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Shared and Distinct Cognitive/Affective Mechanisms in Intrusive Cognition: An Examination of Worry and Obsessions

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Abstract

Generalized anxiety disorder and obsessive-compulsive disorder are defined by chronic intrusive thoughts. The aim of the present study was to evaluate the relationship between cognitive (attentional control) and motivational (negative urgency) mechanisms potentially underlying worry and obsessions. Participants ($N = 526$) completed an online questionnaire battery consisting of self-report measures of worry, OCD symptoms, attentional control (AC), negative urgency (NU), and trait negative affect. After controlling for trait negative affect, self-reported AC was negatively related to worry, repugnant obsessions, and ordering symptoms. Greater NU was associated with increased worry and repugnant obsessions. Further, self-reported AC and NU interacted such that greater NU was associated with greater worry at high but not low levels of AC. AC and NU were independently associated with repugnant obsessions. Perceived executive functioning impairments may confer risk for intrusive thoughts, particularly worries, whereas distress-driven impulsivity may contribute to the involuntary, ego-dystonic features of intrusions.

Keywords

attentional control; negative urgency; OCD; GAD; intrusive thoughts

Introduction

Generalized anxiety disorder (GAD) and obsessive-compulsive disorder (OCD) are primarily defined by excessive negatively-valenced cognitions (American Psychiatric Association [APA], 2013). Although worry and obsessions share common features (Freeston

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Compliance with Ethical Standards

Conflict of Interest: All authors declare that they have no conflicts of interest.

Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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& Ladouceur, 1993; Turner, Beidel, & Stanley, 1992) and frequently co-occur (Brown, Moras, Zinbarg, & Barlow, 1993; Clark & Claybourn, 1997), measures of these symptoms have demonstrated diagnostic specificity in GAD and OCD patient samples (Brown et al., 1993; Huppert et al., 2007). These data suggest that worry and obsessions may result from both shared and unique underlying mechanisms. Elucidating these mechanisms, particularly the ways in which they might interact to produce dysfunction, is important for understanding the etiology of specific classes of symptoms (e.g., intrusive cognition), which should ultimately improve diagnostic validity (Morris & Cuthbert, 2012).

One such mechanism underlying worry and obsessions might be deficits in attentional control (AC; Derryberry & Reed, 2002). AC is conceptualized as a trait-level variable reflective of the ability to volitionally control information processing (Derryberry & Reed, 2002), and has been linked to the successful inhibition of intrusive thoughts (Friedman & Miyake, 2004; Bomyea & Amir, 2011; Brewin & Smart, 2005; Gillie, Vasey, & Thayer, 2015) as well as other intrusive phenomena (e.g., intrusive memories; Anderson et al., 2004; Gillie & Thayer, 2014). It is plausible that deficits in AC may confer risk for obsessions and worry via reductions in the ability to disengage attention from negatively-valenced thoughts. Indeed, GAD patients have reported poorer self-reported AC compared to healthy controls in multiple studies (Armstrong, Zald, & Olatunji, 2011; Moradi, Fata, Abhari, & Abbasi, 2014). Poorer self-reported AC was also associated with greater worry symptoms in a clinical GAD sample (Armstrong et al., 2011) and distinguished GAD patients who sought treatment from those in the community (Hirsch, Mathews, Lequertier, & Perman, 2013); this suggests perceived AC may vary with GAD severity. Additionally, poor self-reported AC was found to mediate the relationship between GAD diagnosis and impaired target detection following distractors, with the effect driven by neutral, not affective, distractors (Olatunji, Ciesielski, Armstrong, Zhao, & Zald, 2011). This suggests that perceived AC may be related to worry via a domain-general attentional deficit, a possibility supported by neural evidence demonstrating an association between trait anxiety, which mediated the relationship between self-reported AC and worry in GAD patients (Armstrong et al., 2011), and altered recruitment of prefrontal cortex regions regardless of stimulus valence (Bishop, 2008; Telzer et al., 2008).

The evidence for the role of AC in obsessions is less clear. Two studies in clinical OCD samples found that OCD patients reported poorer AC compared to a control group, but poorer AC was not related to greater obsessions in patients (Armstrong et al., 2011; Moradi et al., 2014). Because these studies used an obsessions measure that is reflective of obsessions in general and is somewhat specific to repugnant obsessions (OCI-R; Huppert et al., 2007), it may be that poorer perceived AC only predicts worse *repugnant* obsessions (i.e., the ‘pure obsessional’ subtype; Moulding, Aardema, & O’Connor, 2014), a possibility supported by data demonstrating greater executive functioning deficits in this subtype (Lee & Telch, 2010; Lee, Yost, & Telch, 2009). Thus, the equivocal role of self-reported AC in obsessions may be resolved through examination of symptom subtypes. Further, given data suggesting that affective context may be relevant for behaviorally-indexed AC deficits in OCD (Najmi et al., 2010) but not GAD (Olatunji et al., 2011), it is important to consider self-reported AC in conjunction with constructs that reflect the motivational aspects of

worry and obsessional phenomena to understand the interactions of potential diatheses for obsessions/worry, especially in light of recent research suggesting that interactions between cognitive control and emotional processing may be the most important contributors to intrusive cognition (Genet, Malooly, & Siemer, 2013; Quinn & Joormann, in press; Stout, Shackman, Johnson, & Larson, 2015).

