoughts and enjoy cognitively effortful activities. Additionally, though impulsiveness was significantly related to self-report measures of cognitive reflection (i.e., metacognitive reflection, metacognitive insight, and need for cognition), it showed no association with a behavioural measure of cognitive reflection (i.e., CRT scores). These results extend the dual processes paradigm by demonstrating that certain individual differences in dispositional and personality characteristics may play important roles in the extent to which individuals engage in specific decision-making strategies.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

Bialek, M., & Domurat, A. (2018). Cognitive abilities, analytic cognitive style, and overconfidence: A commentary on Duttle (2016). *Bulletin of Economic Research*, *70*(1), E119–E125. doi:10.1111/boer.12117

Bialek, M., & Pennycook, G. (2018). The cognitive reflection test is robust to multiple exposures. *Behavior Research Methods*, *50*(5), 1953–1959. Retrieved from doi:10.3758/s13428-017-0963-x

Bialek, M., & Sawicki, P. (2018). Cognitive reflection effects on time discounting. *Journal of Individual Differences*, *39*(2), 99–106. Retrieved from doi:10.1027/1614-0001/a000254

Brookes, J. (2015). The effect of overt and covert narcissism on self-esteem and self-efficacy beyond self-esteem. *Personality and Individual Differences*, *85*, 172–175. doi:10.1016/j.paid.2015.05.013

Cáceres, P., & San Martin, R. (2017). Low cognitive impulsivity is associated with better gain and loss learning in a probabilistic decision-making task. *Frontiers in Psychology*, *8*(204), 1–7. doi:10.3389/fpsyg.2017.00204

Campitelli, G., & Gerrans, P. (2014). Does the cognitive reflection test measure cognitive reflection? A mathematical modeling approach. *Memory & Cognition*, *42*(3), 434–447. doi:10.3758/s13421-013-0367-9

Campbell, J. D., Trapnell, P. D., Heine, S. J., Katz, I. K., Lavallee, L. F., & Lehman, D. R. (1996). Self-concept clarity: Measurement, personality correlates, and cultural boundaries. *Journal of Personality and Social Psychology*, *70*(1), 141–156. doi:10.1037//0022-3514.70.1.141

Carlson, E. N. (2013). Honestly arrogant or simply misunderstood? Narcissists' awareness of their narcissism. *Self and Identity*, *12*(3), 259–277. Retrieved from doi:10.1080/15298868.2012.659427

Carlson, E. N., Vazire, S., & Oltmanns, T. F. (2011). You probably think this paper's about you: Narcissists' perceptions of their personality and reputation. *Journal of Personality and Social Psychology*, *101*(1), 185–201. doi:10.1037/a0023781

Cokely, E. T., Galesic, M., Schulz, E., Ghazal, S., & Garcia-Retamero, R. (2012). Measuring risk: The Berlin Numeracy test. *Judgment and Decision Making*, *7*(1), 25–47.

Dennis, S. A., Goodson, B. M., & Pearson, C. (2018, August 17). Mturk workers' use of low-cost "Virtual Private Servers" to circumvent screening methods: A research note. Retrieved from SSRN: https://ssrn.com/abstract=3233954

De Neys, W., Cromheeke, S., & Osman, M. (2011). Biased but in doubt: Conflict and decision confidence. *PLoS ONE*, *6*(1), e15954. doi:10.1371/journal.pone.0015954

Dickinson, K. A., & Pincus, A. L. (2003). Interpersonal analysis of grandiose and vulnerable narcissism. *Journal of Personality Disorders*, *17*(3), 188–207. doi:10.1521/pedi.17.3.188.22146

Dupuis, M., Meier, E., & Cuneo, F. (2018). Detecting computer-generated random responding in questionnaire-based data: A comparison of seven indices. *Behavior Research Methods*. doi:10.3758/s13428-018-1103-y

Epstein, S., Pacini, R., Denes-Raj, V., & Heier, H. (1996). Individual differences in intuitive- experiential and analytical-rational thinking styles. *Journal of Personality and Social Psychology*, *71*(2), 390–405. doi:10.1037//0022-3514.71.2.390

Evans, J. B. T., & Stanovich, K. E. (2013). Dual process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science*, *8*(3), 223–241. doi:10.1177/1745691612460685

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*, 1149–1160.

