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Restricted interests and anxiety in children with autism

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Abstract
A preoccupation with restricted interests (RI) is a core symptom of autism spectrum disorders (ASD). Engagement in RI is commonly observed in this population and impacts social, adaptive, and emotional functioning. The presence of anxiety disorders and overlap in symptom expression with RI, such as obsessive compulsive disorder (OCD), in children with ASD suggests a possible link between anxiety and the RI manifestation. RI play a multidimensional role in ASD and have been described as being expressed in multiple forms, such as fact collection or the enactment of RI through play. However, there is little research exploring in more detail the possible relationship between RI expression and anxiety. To explore the association between RI expression and anxiety, the current study examined the association between the various modes of RI expression and anxiety disorder symptoms in 68 elementary-aged children diagnosed with high-functioning ASD. Findings indicated that symbolic enactment of RI in the form of play, rather than information collection or time engaged in RI, was significantly linked with the increased presence and severity of anxiety symptoms. The conceptualization of RI as possible maladaptive coping responses to negative emotional experiences is discussed.

Keywords
anxiety, autism, restricted interests

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The majority of children diagnosed with autism spectrum disorders (ASD) exhibit restricted interests (RI; Klin et al., 2007), which has been described in the *DSM-IV* as an 'encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or in focus' (American Psychiatric Association, 2000: 70). Descriptive studies indicate that the content and expression of RI widely varies across children (Turner, 1999; Klin et al., 2007). RI can include typical, popular childhood interests (e.g. cartoons) or more obscure topics (e.g. washing machines). Research describing in more detail the content of RI and elucidating the impact of this complex symptom domain is lacking relative to studies examining ASD-related social and communicative difficulties (see Richler et al., 2007).

When considering the nearly ubiquitous manifestation of RI in ASD and the potential impact these interests and related behaviors have on overall functioning, the need for an increased and more systematic understanding of RI is clear. At this time, considerable evidence suggests that involvement in these interests is associated with immediate and long-term interference with functioning (Mercier et al., 2000; Piven et al., 1996). Furthermore, efforts to categorize the manner in which youth with ASD manifest or pursue RI through methods such as fact collection has expanded the overall knowledge of RI. In conjunction, the significant presence of anxiety symptoms in the ASD population (Kim et al., 2000; Leyfer et al., 2006) has spurred inquiries in examining the possible relationship between RI and anxiety. Both the multidimensional role that RI appears to play in ASD and the overlap in the behavioral expression of RI and anxiety symptoms have led to questions about how RI may impact the overall symptomatology of ASD (Attwood, 2003; Baron-Cohen and Wheelwright, 1999; Klin et al., 2007).

Expression of restricted interests

RI are expressed in a variety of modalities and have been speculated to play a range of roles in ASD. Although RI are described as intense interests, efforts to identify and describe the behavioral manifestation of RI (i.e. the manner in which they are pursued or expressed) have been researched (Attwood, 2003; Klin et al., 2007; South et al., 2005). Similar to the variability in the content or topics of RI (e.g. cartoons), there is substantial variance in the manner in which RI are expressed and the degree of intensity in which these behaviors are exhibited (Baron-Cohen and Wheelwright, 1999). RI can be manifested, for example, through searching for information and discussion of facts specific to a preferred topic (e.g. facts about cartoons) or exhibited through engagement in common childhood activities, such as drawing pictures of favorite cartoon characters (c.f. Klin et al., 2007). Other behavioral expressions of RI include repetitive patterns of play and excessive attachment to favored objects (South et al., 2005; Wetherby et al., 2004).

Another form of RI expression that has been observed in the literature is the manifestation of RI through play (Wood et al., 2009a, 2009b; Sze and Wood, 2007). In a clinical observation of a cognitive behavioral treatment trial, Sze and Wood (2007) noted that "Sophie", the participant in the case report, created a make-believe world that included characters such as Luke Skywalker, Harrison Ford and Indiana Jones in addition to collecting facts or discussing the topics in social interactions. She incorporated these characters of interest into play scenarios. At times, the authors observed that engaging in the RI posed interference to both adaptive behaviors and treatment.

