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Short Communication

Intelligence and emotional disorders: Is the worrying and ruminating mind a more intelligent mind?

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ABSTRACT

Previous research has shown that anxiety and depression symptoms are negatively associated with measures of intelligence. However, this research has often not taken state distress and test anxiety into account, and recent findings indicate possible positive relationships between generalized anxiety disorder (GAD), worry, and intelligence. The present study examined the relationships between GAD, depression, and social anxiety symptoms, as well as their underlying cognitive processes of worry, rumination, and post-event processing, with verbal and non-verbal intelligence in an undergraduate sample ($N = 126$). While the results indicate that verbal intelligence has positive relationships with GAD and depression symptoms when test anxiety and state negative affect were taken into account, these relationships became non-significant when overlapping variance was controlled for. However, verbal intelligence was a unique positive predictor of worry and rumination severity. Non-verbal intelligence was a unique negative predictor of post-event processing. The possible connections between intelligence and the cognitive processes that underlie emotional disorders are discussed.

1. Introduction

Intelligence has long been recognized as playing a key role in human evolution. Adaptive emotional regulation is also considered to be critically important for survival and reproduction (Darwin, 1872). More recently, some theorists have extrapolated the evolutionary framework to encompass the maladaptive extremes of emotions – the emotional disorders (e.g., Gilbert, 1998, 2001; Marks & Nesse, 1994). In this view, experiencing the "right" emotion (e.g., anxiety, sadness, or happiness), with the optimal intensity and duration, in the correct context or situation, would clearly enhance an organism's fitness. Emotional disorders, therefore, represent the extreme and non-adaptive tails of a normal distribution of individual variability in emotional reactions. For example, given the adaptive value of an emotion like anxiety, which would permit an individual to anticipate and plan for potential threats, it seems clear that anxiety might have co-evolved with increased intelligence. Moreover, given the potentially fatal costs of "false negatives" in decision-making about threats, selection pressures may have favoured errors in the other direction, or "false positives". From an evolutionary standpoint, there are fewer costs associated with worrying about a threatening event that does not occur than failing to anticipate, plan for, or avoid one that does.

Relevant research exploring these relationships has provided mixed results, however. Researchers have often found a negative relationship between intelligence and emotional disorders, across a diverse range of samples (Feldhusen & Klausmeier, 1962; Kerrick, 1955; McCandless & Castaneda, 1956). A recent meta-analysis indicated that gifted children are less likely to have anxiety than non-gifted children (Martin, Burns, & Schonlau, 2010). Multiple studies have also found that depressed individuals score lower on measures of processing speed and visual–spatial reasoning than they do on measures of verbal intelligence (Kluger & Goldberg, 1990; Zillmer, Ball, Fowler, Newman, & Stutts, 1991). However, it is possible that the symptoms of acute depression might decrease an individual's ability to perform optimally on an intelligence test, and that the individual may not have lower intelligence. Aligning with this, Ruisel (2000) argued that state anxiety and test anxiety should be taken into account when interpreting the relationship between anxiety and intelligence, and Moutafi, Furnham, and Tsaousis (2006) found that test anxiety mediated the relationship between neuroticism and intelligence. This research suggests that the negative relationship between emotional disorders and intelligence may be an artifact of the testing itself.

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Recent studies by Coplan et al. (2006, 2012) compared healthy controls to individuals with generalized anxiety disorder (GAD), and found that individuals with GAD had higher intelligence. Worry severity also positively correlated with intelligence within the GAD samples. Unfortunately, both studies had very small samples, and the authors did not investigate the role of other cognitive processes. While worry is the proposed cognitive process underlying GAD (American Psychiatric Association, 2013), rumination and post-event processing are thought to be the primary cognitive processes involved in major depressive disorder and social anxiety disorder, respectively (Clark & Wells, 1995; Nolen-Hoeksema, 2000).

This study sought to further examine the relationships between emotional disorders and intelligence. Using a large undergraduate sample, we examined the relationships of GAD, depression, and social anxiety symptoms, as well as the relationships of worry, rumination, and post-event processing, with verbal and non-verbal intelligence while controlling for state negative affect and test anxiety.

2. Materials and methods

2.1. Participants

A total of 126 undergraduate students participated. The sample consisted primarily of Caucasian (85.7%), young adult (*M* age = 20.46, *SD* = 4.53) women (77.0%). This study was reviewed and approved by the university's research ethics board.

2.2. Measures

2.2.1. Generalized Anxiety Disorder Questionnaire-IV (GADQ-IV; Newman et al., 2002)

The GADQ-IV is a 9-item self-report measure, with higher scores indicating a higher amount of GAD symptoms. The GADQ-IV demonstrates strong convergent and divergent validity, as well as good internal consistency.