Obsessions and worry are both thought to be maintained via covert and overt negatively-reinforced avoidance behavior (Abramowitz, Braddock, & Moore, 2009; Borkovec, Alcaine, & Behar, 2004), and thus it is also important to consider trait differences in variables relevant to negative reinforcement processes. One such variable is negative urgency (NU), a trait-level facet of impulsivity defined as the propensity to engage in distress-elicited rash action, generally to obtain immediate negative reinforcement (Cyders & Smith, 2008). Although impulsivity is not typically considered in internalizing disorders, a growing body of research suggests that NU is associated with multiple forms of intrusive cognition including worry, obsessions, and insomnia-related intrusions (Schmidt, Gay, Ghisletta, & Van Der Linden, 2010; Schmidt, Gay, & Van Der Linden, 2008; Gay, Schmidt, & Van Der Linden, 2011; Cogle, Timpano, & Goetz, 2012). NU has been positively associated with worry and GAD symptom severity in multiple student samples (Gay, Schmidt, & Van der Linden, 2011; Pawluk & Koerner, 2013), although NU was not associated with probable GAD status after the inclusion of covariates (Pawluk & Koerner, 2013), suggesting that NU may contribute less to worry than other vulnerabilities.

NU has also demonstrated associations with obsessions across multiple student samples (Cogle, Timpano, & Goetz, 2012; Gay et al., 2011), and has been negatively related to performance on tasks assessing prepotent response inhibition (Gay, Rochat, Billieux, d'Acremont, & Van der Linden, 2008; Philippe et al., 2010), an ability that appears to be particularly associated with repugnant obsessions (Gillan et al., 2014; Lee et al., 2009; Morein-Zamir, Fineberg, Robbins, & Sahakian, 2010). Neural areas associated with NU (e.g., OFC; Cyders et al., 2014) have also been implicated in OCD (Chamberlain et al., 2008) and obsessions specifically (Rubia et al., 2010). Overall, NU appears to be linked to obsessions and worry, with the evidence particularly robust for repugnant obsessions. However, the literature is sparse and replication in larger samples is required before firmer conclusions can be drawn.

There are a number of limitations of the extant literature on self-reported AC/NU and obsessions/worry. First, the literature on AC/NU and obsessions is particularly limited, especially regarding associations with specific OCD symptom dimensions. Similarities and differences between obsessions and worry may only emerge for specific symptom dimensions (e.g., repugnant obsessions). Second, there are no studies to our knowledge that have examined the interaction between self-reported AC and NU in the prediction of worry or obsessions. Given the dense interconnectivity between neural regions associated with AC and NU (Banks et al., 2007) as well as data suggesting that affective context may be relevant for behaviorally-indexed AC deficits in OCD (Najmi et al., 2010), particularly for those with repugnant obsessions (Morein-Zamir et al., 2010), but not GAD (Olatunji et al., 2011), it is possible that motivational variables (i.e., NU) are more important to obsessions and cognitive variables (i.e., AC) are more important to worry. Third, few studies have controlled for

negative emotionality when examining relationships among these constructs, an important covariate to include given evidence that negative emotionality is positively related to intrusive thoughts (Horowitz, 1975), the propensity for negative mood-based rash action (Cooper, Agocha, & Sheldon, 2000; Settles et al., 2012), and impaired AC (Meesters, Muris, & van Rooijen, 2007). Finally, most studies examining AC, NU, and worry/obsessions have used student or small clinical samples. Research in large community samples is needed to replicate previous findings (Haslam, Holland, & Kuppens, 2012).