Frederick, S. (2005). Cognitive reflection and decision making. *The Journal of Economic Perspectives*, *19*(4), 25–42. doi:10.1257/089533005775196732

Freis, S. D., Brown, A. A., Carroll, P. J., & Arkin, R. M. (2015). Shame, rage, and unsuccessful motivated reasoning in vulnerable narcissism. *Journal of Social and Clinical Psychology*, *34*(10), 877–895. Retrieved from doi:10.1521/jscp.2015.34.10.877

Gabriel, M. T., Critelli, J. W., & Ee, J. S. (1994). Narcissistic illusions in self-evaluations of intelligence and attractiveness. *Journal of Personality*, *62*(1), 143–155. doi:10.1111/j.1467-6494.1994.tb00798.x

Gentile, B., Miller, J. D., Hoffman, B. J., Reidy, D. E., Zeichner, A., & Campbell, W. K. (2013). A test of two brief measures of grandiose narcissism: The Narcissistic Personality Inventory – 13 and the Narcissistic Personality Inventory – 16. *Psychological Assessment*, *25*(4), 1120–1136. doi:10.1037/a0033192

Gigerenzer, G., & Gaissmaier, W. (2011). Heuristic decision making. *Annual Review of Psychology*, *62*(1), 451–482. doi:10.1146/annurev-psych-120709-145346

Grant, A. M. (2001). Rethinking psychological mindedness: Metacognition, self-reflection, and insight. *Behaviour Change*, *18*(1), 8–17. doi:10.1375/bech.18.1.8

Grant, A. M., Franklin, J., & Langford, P. (2002). The self-reflection and insight scale: A new measure of private self-consciousness. *Social Behavior and Personality: An International Journal*, *30*(8), 821–836. doi:10.2224/sbp.2002.30.8.821

Grijalva, E., & Zhang, L. (2016). Narcissism and self-insight: A review and meta-analysis of narcissists' self-enhancement tendencies. *Personality and Social Psychology Bulletin*, *42*(1), 3–24. doi:10.1177/0146167215611636

Hendin, H. M., & Cheek, J. M. (1997). Assessing hypersensitive narcissism: A reexamination of Murray's Narcism Scale. *Journal of Research in Personality*, *31*(4), 588–599. doi:10.1006/jrpe.1997.2204

Hoppe, E. I., & Kusterer, D. J. (2011). Behavioral biases and cognitive reflection. *Economics Letters*, *110*(2), 97–100. doi:10.1016/j.econlet.2010.11.015

Jauk, E., Weigle, E., Lehmann, K., Benedek, M., & Neubauer, A. C. (2017). The relationship between grandiose and vulnerable (hypersensitive) narcissism. *Frontiers in Psychology*, *8*(1600), 1–10. doi:10.3389/fpsyg.2017.01600

Jelihovschi, A. P. G., Cardoso, R. L., & Linhares, A. (2018). An analysis of the associations among cognitive impulsiveness, reasoning process, and rational decision making. *Frontiers in Psychology*, *8*(2324), 1–10. doi:10.3389/fpsyg.2017.02324

Kahn, J. A., Kaplowitz, R. A., Goodman, E., & Emans, S. J. (2002). The association between impulsiveness and sexual risk behaviors in adolescent and young adult women. *Journal of Adolescent Health*, 30(4), 229–232. doi:10.1016/S1054-139X(01)00391-3

Kahneman, D. (2003). A perspective on judgment and choice: Mapping bounded rationality. *American Psychologist*, *58*(9), 697–720. doi:10.1037/0003-066X.58.9.697

Kahneman, D., & Klein, G. (2009). Conditions for intuitive expertise: A failure to disagree. *American Psychologist*, *64*(6), 515–526. doi:10.1037/a0016755

Lange, F., Wagner, A., Müller, A., & Eggert, F. (2017). Subscales of the Barratt Impulsiveness Scale differentially relate to the Big Five factors of personality. *Scandinavian Journal of Psychology*, *58*(3), 254–259. doi:10.1111/sjop.12359

Lyke, J. A. (2009). Insight, but not self-reflection, is related to subjective well-being. *Personality and Individual Differences*, *46*(1), 66–70. doi:10.1016/j.paid.2008.09.010

Macenczak, L. A., Campbell, S., Henley, A. B., & Campbell, W. K. (2016). Direct and interactive effects of narcissism and power on overconfidence. *Personality and Individual Differences*, *91*, 113–122. Retrieved from doi:10.1016/j.paid.2015.11.053

Malhotra, N., Krosnick, J. A., & Haertel, E. (2007). *The psychometric properties of the GSS Wordsum Vocabulary Test (GSS Methodology Report No. 111)*. Chicago: NORC.