2.2.2. Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990)

The PSWQ is a 16-item self-report questionnaire. The PSWQ has been found to have high internal consistency, and high content validity. Higher scores indicate more frequent worries.

2.2.3. Centre for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977)

The CES-D is a 20-item self-report measure. Higher scores indicate more frequent depressive symptoms. The CES-D has high internal consistency, high content validity, and moderate convergent validity.

2.2.4. Ruminative Responses Scale-Brooding and Reflection (RRS-BR; Treynor, Gonzalez, & Nolen-Hoeksema, 2003)

Higher scores on the RRS-BR indicate more frequent rumination. The RRS-BR is a 10-item self-report questionnaire, which has been found to have high internal consistency, and strong convergent validity.

2.2.5. Social Phobia Inventory (SPIN; Connor et al., 2000)

The SPIN is a 17-item self-report measure, with higher scores corresponding to more intense social anxiety symptoms. The SPIN has excellent internal consistency and good convergent validity.

2.2.6. Post-Event Processing Questionnaire-Revised (PEPQ-R; McEvoy & Kingsep, 2006)

The PEPQ-R is an 8-item self-report questionnaire. The PEPQ-R has been found to have high internal consistency and moderate convergent validity. Higher scores indicate more frequent and intense post-event processing.

2.2.7. Verbal Comprehension Index (VCI; Wechsler, 2008)

A VCI score was calculated for each participant using the Similarities, Comprehension, and the Vocabulary subscales from the Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV; Wechsler, 2008). Raw scores on each of the three scales were converted into scaled scores and transformed according to the rules specified in the WAIS-IV manual. Higher scores on the VCI indicate higher verbal intelligence. The subscales and the VCI have been shown to have excellent psychometric properties.

2.2.8. Raven's Standard Progressive Matrices (SPM; Raven, Raven, & Court, 2000)

The SPM is a series of five matrices sets with a part missing. Participants select a pattern that they believe completes the overall design. The SPM has excellent psychometric properties and higher scores indicate higher non-verbal intelligence.

2.2.9. Positive and Negative Affect Schedule – Negative Affect subscale (PANAS-NA; Watson, Clark, & Tellegen, 1988)

The PANAS-NA is a 10-item self-report measure, with higher scores indicating more intense state negative affect. The PANAS-NA has demonstrated high internal consistency, convergent validity, discriminant validity, and construct validity.

2.2.10. Cognitive Test Anxiety Scale (CTAS; Cassady & Johnson, 2002)

The CTAS is a 27-item self-report measure. The CTAS demonstrates high levels of internal consistency, stability, and predictive validity. Higher scores indicate more severe test anxiety.

2.3. Procedure

After expressing interest in the study, potential participants met individually with one of the primary researchers, or one of seven research assistants. The primary researchers provided extensive training to the research assistants on how to complete the WAIS-IV subscales and the SPM. Participants were fully informed of the nature of the study, and then completed a demographic characteristics questionnaire, followed by the measures in the following order: the PEPQ-R, the CES-D, the WAIS-IV: Similarities, the SPIN, the PSWQ, the WAIS-IV: Comprehension, the PANAS-NA, the CTAS, the WAIS-IV: Vocabulary, the RRS-BR, the GADQ-IV, and the SPM.

2.4. Statistical analyses

Partial correlations were first examined between the VCI and SPM and the symptom measures, as well as between the VCI and SPM and the cognitive process measures, controlling for scores on the PANAS-NA and the CTAS. To examine if the associations between the VCI and SPM and the measures of interest were unique (i.e., not due to overlapping variance among measures), hierarchical regression analyses were conducted.

3. Results and discussion

When controlling for test anxiety and state negative affect, the VCI positively partially correlated (*pr*) with the GADQ-IV, $pr(122) = .18$, $p = .045$, and with the CES-D, $pr(122) = .20$, $p = .023$. The VCI also positively correlated with the PSWQ, $pr(122) = .21$,

Table 1
Hierarchical regression analyses.