To address limitations in the current literature, we conducted analyses on a large community sample to assess the relative associations and potential interactive relations perceived AC and NU share with worry and obsessions, accounting for the influence of negative affect. First, given the relative paucity of research examining self-reported AC and NU across types of OCD symptoms, we examined the relations between the OCD symptom dimensions and AC and NU, controlling for negative affect. Given prior data demonstrating that repugnant obsessions are uniquely associated with behaviorally-indexed executive functioning impairment (Lee et al., 2009; Lee & Telch, 2010) and difficulties inhibiting prepotent responses in affective contexts (Morein-Zamir et al., 2010), we hypothesized that repugnant obsessions would be uniquely and inversely associated with AC and positively associated with NU. We were also interested in the unique and interactive relations self-reported AC and NU shared with obsessions and worry. Based on prior studies demonstrating symptom level associations between obsessions and NU (Cogle et al., 2012), but not AC (Armstrong et al., 2011), and data suggesting the importance of affective context to response suppression in OCD, especially for repugnant obsessions (Najmi et al., 2010; Morein-Zamir et al., 2010), we hypothesized an interaction between AC and NU such that perceived AC would only be related to repugnant obsessions for individuals with low NU, controlling for negative affect. Conversely, given self-report data revealing associations between AC and worry/GAD severity (Armstrong et al., 2011; Hirsch et al., 2013) and neural/behavioral data suggesting that AC deficits in GAD are not dependent on affective context (Bishop, 2008; Olatunji et al., 2011), we hypothesized that NU would only be associated with worry in individuals with good self-reported AC.

Methods

Participants

The current sample included 526 individuals (62.9% female) who were recruited through an online crowdsourcing marketplace. Ages ranged from 18 to 72 ($M = 34.87$, $SD = 12.41$). The racial/ethnic breakdown of the sample was 84.2% Caucasian, 8.0% African American, 4.2% Asian, 1.1% American Indian or Alaskan Native, and 2.5% other (e.g., biracial). In addition, 6.5% of the sample identified as Hispanic or Latino. With regard to highest level of education, 35.7% of the sample completed some college or had a 2 year degree 35.2% had a 4 year college degree, 12.9% completed high school or the equivalent, 11.4% completed graduate school, 3.6% completed a trade or technical school, and 1.2% completed some high school. Finally, 36.3% of the sample were married, 35.9% single or never married, 15.2% cohabitating, 10.1% divorced, 1.1% widowed, 0.8% separated, and 0.6% other.

Procedure

Participants were recruited to complete an online survey examining risk factors associated with anxiety pathology through Amazon's Mechanical Turk (Mturk). Inclusion criteria for the current study included: being 18 years of age or older, living in the United States, and high quality work on previous Mturk tasks as indicated by a Human Intelligence Task rating greater than 90% (Paolacci & Chandler, 2014). Previous research has shown that data collected with Mturk are of high quality and diverse in nature (Buhrmester, Kwang, & Gosling, 2011; Paolacci & Chandler, 2014). Although samples recruited from Mturk cannot be said to be representative of the general United States population (Paolacci & Chandler, 2014), they are considerably more diverse than student samples commonly used in psychology research (Buhrmester et al., 2011). Two validity check items were included in the battery of questionnaires as an indicator of random responding (e.g., "Are you reading this questionnaire?"). No participants were excluded for missing both items. Participants were paid \$1.00 for their participation, which took approximately 1 hour. This payment is consistent with the median hourly wage for tasks performed on Mturk (Horton & Chilton, 2010). Informed consent was obtained prior to data collection and all procedures were approved by the university's institutional review board.

Measures

Attentional Control Scale (ACS)—The ACS (Derryberry & Reed, 2002) is a 20-item scale designed to assess individual differences in attentional control. Respondents are asked to rate the extent to which their experience is consistent with each item. Responses are scored on a Likert scale ranging from (1) almost never to (4) always (e.g., 'When I need to concentrate and solve a problem, I have trouble focusing my attention'). Items are reverse-coded so that higher scores indicate greater attentional control. The ACS has previously demonstrated good reliability (Derryberry & Reed, 2002). Regarding convergent validity with behavioral and neural indices of attentional control, anxious individuals with high ACS scores have been found to disengage better from threat cues in a spatial orienting task than those with low ACS scores (Derryberry & Reed, 2002). Further, ACS scores were positively associated with activation in the rostral anterior cingulate cortex, a neural region associated with AC (di Pellegrino, Ciaramelli, & Ladavas, 2007), but were not associated with activation in neural regions unrelated to executive functioning (e.g., amygdala) (Mathews, Yiend, & Lawrence, 2004). Finally, the ACS has demonstrated significant positive associations with behavioral indices of executive functioning, including the ability to manipulate material in working memory ($r = .27, p < .05$) and inhibit prepotent responses ($r = .33, p < .05$) (Judah, Grant, Mills, & Lechner, 2014). In the current study, the ACS demonstrated good internal consistency ($\alpha = .86$).