It is unclear at this time why RI are ubiquitous in children with ASD and what elements maintain this enduring feature. It is clear, though, that the manifestation of RI likely serves many roles in ASD symptomatology. Involvement in activities related to one's RI has been viewed as a pleasurable affective experience, such that the pursuit of these interests is considered to be ego-syntonic, intrinsically motivating, and reinforcing (Baker, 2000; Baker et al., 1998; Klin et al., 2007; Mercier et al., 2000). It also, has been conceptualized as a by-product of a unique ASD-related cognitive profile, such as executive dysfunction (Turner, 1999). Alternatively, RI have been speculated to provide a possible coping response to distress (Baron-Cohen, 1989), such that expression of RI may provide a way for children with ASD to find comfort and relief from stressors (Klin et al., 2007). In extending this aspect of RI expression, it is possible to draw from theories of typical child development. Although the play of children with ASD is drastically different from that of typically developing children, play related to RI expression may provide some of the benefits in coping with distress that has been purposed as a beneficial element of play in non-ASD populations (Moore and Russ, 2006). It is uncertain whether and to what extent this may be in the case of ASD, but it provides an additional view to conceptualize the complexities of RI.

One element of RI that has been well-documented is the interfering impact it has on the overall functioning of children with ASD (Attwood, 2003; Baron-Cohen and Wheelwright, 1999; Klin et al., 2007). Attwood noted that when children with ASD are involved in RI-related activities they often miss important information from their environment. Additionally, Klin and colleagues (2007) found that engagement in RI was associated with interference in children's self-guided activities and social interactions across domains of the family, peers, and members of the community. Frequent expression of RI interfered across social and adaptive domains and was negatively associated with later adaptive and social outcomes. Hence, it is likely that intensity of RI expression may contribute to distress for children with ASD and their families, thus predisposing this population to increased stress and anxiety.

Restricted interests and anxiety

Comorbid conditions of anxiety disorders are common among people with ASD. Although studies vary, clinically significant levels of anxiety have been reported in at least 35 per cent of people diagnosed with ASD (Kim et al., 2000; Leyfer et al., 2006). It has been hypothesized that people on the autism spectrum may be more susceptible to high anxiety given their unique social, communicative, behavioral, and sensory difficulties, particularly children considered to be higher-functioning (Baron-Cohen, 1989; Bellini, 2006). For example, social skill impairments, difficulty with understanding the perspectives of other people, and increased sensitivity to sensory stimuli may predispose children with ASD to experience daily social interactions as overwhelming, unpredictable, and distressing to a greater degree than it does their typically developing peers, thereby contributing to heightened feelings of anxiety. In addition, many children with ASD have been found to exhibit clinically significant anxiety symptoms that include separation anxiety, generalized anxiety, and social anxiety, as well as OCD (Wood and Gadow, 2010). Also, studies using the Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS; Scahill et al., 1997) have found that large subgroups of children with ASD engage in clinically significant obsessions and compulsions (Scahill et al., 2006; Zandt et al., 2007).

The possibility of symptom overlap has been an important consideration in trying to understand the high co-occurrence of anxiety in the ASD population. But, it is feasible to distinguish between anxiety and core ASD features, particularly in higher-functioning children with greater verbal and cognitive abilities (Wood and Gadow, 2010). On one hand, manifestations of RI can appear similar in their content and expression to anxiety symptoms such as compulsive behaviors characteristic of OCD. To illustrate, RI related to numbers can be expressed by children speaking at length about numbers in a repetitive, scripted way or lining up blocks with numbers, all of which can appear similar to the compulsive behaviors that emerge in response to obsessive thoughts in OCD. An important distinguishing factor in separating ASD from anxious behaviors may be identifying the emotional valence of the behavior as well as assessing whether the behaviors represent commonly observed anxiety symptoms in non-ASD groups (e.g. excessive hand washing for compulsions). Following this line of assessment, repetitive thoughts about an "interest" would have a largely positive, affective emotional valence in the context of RI, while OCD-related obsessions are by definition unpleasant and designed to reduce perceived threat.