Mata, A., Ferreira, M. B., & Sherman, S. J. (2013). The metacognitive advantage of deliberative thinkers: A dual-process perspective on overconfidence. *Journal of Personality and Social Psychology*, *105*(3), 353–375. doi:10.1037/a0033640

Miller, J. D., Campbell, W. K., Young, D. L., Lakey, C. E., Reidy, D. E., Zeichner, A., & Goodie, A. S. (2009). Examining the relations among narcissism, impulsivity, and self- defeating behaviors. *Journal of Personality*, *77*(3), 761–794. doi:10.1111/j.1467-6494.2009.00564.x

Miller, J. D., Hoffman, B. J., Gaughan, E. T., Gentile, B., Maples, J., & Campbell, W. K. (2010). Grandiose and vulnerable narcissism: A nomological network analysis. *Journal of Personality*, *79*(5), 1015–1032.

Miller, J. D., Lynam, D. R., Hyatt, C. S., & Campbell, W. K. (2017). Controversies in narcissism. *Annual Review of Clinical Psychology*, *13*(1), 291–315. doi:10.1146/annurev-clinpsy-032816-045244

Miller, J. D., Lynam, D. R., Vize, C., Crowe, M., Sleep, C., Maples-Keller, J. L., … Campbell, W. K. (2018). Vulnerable narcissism is (mostly) a disorder of neuroticism. *Journal of Personality*, *86*(2), 186–199. doi:10.1111/jopy.12303

Moeller, G. F., Barratt, E. S., Dougherty, D. M., Schmitz, J. M., & Swann, A. C. (2001). Psychiatric aspects of impulsivity. *American Journal of Psychiatry*, *158*(11), 1783–1793. doi:10.1176/appi.ajp.158.11.1783

Morf, C. C., & Rhodewalt, F. (2001). Unraveling the paradoxes of narcissism: A dynamic self- regulatory processing model. *Psychological Inquiry*, *12*(4), 177–196. Retrieved from doi:10.1207/S15327965PLI1204_1

Noori, M. (2016). Cognitive reflection as a predictor of susceptibility to behavioral anomalies. *Judgment and Decision Making*, *11*(1), 114–120.

Pacini, R., & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Journal of Personality and Social Psychology*, *76*(6), 972–987.

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt Impulsiveness Scale. *Journal of Clinical Psychology*, *51*(6), 768–774. doi:10.1002/1097-4679(199511)51:6<768::AID-JCLP2270510607>3.0.CO;2-1

Pennycook, G., Cheyne, J. A., Koehler, D. J., & Fugelsang, J. A. (2013). Belief bias during reasoning among religious believers and skeptics. *Psychonomic Bulletin & Review*, *20*(4), 806–811. doi:10.3758/s13423-013-0394-3

Pennycook, G., Cheyne, J. A., Barr, N., Koehler, D. J., & Fugelsang, J. A. (2015). On the reception and detection of pseudo-profound bullshit. *Judgment and Decision Making*, *10*(6), 549–563. doi.org/10.3389/fpsyg.2013.00279

Pennycook, G., Cheyne, J. A., Koehler, D. J., & Fugelsang, J. A. (2016). Is the cognitive reflection test a measure of both reflection and intuition? *Behavior Research Methods*, *48*(1), 341–348. doi:10.3758/s13428-015-0576-1

Pennycook, G., De Neys, W., Evans, J. St. B. T., Stanovich, K. E., & Thompson, V. A. (2018). The mythical dual-process typology [Commentary on Melnikoff & Bargh, 2018]. *Trends in Cognitive Sciences*, *22*(8), 667–668. doi:10.1016/j.tics.2018.04.008

Pennycook, G., Fugelsang, J. A., & Koehler, D. J. (2015). Everyday consequences of analytic thinking. *Current Directions in Psychological Science*, *24*(6), 425–432. Retrieved from doi:10.1177/0963721415604610

Pennycook, G., & Rand, D. (2019). Lazy, not biased: Susceptibility to partisan fake news is better explained by lack of reasoning than by motivated reasoning. *Cognition*, *188*, 39-50. doi:10.1016/j.cognition.2018.06.011

Pennycook, G., & Ross, R. M. (2016). Commentary: Cognitive reflection vs. calculation in decision making. *Frontiers in Psychology*, *7*, 9. doi:10.3389/fpsyg.2016.00009