Dimensional Obsessive-Compulsive Scale (DOCS)—The DOCS (Abramowitz et al., 2010) was used to measure obsessive-compulsive symptoms. The DOCS is a 20-item scale that assesses the severity of the four dimensions of obsessive-compulsive symptoms most reliably replicated in structural research on OCD: contamination, responsibility for harm and mistakes, unacceptable thoughts, and symmetry/completeness. Respondents indicate their experiences with thoughts and behaviors related to the symptom dimensions on a 5 point Likert scale (0–4). Higher scores represent greater experience of obsessive-

compulsive symptoms. Previous work has found the DOCS to demonstrate good psychometric properties (Abramowitz et al., 2010). In the current study, the DOCS displayed excellent internal consistency for the total score ($\alpha = .95$), as well as the responsibility for harm ($\alpha = .92$), unacceptable thoughts ($\alpha = .92$), and symmetry/completeness ($\alpha = .91$) subscales. The contamination subscale demonstrated good internal consistency ($\alpha = .87$).

Penn State Worry Questionnaire (PSWQ)—The PSWQ (Meyer, Miller, Metzger, & Borkovec, 1990) is a 16-item self-report measure assessing the frequency, intensity, and uncontrollability of worry. Items are rated using a 5 point Likert scale ranging from (1) not at all typical of me to (5) very typical of me. Higher scores indicate greater levels of worry. The PSWQ has been shown to have good internal consistency and test re-test reliability across clinical and college samples (Meyer et al., 1990). In the current sample, the PSWQ demonstrated excellent internal consistency ($\alpha = .93$).

Positive Affect Negative Affect Scales – Negative Affect Subscale (PANAS-NA)—In the current study the PANAS-NA (Watson, Clark, & Tellegen, 1988) was used to measure trait negative affect. The PANAS-NA is made up of 10 words that describe negative emotions. Respondents are asked to indicate to what extent they generally feel particular emotions on a 5 point Likert scale ranging from (1) very slightly to (5) extremely. Higher scores indicate a greater experience of negative affect. The PANAS is widely used and has demonstrated strong psychometric properties (Watson, 2000). In the current sample the PANAS-NA demonstrated excellent internal consistency ($\alpha = .94$).

UPPS Impulsivity Scale – Negative Urgency Subscale (UPPS-NU)—In the current study the UPPS-NU (Whiteside & Lynam, 2001) was used to measure negative urgency. The UPPS-NU contains 12 items and participants are asked to rate how strongly they agree with a statement regarding how they act and think ranging from (1) agree strongly to (4) disagree strongly (e.g., ‘When I feel bad, I will often do things I later regret in order to make myself feel better now’). Items were reverse-coded so that higher scores indicated greater NU. Previous work has found the UPPS-NU to have good internal consistency (Whiteside, Lynam, Miller, & Reynolds, 2005). In the current sample the UPPS-NU demonstrated excellent internal consistency ($\alpha = .93$).

Data Analytic Procedure

Descriptive statistics and correlations between all variables were first computed and reported using the scale scores. Confirmatory factor analysis (CFA) of item-level data was then used to fit the measurement models of NU (as measured by the UPPS-NU), perceived AC (as measured by the ACS), the OC symptom factors (i.e., Contamination, Harm Avoidance, Unacceptable Thoughts, and Symmetry; as measured by the DOCS), and Worry (as measured by the PSWQ). CFAs were conducted using full information maximum likelihood and the robust maximum likelihood estimator (MLR in Mplus). Fit for CFA and subsequent structural equation models (SEMs) was assessed using the likelihood ratio test (LRT), but fit indices were also examined to determine model fit given that the LRT can be overly conservative (e.g., Kenny & McCoach, 2003; Moshagen, 2012; Mulaik, 2007). Fit indices

included the comparative fit index (CFI), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA) with accompanying 90% confidence interval (CI).

Once measurement models were established, SEMs were fit. The first SEM examined the unique relations the OC symptom factors share with the NU and self-reported AC factors, controlling for the effect of a negative affect factor (measured by the PANAS-NA). The second examined the relations the Worry factor shares with the NU and AC factors, controlling for the effect of a negative affect factor. Following this, SEM models examined whether there were main and interactive effects of the NU and the AC factors, controlling for the negative affect factor, on the Unacceptable Thoughts and the Worry factors. Main effects models were conducted separately for the Unacceptable Thoughts factor, and then the Worry factor. Interaction effects models were then conducted separately. To determine whether inclusion of an interaction term improved model fit, the $-2\log\text{likelihood}$ value was compared to the $-2\log\text{likelihood}$ value in the main effects model. A significant difference indicated that including the interaction term improved model fit. To probe the interactions, simple slopes of each predictor variable were examined for significance at 1 standard deviation above and below the mean of the other predictor variable.

Results

Descriptive Statistics and Correlations

Descriptive statistics and correlations for all variables of interest are provided in Table 1. There was no missing data at the item-level. All variables were significantly correlated.