Given both the common co-occurrence of clinically valid affective conditions in ASD such as anxiety disorders and the high levels of distress children with ASD can experience, it is plausible that some behavioral expressions of RI may function as a way of coping with negative emotional experiences (Attwood, 2003; Baron-Cohen, 1989; Kim, Szatmari, Bryson, Streiner & Wilson, 2000; Klin et al, 2007; Turner, 1999). One hypothesis is that engagement in RI-related behavior may distract individuals from sensations of distress and perceptions of threat (Zandt et al., 2007). For example, Zandt and colleagues found that the expression of RI and repetitive behaviors in children with ASD was associated with greater endorsement of OCD-related obsessions, suggesting that manifestations of RI may be an attempt to cope with anxious thoughts (similar to compulsions in OCD) as well as serving as markers for distress. The completion of idiosyncratic routines associated with RI also has been hypothesized to confer a sense of organization and predictability, possibly providing a buffer to distress or anxiety (Baron-Cohen, 1989; Mercier et al., 2000; Zandt et al., 2007). Klin and colleagues (2007) hypothesized that engagement in RI activities provided an anxiety reduction quality for navigating the challenges and demands of social interactions. Drawing from the theoretical understanding of anxiety in typically developing populations, individuals engage in distractions and avoidance strategies to alleviate the distress caused by general anxiety (Mineka and Zinbarg, 2006). Similarly, it may be possible that engaging in specific behaviors related to RI may also serve as distractions to facilitate avoidance of distress. If so, specific forms of RI would be expected to be more frequent in children with ASD who experience higher levels of general anxiety.

Purpose

Given the common co-occurrence of RI and anxiety in children with ASD and the lack of research in this area, we examined the association between manifestations of RI and anxiety symptoms. Based on a content analysis of the Yale Special Interest Survey, common descriptive categories of RI as coded by Klin and colleagues (2007) were identified to examine whether expression of RI were associated with anxiety symptoms. Three primary forms of RI expression were identified: (a) facts/verbal memory and learning, (b) attachment

to objects, and, for the purpose of the current study, an additional category of (c) symbolic enactment was developed to incorporate clinical observations in the literature. In addition, time spent engaging in RI was also explored to determine if this variable was associated with the presence and severity of anxiety symptoms.

We hypothesized that RI expression, both type and degree of intensity, was associated with differences in anxiety symptomatology. We proposed that children engaging in symbolically enacted RI would demonstrate greater symptoms and severity of anxiety than other forms of RI manifestation (e.g. facts/verbal memory and learning) based on research with non-ASD children associating pretend play with a possible coping mechanism for anxiety (Moore and Russ, 2006). We also hypothesized that children who demonstrated more intense or time-consuming RI would exhibit higher levels of anxiety associated with increased intrusion to daily functioning.

Methods

Participants

Data obtained from 68 children diagnosed with ASD were used in this study. All children were participants in a federally funded investigation of a treatment program for ASD (c.f. Wood et al., 2009a, 2009b), which was a randomized double-blind cognitive behavioral treatment (CBT) for school-aged children diagnosed with high functioning ASD (verbal abilities greater than 70 on a standardized cognitive assessment) and comorbid anxiety. Participants and their families attended 16 weekly, 90-minute CBT sessions with a trained therapist. The sample was 75 per cent male, with an age range of 7 to 13 ($M = 9.36$, $SD = 1.58$). The parent respondents were 82 per cent female. Child ethnicity was 59 per cent European American, 18 per cent multiracial, 10 per cent Latina/o, 10 per cent Asian American and 3 per cent African American.