Variable	R	Adjusted R^2	R^2 change	t	pr
Dependent variable: GADQ-IV					
Step 1	.60	.35	.36**		
PANAS-NA				3.63**	.31**
CTAS				6.36**	.50**
Step 2	.67	.43	.09**		
SPIN				1.00	.09
CES-D				4.21**	.36**
Step 3	.68	.43	.01		
VCI				1.26	.11
Dependent variable: CES-D					
Step 1	.53	.26	.28*		
PANAS-NA				4.96**	.41**
CTAS				3.39**	.29**
Step 2	.61	.35	.10**		
SPIN				0.61	.05
GADQ-IV				4.21**	.36**
Step 3	.62	.36	.01		
VCI				1.67	.15
Dependent variable: PSWQ					
Step 1	.61	.36	.36**		
PANAS-NA				4.28**	.36**
CTAS				6.07**	.48**
Step 2	.68	.44	.09**		
PEPQ-R				3.65**	.31**
RRS-BR				1.28	.11
Step 3	.69	.46	.02*		
VCI				2.17*	.19*
Dependent variable: RRS-BR					
Step 1	.42	.16	.18**		
PANAS-NA				4.16**	.35**
CTAS				1.94	.17
Step 2	.51	.24	.09**		
PEPQ-R				2.85*	.25*
PSWQ				1.28	.11
Step 3	.55	.27	.04*		
VCI				2.52*	.22*
Dependent variable: PEPQ-R					
Step 1	.43	.17	.18		
PANAS-NA				2.80*	.24*
CTAS				3.63**	.31**
Step 2	.58	.31	.15		
PSWQ				3.65**	.31**
RRS-BR				2.85*	.25*
Step 3	.61	.35	.04		
SPM				−2.79*	−.25*

* $p < .05$.
** $p < .001$.

$p = .018$, and the RRS-BR, $pr(122) = .24$, $p = .007$. The VCI did not correlate with the SPIN or the PEPQ-R, $ps > .590$. The SPM negatively correlated with the PEPQ-R, $pr(122) = -.20$, $p = .027$, but did not correlate with any other measure, $ps > .085$. Table 1 reports the results of the hierarchical regression analyses. The VCI was a unique positive predictor of the PSWQ and RRS-BR, while the SPM was a unique negative predictor of the PEPQ-R. The results of this study indicate that verbal intelligence is positively associated with the tendency to worry and ruminate. Non-verbal intelligence, on the other hand, is negatively associated with the tendency to process past social events.

Overall, the results of this study support and extend the findings of Coplan et al. (2006, 2012). While Coplan et al. (2006, 2012) found a positive association between worry and intelligence only in a clinical sample, the current study extended this finding to a non-clinical sample. The present findings have also revealed that rumination is positively related to verbal intelligence. However, post-event processing was negatively related to non-verbal intelligence. It is possible that more verbally intelligent individuals are able to consider past and future events in greater detail, leading to more intense rumination and worry. Individuals with higher non-verbal intelligence may be stronger at processing the non-verbal signals from individuals they interact with in the moment, leading to a decreased need to re-process past social encounters.

Previous studies in this area found a negative relationship between intelligence and anxiety and depression (e.g., Feldhusen & Klausmeier, 1962; Kluger & Goldberg, 1990). By controlling for state distress and test anxiety, this study found positive correlations between GAD and depression symptoms and verbal intelligence, although the relationship was lost when controlling for overlapping variance. No relationship was found between social anxiety symptoms and verbal or non-verbal intelligence. These findings indicate that while intelligence may be related to the symptoms of emotional disorders, it is more strongly linked to the cognitive processes that underlie these disorders.

One additional implication that arises from this study is that future researchers who wish to examine the relationship between intelligence and various psychological variables, such as psychopathology, cognitive processes, or personality, should consider the role of state negative affect (i.e., current emotional state) and test anxiety. This study illustrates that these variables may play a significant role in the observed strength and direction of the relationships higher-level constructs have with intelligence.

The present study was not without limitations. The sample for this study was undergraduate students, with few individuals over the age of 30 participating. It is difficult to be certain how the results obtained from this sample would generalize to older populations. However, this did not restrict the range of VCI scores, which ranged from 74 to 130. Similarly the range of the emotional disorder symptoms varied considerably, with the mean scores for the sample at or above the empirical cut-offs for the GADQ-IV, SPIN, and CES-D. Yet, without clinical interviews it is unclear how many participants would have met diagnostic criteria for the emotional disorders examined in this study.

The present study examined the relationships between verbal and non-verbal intelligence and the symptoms and cognitions of emotional disorders. Although only small positive correlations between verbal intelligence and the symptoms of GAD and depression were found, positive associations between verbal intelligence and worry and rumination and a negative association between non-verbal intelligence and post-event processing emerged. Future studies are needed to provide a thorough explanation and interpretation of the relationships between these cognitive processes and intelligence. However, these preliminary results indicate that a worrying and ruminating mind is a more verbally intelligent mind; a socially ruminative mind, however, might be less able to process non-verbal information.

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Declaration of conflicting interests

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