Confirmatory Factor Analysis Models of NU, AC, OC Symptoms, and Worry

The NU factor, consisting of the UPPS-NU items, demonstrated adequate fit to the data ($\chi^2 = 233.13$, $df = 54$, $p < .05$, CFI = .94, SRMR = .04, RMSEA = .08, 90% CI [.07, .09]). All items loaded significantly and highly on this factor (λ s = .64 to .86) with the exception of the reverse-keyed item 11, which had a poor but significant loading ($\lambda = -.27$). The self-reported AC factor, consisting of the negatively-keyed items of the ACS, demonstrated adequate fit to the data ($\chi^2 = 182.94$, $df = 44$, $p < .05$, CFI = .92, SRMR = .05, RMSEA = .08, 90% CI [.07, .09]).¹ All items loaded significantly on this factor (λ s = .41 to .82). The correlated factors model of OC symptoms (i.e., Contamination, Harm Avoidance, Unacceptable Thoughts, and Symmetry factors), consisting of items from the DOCS, provided adequate fit to the data ($\chi^2 = 354.51$, $df = 164$, $p < .05$, CFI = .95, SRMR = .03, RMSEA = .05, 90% CI [.04, .05]). All items loaded highly and significantly on their respective factors (λ s = .70 to .86). Finally, the Worry factor consisted of the 16 PSWQ items with residual covariances allowed between the negatively-keyed items (i.e., Brown, 2003). This model provided modest to adequate fit to the data ($\chi^2 = 516.62$, $df = 94$, $p < .05$, CFI = .91, SRMR = .04, RMSEA = .09, 90% CI [.09, .10]). The positively-keyed items all

¹A two-factor model of the ACS, consisting of an Attention Focusing and an Attention Shifting factor, did not provide adequate fit to the data. Further, an EFA of the ACS revealed that a two-factor solution comprised of negatively- and positively-keyed items best fit the data. We used the negatively-keyed items in the current analyses because these items were most likely to share stronger associations with psychopathology, although results of the current study were consistent regardless of whether the negatively- or positively-keyed items were used. Negatively-keyed items were reverse-coded so higher AC factor scores indicated greater AC.

loaded highly and significantly on the Worry factor ($\lambda_s = .71$ to $.90$). The factor loadings for the negatively-keyed items were all modest but significant ($\lambda_s = -.20$ to $-.37$).

Structural Equation Model Examining the Unique Relations OC Symptoms Share with NU and AC Controlling for Negative Affect

An SEM examining the unique relations between the OC symptom factors and the NU and self-reported AC factors (controlling for negative affect) provided adequate fit to the data ($\chi^2 = 2518.12$, $df = 1304$, $p < .05$, CFI = .92, SRMR = .04, RMSEA = .04, 90% CI [.04, .05]). Standardized model parameters are provided in the top panel of Table 2. In this model, the Unacceptable Thoughts factor was positively associated with the NU factor ($\beta = .19$, $p < .01$) as was negative affect ($\beta = .32$, $p < .001$). Unacceptable Thoughts ($\beta = -.14$, $p < .05$), Symmetry ($\beta = -.16$, $p < .05$), and negative affect ($\beta = -.38$, $p < .01$) were all inversely associated with the AC factor. There were no other significant relations. This model accounted for 24% of the variance in the NU factor and 32% of the variance in the AC factor. Whereas negative affect was included as a control variable to ensure that these factors were not related simply due to their overlapping levels of this construct, it was equally important to demonstrate that the variance accounted for in the NU and AC factors was not primarily due to negative affect. Therefore, analyses were conducted without including negative affect in the model. Similar relations between the OC symptom factors and the NU and AC factors were found. This model, without negative affect, accounted for 17% of the variance in the NU factor and 23% of the variance in the AC factor.

Structural Equation Model Examining the Relations Worry Shares with NU and AC Controlling for Negative Affect

An SEM examining the unique relations between the Worry factor and the NU and self-reported AC factors (controlling for negative affect) provided adequate fit to the data ($\chi^2 = 2586.11$, $df = 1111$, $p < .05$, CFI = .90, SRMR = .05, RMSEA = .05, 90% CI [.05, .05]). Standardized model parameters are provided in the bottom panel of Table 2. In this model, the Worry factor was significantly, positively associated with the NU factor ($\beta = .30$, $p < .001$) as was negative affect ($\beta = .26$, $p < .001$). The Worry factor was significantly, inversely associated with the AC factor ($\beta = -.37$, $p < .001$) as was negative affect ($\beta = -.28$, $p < .001$). This model accounted for 25% of the variance in the NU factor and 35% of the variance in the AC factor. Excluding negative affect from these models resulted in similar relations between the Worry factor and the NU and AC factors, accounting for 21% of the variance in the NU factor and 30% of the variance in the AC factor.