All children in the study were referred by a medical center–based autism clinic, a regional autism center, a parent support group, or a school specialist. The included subjects met research criteria for a diagnosis of autism, Asperger syndrome, or PDD-NOS using the "New System" developed by Ami Klin and colleagues (Klin et al., 2005), combining scores from the Autism Diagnosis Interview–Revised (ADI-R; Le Couteur et al., 2003), Autism Diagnostic Observation Schedule–Module 3 (ADOS; Lord et al., 2002), a parent-report checklist of the child's restricted interests, and a review of available previous assessment records. The subjects also met research diagnostic criteria for an anxiety disorder, such as separation anxiety disorder (SAD), social phobia, generalized anxiety, or obsessive compulsive disorder (OCD) based on semi-structured diagnostic interviews with the caregiver(s) and the child using the Anxiety Disorders Interview Schedule for DSM-IV–Child and Parent Versions (ADIS-C/P; Silverman and Albano, 1996). Children were not taking any psychiatric medication or were taking a stable dose of psychiatric medication (i.e. at least one month at the same dosage) at the baseline assessment (Wood et al., 2009a).

Measures

Four measures were used in this study: the Yale Special Interest Survey (YSIS; Klin et al., 2007), the Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS; Goodman et al., 1989), the Anxiety Disorders Interview Schedule (ADIS; Silverman and Albano, 1996) and

the Multidimensional Anxiety Scale for Children–Parent Version (MASC-P; March, 1997). All measures were completed during the pre-treatment assessment for the overall CBT treatment study. For the present study, the YSIS served as the independent variable to capture the various expressions of RI and the degree to which children engage in RI. The dependent variable of anxiety symptoms was measured through the CY-BOCS, ADIS, and MASC. These measures were selected because they have been used as standards in the field to assess for these symptoms (particularly the anxiety measures) and because they were part of the larger CBT study.

The YSIS is an open-ended, parent-report measure that yields a description of children's RI and modality in which they express these interests, such as through fact collection or discussion. Also, it provides a measurement of the amount of time the child spends involved with RI in different social domains (self, peer, family and adult). ''Self'' represents total time when a child was left by him/herself, ''peer'' represents the total time interacting or in conversation with peers, ''family'' indicates the total time spent interacting or conversing with family and ''adult'' indicates the total time spent interacting or conversing with other adults. Scores range from 0 to 3 with greater values indicating more time spent involved in an RI (0 reflects no time spent involved with an RI; 1 indicates less than 25 per cent of total time; 2 denotes between 25 and 75 per cent of total time, and 3 reflects more than 75 per cent of time spent involved with restricted interests with a specific domain). Parents independently completed the measure for their children without a clinician present. An initial study of the YSIS indicated inter-rater reliability with a kappa score of .85 and 95 per cent agreement between two trained coders (Klin et al., 2007). The distribution of the degree of time involved with RI on the YSIS with peers, adults, self and family is depicted in Table 1. In order to ensure reliability of coding of the YSIS, two independent raters coded parent responses to the categories used in analyses: facts/verbal memory and learning, symbolically enacted RI, attachment to typical objects and attachment to atypical objects. There was 94 per cent agreement between raters, $\kappa = .85$.

Descriptive categories on the YSIS for the manners in which RI are expressed were initially coded based on the procedures developed by Klin et al. (2007). The purpose of the original coding system was to capture the ''nature'' of the child's knowledge and interest-related behaviors, as opposed to ''topics'' of interest. In the original study over 80 per cent of the elementary age children manifested RI through facts/verbal memory and learning.

Table 1 Participants coded as spending infrequent or frequent time on restricted interests when alone or with others

	Per cent time spent on restricted interests			
Social domain	0	1	2	3
Self	10 (14.7%)	7 (10.3%)	16 (23.5%)	35 (51.5%)
Family	10 (14.7%)	10 (14.7%)	22 (32.4%)	26 (38.2%)
Peers	10 (14.7%)	12 (17.6%)	22 (32.4%)	24 (22.2%)
Other adults	10 (14.7%)	17 (15.7%)	20 (18.5%)	21 (19.4%)

Note: 0 refers to no time spent on restricted interests (RI); 1 refers to more than 0 but less than 25 per cent time spent on RI; 2 refers to more than 25 per cent and less than 75 per cent time on RI; and 3 refers to more than 75 per cent and less than 100 per cent of the time on RI.