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in Experimental Social Psychology*, *19*, 123–205. doi:10.1016/S0065-2601(08)60214-2

Primi, C., Morsanyi, K., Chiesi, F., Donati, M. A., & Hamilton, J. (2016). The development and testing of a new version of the cognitive reflection test applying item response theory (IRT). *Journal of Behavioral Decision Making*, *29*(5), 453–469. doi:10.1002/bdm.1883

Roberts, L. D., Heritage, B., & Gasson, N. (2015). The measurement of psychological literacy: A first approximation. *Frontiers in Psychology*, *6*(105), 1–12. doi:10.3389/fpsyg.2015.00105

Roberts, C., & Stark, P. (2008). Readiness for self-directed change in professional behaviours: Factorial validation of the self-reflection and insight scale. *Medical Education*, *42*(11), 1054–1063. doi:10.1111/j.1365-2923.2008.03156.x

Sadowski, C. J., & Cogburn, H. E. (1997). Need for cognition in the Big-Five factor structure. *The Journal of Psychology*, *131*(3), 307–312. doi:10.1080/00223989709603517

Saucier, G. (1994). Mini-Markers: A brief version of Goldberg's unipolar Big-Five markers. *Journal of Personality Assessment*, *63*(3), 506–516. doi:10.1207/s15327752jpa6303_8

Sherman, E. D., Miller, J. D., Few, L. R., Campbell, W. K., Widiger, T. A., Crego, C., & Lynam, D. R. (2015). Development of a short form of the five-factor narcissism inventory: The FFNI-SF. *Psychological Assessment*, *27*(3), 1110–1116. doi:10.1037/pas0000100

Sieck, W. R., & Arkes, H. R. (2005). The recalcitrance of overconfidence and its contribution to decision aid neglect. *Journal of Behavioral Decision Making*, *18*(1), 29–53. doi:10.1002/bdm.486

Silvia, P. J., & Phillips, A. G. (2011). Evaluating self-reflection and insight as self-conscious traits. *Personality and Individual Differences*, *50*(2), 234–237. doi:10.1016/j.paid.2010.09.035

Sinayev, A., & Peters, E. (2015). Cognitive reflection vs. calculation in decision making. *Frontiers in Psychology*, *6*, 532.doi:10.3389/fpsyg.2015.00532

Sloman, S. A. (1996). The empirical case for two systems of reasoning. *Psychological Bulletin*, *119*(1), 3–22. doi:10.1037/0033-2909.119.1.3

Stagnaro, M. N., Pennycook, G., & Rand, D. G. (2018). Performance on the cognitive reflection test is stable across time. *Judgment and Decision Making*, *13*(3), 260–267.

Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, *8*(3), 220–247. doi:10.1207/s15327957pspr0803_1

Thompson, V. A., Prowse Turner, J. A., & Pennycook, G. (2011). Intuition, reason, and metacognition. *Cognitive Psychology*, *63*(3), 107–140. doi:10.1016/j.cogpsych.2011.06.001

Thorndike, R. L. (1942). Two screening tests of verbal intelligence. *Journal of Applied Psychology*, *26*(2), 128–135. https://psycnet.apa.org/doi/10.1037/h0060053

Toplak, M. E., West, R. F., & Stanovich, K. E. (2014). Assessing miserly information processing: An expansion of the cognitive reflection test. *Thinking & Reasoning*, *20*(2), 147–168.

Trapnell, P. D., & Campbell, J. D. (1999). Private self-consciousness and the Five-Factor Model of Personality: Distinguishing rumination from reflection. *Journal of Personality and Social Psychology*, *76*(2), 284–304. doi:10.1037//0022-3514.76.2.284

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, *185*(4157), 1124–1131. doi:10.1126/science.185.4157.1124

Vazire, S., & Funder, D. C. (2006). Impulsivity and the self-defeating behavior of narcissists. *Personality and Social Psychology Review*, *10*(2), 154–165. doi:10.1207/s15327957pspr1002_4

Welsh, M. B., Burns, N. R., & Delfabbro, P. H. (2013). The cognitive reflection test: How much more than numerical ability? In M. Knauff, N. Sebanz, M. Pauen, & I. Wachsmuth (Eds.), *Proceedings of the 35th Annual Meeting of the Cognitive Science Society* (pp. 1587–1592). Berlin: Cognitive Science Society.