Structural Equation Models Examining the Main and Interactive Effects of NU and AC on Unacceptable Thoughts and Worry, Controlling for Negative Affect

The main effects model including the associations of NU, self-reported AC, and negative affect with the Unacceptable Thoughts factor provided adequate fit to the data ($\chi^2 = 1512.95$, $df = 659$, $p < .05$, CFI = .92, SRMR = .05, RMSEA = .05, 90% CI [.05, .05]). Inclusion of the interaction term did not significantly improve model fit (adjusted $\chi^2 = .26$, $p > .05$). However, to be consistent, results for the model with the interaction term included were reported (see Table 3). In this model, the Unacceptable Thoughts factor was

significantly, positively associated with the NU factor ($B = .18, p < .05$) and negative affect ($B = .49, p < .001$), and negatively associated with the AC factor ($B = -.21, p < .01$).

The main effects model including the associations of NU, AC, and negative affect with the Worry factor provided adequate fit to the data ($\chi^2 = 2586.11, df = 1111, p < .05, CFI = .90, SRMR = .05, RMSEA = .05, 90\% CI [.05, .05]$). Inclusion of the interaction term significantly improved model fit (adjusted $\chi^2 = 6.48, p < .05$). Results for the main and interactive effects are reported in Table 3. In this model, the Worry factor was positively associated with the NU factor ($B = .21, p < .001$) and negative affect ($B = .65, p < .001$), and negatively associated with the AC factor ($B = -.37, p < .001$). Further, the interaction between the NU and the AC factors was significant ($B = .11, p < .05$; see Figure 1). The relation between the NU factor and the Worry factor was significant at 1 *SD* above the mean AC factor score (i.e., good AC; $B = .32, p < .001$) and at mean levels of AC (i.e., the reported main effect of the NU factor), but not at 1 *SD* below the mean AC factor score ($B = .10, p > .05$). The relation between the AC factor and the Worry factor was significant at 1 *SD* below the mean NU factor score ($B = -.48, p < .001$), at mean levels of NU, and at 1 *SD* above the mean NU factor score ($B = -.26, p < .01$).

Discussion

The results of the present study partially confirmed our hypotheses. In a large community sample, poorer self-reported AC and greater NU were associated with more severe worry symptoms, even after controlling for trait negative affect, replicating prior findings in clinical and student samples (Armstrong et al., 2011; Gay et al., 2011; Hirsh et al., 2013; Pawluk & Koerner, 2013). Similarly, poorer self-reported AC was also related to greater repugnant obsessions independent of trait negative affect. However, contrary to predictions, repugnant obsessions were not the only OCD symptoms associated with unique variance in self-reported AC, with variance also shared by ordering symptoms. In contrast, repugnant obsessions were found to be the only OCD symptom type associated with NU, consistent with our hypothesis and prior literature on NU and obsessions in student samples (Cougale et al., 2012; Gay et al., 2011). Results failed to support our hypothesis that NU and perceived AC would interact for repugnant obsessions; only main effects emerged. However, in line with our hypothesis for worry, a significant interaction was found such that NU became non-significant at low levels of AC but was significant at average and high levels of AC.

Although the effect size was nearly twice as large for worry, the significant relationship between self-reported AC and repugnant obsessions is inconsistent with the non-significant association found by Armstrong and colleagues (2011). However, Armstrong and colleagues (2011) used a measure of obsessions only partially reflective of repugnant obsessions (OCI-R; Huppert et al., 2007) in a sample of OCD patients, which may have obscured the relationship and/or introduced limitations related to range restriction. Further, self-reported AC was not uniquely related to repugnant obsessions, but was also associated with ordering symptoms, an association consistent with two previous studies that found relationships between ordering, but not contamination symptoms, and impaired performance on executive functioning tasks (Hashimoto et al., 2011; Lawrence et al., 2006). However, in line with recent meta-analytic findings revealing broad executive functioning impairments across

OCD subtypes (Snyder, Kaiser, Warren, & Heller, 2014), Lawrence and colleagues (2006) found that, as an overall group, OCD patients had deficits in executive functioning relative to controls. Given data demonstrating that such deficits are not impacted after treatment nor related to clinical severity (Bannon, Gonsalvez, Croft, & Boyce, 2006; Roh et al., 2005), it is possible that domain-general AC impairments are trait markers of OCD rather than central maintaining factors, although studies directly examining the relationship between AC and OCD symptom types are sparse and further research is necessary.