The two most common modes of RI expression from the original coding scheme were (a) facts/verbal memory and learning and (b) object attachment, which were used in our analysis. Facts/verbal memory and learning was defined as the collection of facts within a system or topic involving verbal memory. A content analysis of the items endorsed by parents on the YSIS in the current study included a high frequency of reports that children demonstrated RI through their play. In addition observations of this mode of RI expression were consistent with clinical accounts that RI are manifested through play behaviors (c.f. Sze and Wood, 2007; Wood et al., 2009a, 2009b).

As a result, an additional coding category was developed: symbolic enactment. It is defined as a child repeatedly enacting or emulating characters or objects related to an RI. For example, a child who gathers information about a character of a favorite TV show would be manifesting an RI via facts/verbal memory and learning, while a child who reenacts scenes or mimics a character from a show would be symbolically enacting an RI.

The original category of object attachment on the YSIS was also modified in the present study by separating it into two distinct sub-categories, attachment to atypical and typical objects. A content analysis indicated that, although the YSIS requires parents to indicate only attachment to atypical objects, some of the objects recorded by parents were typical for elementary-aged children. Therefore, attachment to typical objects was defined as items that are commonly enjoyed by most elementary age children (e.g. action figures, baseball mitt). Attachment to atypical objects was defined as items that are not commonly enjoyed by most elementary age children (e.g. bits of string, trash). A similar method was used by Bruckner and Yoder (2007) to differentiate collection of items characteristic of ASD from that of OCD hoarding. In the current study, the validity of separating attachment to typical and atypical objects into two distinct categories was assessed using a chi-square analysis. A significant and negative relationship between the categories was found x^2 (1, $N = 68$) = 5.07, $p = .02$). None of the children who demonstrated an attachment to atypical objects (12 per cent) also had an attachment to typical objects (35 per cent). Therefore, despite the possibility that children could have been assigned to both categories, the results indicate that the categories were mutually exclusive, providing support for the use of these two separate sub-categories.

The CY-BOCS was administered to parents and their children separately during the assessment by trained clinicians, and their reports were combined to measure the presence of obsessions and compulsions related to OCD. This study examined data from the CY-BOCS symptom checklist, examining the presence of 33 common obsessions grouped into eight categories: aggressive, contamination, sexual, hoarding/saving, religious, symmetry, somatic, and miscellaneous obsessions. Likewise, 28 compulsions are grouped into seven categories: cleaning/washing, checking, repeating, counting, ordering/arranging, hoarding/collecting, and miscellaneous compulsions. Sum scores of all reported symptoms (0 = no, 1 = yes) were created disjunctively based on parent and child report. The CY-BOCS has been shown to have good internal consistency (alpha = .90), is significantly correlated with other measures of OCD, and has maintained consistency with children as young as five (Storch et al., 2004). Although a version of the CY-BOCS adapted for children with pervasive developmental disorders exists (Scahill et al., 2006), it was not available at the time the CBT trial, from which the data from the current study was drawn from, was initiated. Additionally, the adapted version does not account for OCD-related obsessions, which is a variable of interest in the current study.

In the present study, the coding system developed by Russell et al. (2005) was used to identify the presence of obsessions and compulsions according to the previously described

eight obsessions and seven compulsions of the CY-BOCS categories. For each participant, the presence (assigned a coding value of 1) or absence (assigned a coding value of 0) of any symptoms within a category was identified for all 15 categories. This procedure allowed separate obsessive total scores (0-8) and compulsive total scores (0-7) to be calculated by respectively summing the number of obsessive and compulsive categories noted.

The ADIS (Silverman and Albano, 1996) is a semi-structured interview that yields reliable diagnoses of anxiety disorders administered by a trained diagnostician. Every diagnosis is given a severity score ranging from 1-8. The severity score of the primary anxiety diagnosis was used in analyses for this study. Evidence of agreement between clinicians and a clinical review team on severity scores for a randomly selected subsample of children from this study is available in Wood et al. (2009a). Eleven of the children who were included in this study did not complete the ADIS.