The observed AC/NU interaction suggests that motivational processes theorized to be relevant to worry (i.e., emotional avoidance; Borkovec et al., 2004) may only be associated with symptom severity when ‘cold’ cognitive control processes are intact, which is consistent with data demonstrating that behaviorally-indexed AC impairments in GAD patients were primarily observed with neutral stimuli (Olatunji et al., 2011). The relatively greater association between self-reported AC and worry compared to repugnant obsessions is also consistent with some neural data demonstrating that, across multiple groups characterized by varying amounts of OCD and worry symptoms, only worry symptoms predicted enhanced error-related negativity (ERN) amplitude during an AC task (Zambrano-Vazquez & Allen, 2014). The ERN is thought to originate from the anterior cingulate cortex (ACC; Olvet & Hajcak, 2008), a brain region in which activation has been positively associated with ACS scores (Mathews et al., 2004). It may be that perseverative worry is more related to impaired AC based in ACC dysfunction, whereas obsessions are more related to broad impairment across the entire executive system (Snyder et al., 2014), including, but not limited to, the ACC and the NU-related OFC (Cyders et al., 2014).

The positive associations found between NU and repugnant obsessions/worry contribute to the growing literature on the relationship between NU and intrusive thoughts (Gay et al., 2011). The unique relationship between NU and the unacceptable thoughts factor of the DOCS is consistent with past literature on differences between repugnant obsessions, which are associated with less overt compulsive behavior (Moulding et al., 2014), and contamination, checking, and ordering obsessions (Brakoulias et al., 2013; Hasler et al., 2005; Lee et al., 2009). Lee and colleagues (2009) found that only individuals with repugnant obsessions demonstrated performance deficits on an OFC-dependent reversal learning task (McAlonan & Brown, 2003), a neural region associated with NU (Cyders et al., 2014) and greater obsessional, but not compulsive, symptom improvement in OCD patients (Rubia et al., 2010). Further, these data are also consistent with the higher rates of substance-use disorders, which have been robustly linked to greater NU (Albein-Urios, Martinez-Gonzalez, Lozano, Clark, & Verdejo-Garcia, 2012; Verdejo-Garcia, Bechara, Recknor, & Perez-Garcia, 2007), impaired reversal learning (Izquierdo & Jentsch, 2012), and OFC abnormalities (Schoenbaum, Roesch, & Stalnaker, 2006), in OCD patients with repugnant obsessions compared to other subtypes (Brakoulias et al., 2013; Hasler et al., 2005).

There are some limitations of the present study that should be noted. First, all relationships examined were cross-sectional in nature; longitudinal and experimental work is required to determine directionality/causality of the observed associations. Second, the ACS was not adequately modeled as a two-factor solution representing ‘shifting’ and ‘focusing’

attentional facets as has been found in prior research (Judah et al., 2014; Olafsson et al., 2011; but see Fajkowska & Derryberry, 2010 for an exception), although the two-factor solution found by Judah and colleagues (2014) utilized only 12 of the original 20 items, with the ‘focusing’ factor represented only by negatively-keyed items and the ‘shifting’ factor by positively-keyed items. Future studies are needed to clarify the ACS’s factor structure and the meaning of its factors. Third, all constructs were assessed using self-report measures. Future studies would benefit from the inclusion of behavioral and neural measures of AC (Judah et al., 2014; Mathews et al., 2004) and NU (Cyders et al., 2014; Gipson et al., 2012; MacPherson et al., 2012) to enhance confidence that the observed findings are not due to shared method variance. Finally, it is important to test the observed relationships in large clinical samples in order to assess the associations between NU/AC and functional impairment in GAD and multiple OCD subtypes with varying levels of co-morbidity. Future studies should assess the utility of NU/AC in distinguishing individuals with GAD/OCD from non-disordered controls matched for trait symptom levels (e.g., uncontrollability of worry in GAD; Ruscio & Borkovec, 2004). Such studies, in conjunction with prospective risk factor investigations and RCTs explicitly evaluating AC/NU as a mechanism of symptom reduction, will increase our understanding of the precise role of AC/NU in levels of worry/obsessions associated with clinically significant distress/impairment.

The present results have important theoretical and clinical implications. The relationship between domain-general self-reported AC and repugnant obsessions/worry is consistent with prior correlational and experimental work demonstrating a positive association between performance on cognitive control tasks and successful inhibition of intrusive thoughts (Bomyea & Amir, 2011; Brewin & Smart, 2005; Verwoerd, Wessel, & de Jong, 2009), providing support for theories suggesting that the ability to suppress unwanted intrusions depends on executive functions (Friedman & Miyake, 2004; Levy & Anderson, 2008). However, the present results suggest that good AC, independent of affective/motivational variables, may be most important for the successful inhibition of worry intrusions specifically, whereas both AC and affective/motivational variables, particularly the ability to resist immediate reinforcement opportunities under distress, are important for the inhibition of repugnant obsessional intrusions, consistent with theoretical models emphasizing executive dysfunction in conjunction with reward learning abnormalities in OCD (Dichter, Damiano, & Allen, 2012; Snyder et al., 2014).

Clinically, the present data suggest that AC may be more relevant as a marker of treatment response for worry compared to obsessions. Indeed, greater pre-treatment AC-related neural activity (i.e., ACC; Nitschke et al., 2009) has been shown to predict better response to pharmacotherapy in GAD, whereas this has generally not been found for OCD (Saxena, O’Neill, & Rauch, 2007). In contrast, NU-related neural activity (i.e., OFC; Cyders et al., 2014) has been more consistently associated with OCD pharmacotherapy response (Kang et al., 2003; Saxena et al., 2002; Swedo et al., 1992). With regard to psychosocial treatment, the specificity of NU to repugnant obsessions suggests that treatments targeting distress tolerance (e.g., via emotional exposure and adaptive skills training; Bornovalova, Gratz, Daughters, Hunt, & Lejuez, 2012; Macatee & Cougle, 2015) may be more helpful for this subtype, a possibility supported by RCT data demonstrating the efficacy of stress management training for ‘pure obsessionals’ (Whittal, Woody, McLean, Rachman, &

Robichaud, 2010) but not other OCD subtypes (Lindsay, Crino, & Andrews, 1997; Simpson et al., 2008). In contrast, domain-general AC training interventions (e.g., via working memory training; Siegle et al., 2014) may be more effective for individuals with GAD (Bomyea & Amir, 2011; Mohlman, 2008).

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Figure 1.

The effects of Negative Urgency (by standard deviations [*SDs*]) at Attentional Control 1 *SD* above and below the mean. The effects of Negative Urgency were significant at Good Attentional Control (i.e., 1 *SD* above the mean on the Attentional Control factor) and at mean levels of Attentional Control, but not at Poor Attentional Control (i.e., 1 *SD* below the mean on the Attentional Control factor). AC = Attentional Control. NU = Negative Urgency.

Table 1

Descriptive Statistics and Correlations for Study Measures

	1	2	3	4	5	6	7	8
1. UPPS-NU	--							
2. ACS	-.41*	--						
3. DOCS Cont	.19*	-.17*	--					
4. DOCS HA	.32*	-.25*	.62*	--				
5. DOCS UT	.37*	-.32*	.46*	.61*	--			
6. DOCS Symmetry	.26*	-.24*	.57*	.61*	.51*	--		
7. PSWQ	.45*	-.46*	.17*	.40*	.49*	.33*	--	
8. PANAS-NA	.44*	-.38*	.25*	.47*	.51*	.39*	.56*	--
Mean	32.62	53.16	2.96	3.49	4.09	3.17	49.42	20.00
Standard Deviation	8.87	9.75	3.41	4.05	4.32	3.85	15.09	9.04

Note. UPPS-NU = UPPS-Negative Urgency. ACS = Attentional Control Scale. DOCS = Dimensional Obsessive Compulsive Scale. Cont = Contamination. HA = Harm Avoidance. UT = Unacceptable Thoughts. PSWQ = Penn State Worry Questionnaire. PANAS-NA = Positive Affect Negative Affect Scales – Negative Affect subscale. Although only the negatively-keyed items of the ACS were used in factor analyses, the full scale is included and reported on in the descriptives and correlations. The UPPS-NU descriptives were reported using the original scale-coding (i.e., higher scores indicating less negative urgency) to facilitate comparison with other studies.

* $p < .05$.

Structural Equation Models Examining the Relations OC Symptoms and Worry Share with Negative Urgency and Attentional Control

Table 2

OC Symptom Model	Negative Urgency			Attentional Control		
	B	SE	R ²	β	SE	R ²
Overall			.24			.32
Contamination	-.02	.07		-.06	.08	
Harm Avoidance	.05	.09		.05	.09	
Unacceptable Thoughts	.19**	.07		-.14*	.07	
Symmetry	.02	.07		-.16*	.07	
Negative Affect	.32***	.05		-.38***	.06	
Worry Model	B	SE	R ²	B	SE	R ²
Overall			.25			.35
Worry	.30***	.06		-.37***	.06	
Negative Affect	.26***	.06		-.28***	.06	

Note. OC = Obsessive Compulsive. SE = Standard Error.

p < .001,

**
p < .01,

*
p < .05.

Table 3

	Unacceptable Thoughts Factor		Worry Factor	
	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>
Negative Urgency	.18*	.07	.21***	.06
Attentional Control	-.21**	.07	-.37***	.07
NU X AC	.03	.05	.11*	.05
Negative Affect	.49***	.08	.65***	.07

Direct and Interactive Relations between Negative Urgency and Attentional Control with Unacceptable Thoughts and Worry

Note. NU = Negative Urgency. AC = Attentional Control. *SE* = Standard Error. Parameters reported are unstandardized.

 $p < .001$,

**
 $p < .01$,

*
 $p < .05$.