Last, the MASC-P is a 39-item self-report measuring anxiety adapted from the child-report version of the measure (March, 1997). This measure yields four subscale scores and a total score. Each item is rated from 0-3, with scores ranging from *never true about me* (0) to *often true about me* (3). The total score, which is a combined score of the number and severity of anxiety symptoms on the MASC-P, was used in the analyses in this study as a measure of general anxiety. The MASC-P has evidence of good internal consistency and convergent validity (Wood et al., 2002).

Results

Approximately 85 per cent ($n = 58$) of the children in the study exhibited an RI. Children were classified based on the type of RI manifestations described by their parents on the YSIS. There were 38 children who demonstrated symbolic enactment, 20 who only engaged in RI-related facts/verbal memory and learning, and 10 who did not present any RI. Descriptive statistics on RI and OCD symptoms are provided in Table 2. The total number of different obsessions for each child was $M = 1.91$, $SD = 1.94$, while the total

Table 2 Percent of children with restricted interests on the Yale Special Interest Survey and obsessions and/or compulsions on the Children's Yale-Brown Obsessive Compulsive Scale

Category	Per cent of children
Any restricted interest	85
Symbolical enactment	56
Facts/verbal memory and learning w/o symbolic enactment	29
Attachment to atypical object	12
Attachment to typical object	35
Obsessive contamination	42
Obsessive hoarding	30
Obsessive aggression	25
Obsessive miscellaneous	34
Compulsive rituals with others	30
Compulsive hoarding	25
Compulsive ordering	21
Compulsive miscellaneous	45

number of different compulsions for each child was $M = 2.10$, $SD = 2.12$. For the MASC-P total score, $M = 71.82$, $SD = 15.2$.

The relationship between time spent on RI and anxiety symptoms indicated there was a significant positive correlation between YSIS frequency of RI during (a) family time, (b) time with peers, and (c) total time and CY-BOCS Compulsive Ordering, $r\ (68) = .23$, $p = .05$; $r\ (68) = .30$, $p < .05$ and $r\ (68) = .23$, $p = .05$ respectively. That is, children who engaged in compulsive ordering were more likely than children who did not have this compulsion to spend more time engaged in RI-related behaviors. Other associations between YSIS time variables and the CY-BOCS, ADIS, and MASC-P measures were not statistically significant.

A t test was used to examine the relationship between engagement in symbolic enactment and the presence and severity of anxiety symptoms. A t test was conducted to assess the degree of primary symptom severity and revealed that the subjects who demonstrated a symbolically enacted RI had a greater degree of primary symptom severity as measured by the ADIS ($M = 5.45$, $SD = .506$) than subjects who did not present a symbolically enacted RI ($M = 5.07$, $SD = .604$), $t\ (57) = 2.55$, $p = .05$. Eleven fewer subjects were included in the analysis because they were not administered the ADIS. Also, children expressing RI through symbolic enactment had higher total anxiety scores on the MASC-P ($M = 75.94$, $SD = 17.57$) than was observed for children who did not demonstrate symbolic enactment ($M = 67.03$, $SD = 10.31$), $t\ (68) = 2.48$, $p < .01$. The MASC-P total score is a combined measure of both the number and severity of anxiety symptoms.

The relationship between type of RI and the presence of obsessive and compulsive behaviors as coded on the CY-BOCS was examined. Symbolically enacted RI was related to obsessive hoarding, obsessive aggressions and miscellaneous obsessions on the CY-BOCS, $\chi^2\ (1, N = 68) = 5.53$, $\chi^2\ (1, N = 68) = 5.04$, and $\chi^2\ (1, N = 68) = 6.14$, respectively. Other associations were not significant (see Table 3). Further, t tests were conducted to examine differences between children who did and did not manifest symbolically-enacted RI with regard to the number of obsessions and compulsions as measured on the CY-BOCS. There was a significant relationship between the presence of a symbolically enacted RI and total number of obsessions, $t\ (68) = 2.27$, $p < .05$, and total number of compulsions, $t\ (68) = 2.28$, $p < .05$. Children with a symbolically enacted RI exhibited a significantly greater number of obsessions and compulsions relative to those who did not (see Table 4).

Table 3 Obsessive compulsive disorder (OCD) symptoms among children with symbolic enactment

OCD symptoms	Symbolic enactment	No symbolic enactment	x^2 (1)
Obsessive contamination	16	12	.34
Obsessive aggression	13	4	5.04*
Obsessive hoarding	15	5	5.53*
Miscellaneous obsession	17	6	6.14*
Compulsive washing	9	5	.91
Compulsive ordering	9	5	.91
Compulsive hoarding	12	5	2.83
Compulsive rituals involving others	14	6	3.31
Miscellaneous compulsions	19	11	2.33

*$p < .05$.

Table 4 Average number of different categorical obsessions and compulsions on the Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS) as a function of symbolic enactment on the Yale Special Interest Survey (YSIS)

	Symbolic enactment		No symbolic enactment		
Variable	*M*	*SD*	*M*	*SD*	*t*
Number of obsessions	2.44	1.96	1.25	1.72	2.27*
Number of compulsions	2.92	2.47	1.12	1.04	2.28*

*$p < .05$.

Table 5 Object attachment in relation to obsessive compulsive disorder related hoarding

	Obsessive hoarding	No obsessive hoarding	x^2 (1)
Attachment to atypical objects	5	3	4.78*
Attachment to typical objects	10	14	2.68

*$p < .05$.

Relationships between the YSIS attachment to typical and atypical objects and anxiety symptoms indicated that attachment to atypical objects on the YSIS and Obsessive Hoarding on the CYBOCS were significantly associated, χ^2 (1, $N = 68$) = 4.78, $p < .05$. No relationship was found between Obsessive Hoarding and attachment to typical objects (see Table 5).

Discussion

Although there has been speculation about the relationship between manifestations of RI and anxiety symptoms (Attwood, 2003; Klin et al., 2007), few studies have empirically explored this linkage. In the current study, we examined relationships between different expressions of RI and anxiety symptoms, finding that only some manifestations of RI were associated significantly with anxiety. The manner in which RI are manifested is highly associated with anxiety symptoms and severity. Specifically, children with ASD who exhibited symbolic enactment of RI were more likely to demonstrate a greater number of anxiety symptoms, including OCD and general anxiety symptoms, in addition to more severe primary anxiety diagnoses. RI expressed through attachment to atypical objects was associated with greater obsessive hoarding. RI expressed through facts/verbal memory and learning, on the other hand, was unrelated to symptoms of anxiety. Surprisingly, time engaged in RI seemed to play only a small role in relation to anxiety symptoms. Increased time spent in RI-related behavior was only associated with increased frequency of OCD-related compulsive ordering but unrelated to other anxiety symptoms. Time engaged in RI may be only one facet of understanding the association between RI and anxiety symptoms.

Given the exploratory nature of this study, several hypotheses may explain the findings. It is possible, for example, that symbolically enacted RI only appear coupled to anxiety in

children with high functioning ASD because these problems have overlapping behavioral manifestations, such that RI-related behaviors may be misinterpreted as anxiety-related behaviors. Given that the RI data collected was based on parent report, it is possible that these behaviors may have been difficult for parents to distinguish, as researchers and clinicians have found it complex to differentiate these two behaviors at times (Albano et al., 2003; King et al., 2002; Lewis and Bodfish, 1998; Zandt et al., 2007).

Another possible explanation is that symbolically enacted RI are manifested as an expression of anxiety or as an attempt to manage anxious feelings. RI can be accompanied by negative affective experiences and may be related to arousal modulation and emotion regulation (Carcani-Rathwell et al., 2006; King et al., 2002; Turner, 1999).

Although children with symbolically enacted RI demonstrated higher levels of anxiety, we are not able to specifically determine the affective states of the children during their engagement in RI, the exact effect of the RI on anxiety as a means for coping, or the directionality of the RI and anxiety relationship (e.g. whether an anxious affective state preceded a manifestation of RI or vice versa) due to lack of in-vivo observational data collection or functional analyses, which are considered the gold standard methods determining the function of behaviors (Iwata et al., 2000). Such methods would have provided more detailed and specific information to draw more conclusive results. Additionally, there exists the possibility that the anxiety related to symbolically enacted RI could result from the disruption of RI-related play; however, the anxiety measures used in this study examined more general, continuous, and distal forms of anxiety rather than the immediate effect of interrupted play.

Children with ASD are prone to experience anxiety, perhaps due to the associated challenges with sensory overload, difficulty with change, and the unpredictability of social situations common in the ASD syndrome (Bellini, 2006; Gillott et al., 2001). In addition to the stressors that may arise from these ASD-related difficulties, ASD may also impinge upon children's ability to cope with stressful, everyday life events (e.g. academic challenges, family conflict) that many children may experience. These communicative, social, and cognitive impairments (e.g. difficulty inferring mental states) place children with ASD at a greater disadvantage than their typically developing peers in forming effective, appropriate and healthy coping skills (Groden et al., 2006). Thus, understanding their methods for addressing anxiety, both effective and ineffective, is important.

The literature on the mechanisms of OCD may provide a framework for understanding the relationship between symbolically enacted RI and anxiety in ASD. Symbolically enacted RI may operate as a maladaptive coping strategy, in a similar manner to OCD compulsions. As in OCD, a negative reinforcement relationship may be established between levels of distress/anxiety (e.g. caused by noise or obsessions) and engagement in distracting behaviors (e.g. RI behaviors or compulsions), such that engagement in the distracting behaviors reduces the negative valence of the distress, causing maintenance or increases in the latter behavior over time (March and Mulle, 1998; Turner, 1999). Compulsions are maladaptive to the extent that they do not address the source of anxiety and can be socially stigmatizing. In a similar manner, symbolically enacted RI may temporarily reduce emotional distress, serving as an operant for the maintenance of these behaviors.

Another consideration is that among typically developing children, pretend play that is closely related to the source of stressors is more effective in reducing anxiety than is play with themes unrelated to those stressors (Barnett, 1984). While the behavioral components of symbolically enacted RI appear similar to pretend play, it appears to play a different role in

children with ASD. The quality of play in children with ASD may not provide similar benefits because the themes of RI are rarely related to the problems with which children are attempting to cope, and are often atypical or far removed from their immediate environment.

Overall, the findings indicate that specific manifestations of RI are linked with symptoms of anxiety in children with ASD. The association between symbolically enacted RI and heightened anxiety suggest that these manifestations may provide a unique way to conceptualize the nature of RI. The traditional understanding of RI has been that these interests and their related behaviors are ego-syntonic and are driven by the pursuit of gratification and reward (Klin et al., 2007; Mercier et al., 2000). Children appear to develop RI in areas in which they have an intrinsic motivation, contributing to their success and talents in these areas (Baron-Cohen and Wheelwright, 1999). The present findings are not at odds with these observations; however, they are consistent with the notion that manifestations of RI that are more intense or take on specific (symbolically enacted) forms could be used as a shield or distraction from anxiety.

In the absence of more effective coping strategies, engaging in intensive RI may be a default method of attention-shifting in autism. Unfortunately, excessive involvement with RI is unlikely to directly address causes of distress, thus representing a maladaptive coping response. Studies demonstrate that greater levels of RI impede social development, communication, and learning in children with ASD (Mercier et al., 2000; Piven et al., 1996). Therefore, the short term relief potentially provided by engaging in RI-related behaviors may ultimately contribute to the overall psychopathology risk and burden experienced by children with ASD.

Evidence that symbolically enacted RI was significantly associated with higher levels of anxiety indicates that the expression of these symptoms may play a unique role in the diverse presentation and functioning of youth with ASD. The findings from the present study were based on a population of high-functioning children diagnosed with comorid anxiety disorders. It will be interesting for future studies to examine the association of RI expression, particularly symbolic enactment, in a population of children without comorbid anxiety diagnoses to further substantiate our findings and expand knowledge on the complex nature of RI and anxiety in this population. Overall, further exploration in this domain is warranted and developing effective alternatives for RI (e.g. promotion of more appropriate coping behaviors) appears to be an essential next step.

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