Published in final edited form as:

Res Autism Spectr Disord. 2014 May 1; 8(5): 589–596. doi:10.1016/j.rasd.2014.02.002.

Internal State Language in the Storybook Narratives of Children with and without Autism Spectrum Disorder: Investigating Relations to Theory of Mind Abilities

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Abstract

The current study examines narratives elicited using a wordless picture book, focusing on language used to describe the characters' thoughts and emotions (i.e., internal state language, ISL). The sample includes 21 children with Autism Spectrum Disorder (ASD) and 24 typically developing controls, matched on children's gender, IQ, as well as receptive and expressive vocabulary. This research had three major findings. First, despite equivalent performance on standardized language assessments, the volume of children's narratives (i.e., the number of utterances and words, the range of unique verbs and adjectives) was lower in children with ASD than in typically developing controls. Second, after controlling for narrative volume, the narratives of children with ASD were less likely to reference the characters' emotions than was the case for typically developing controls. Finally, our results revealed a specific association between children's use of emotion terms and their performance on a battery of experimental tasks evaluating children's Theory of Mind abilities. Implications for our understanding of narrative deficits in ASD as well as interventions that use narrative as a context for improving social comprehension are discussed.

Keywords

autism spectrum disorder; narrative; internal state language; theory of mind

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1. Introduction

As children grow older, narratives provide an increasingly rich context for social interaction and relationships. Successful narratives include strategies for monitoring and maintaining listener involvement (Bruner, 1990; Ochs & Capps, 2001), and elaborate a point of view concerning the emotions, thoughts, and actions of people. Both characteristics of successful narratives have been linked to children's emerging Theory of Mind (ToM), which is significantly delayed in children with Autism Spectrum Disorder (ASD; Baron-Cohen, Leslie, & Frith, 1985; Heerey, Keltner, & Capps, 2003; Tager-Flusberg, 1999; Capps, Losh, & Thurber, 2000). Difficulties formulating narratives constrain children's emerging ability to organize otherwise disconnected experiences in meaningful ways, and limit children's access to a rich form of interaction (Losh & Capps, 2003). The current study examines narratives elicited using a wordless picture book, focusing on children's language used to describe the characters' thoughts and emotions (i.e., internal state language, ISL). The narratives of children with ASD are compared to matched typically developing controls, and associations between ISL and ToM are investigated.

When compared to matched controls, the narratives of individuals with ASD show a limited use of devices to monitor and maintain listener involvement. For example, using a storybook task, Capps, Losh, and Thurber (2000) reported that children with ASD were less likely than typically developing controls to maintain the listeners' attention through evaluative devices such as empathic stress, repetition, character speech, and sound effects. Moreover, the authors reported that children with ASD were less likely to use complex syntax, which may indicate that the narratives of children with ASD were less integrated than those of matched controls. Consistent with this interpretation, Diehl, Bennetto, and Young (2006) found that individual elements in the narratives of children with ASD evidenced fewer causal connections to other story elements than was the case for typically developing controls. Finally, two recent studies evaluated the organizational structure of individuals' personal narratives, particularly the extent to which the events were organized in a chronological sequence, building up to a highpoint and/or resolution (Goldman, 2008; McCabe, Hillier, & Shapiro, 2013). Results showed that the narratives of both children and adults with ASD often failed to specify information necessary to follow their stories and lacked organizing highpoints.

In addition to the limited use of strategies to support the listeners' attention, interest, and understanding, the narratives of children with ASD have also been shown to make limited references to the emotions or thoughts that motivate people's actions. Early studies that compared the narratives of children with autism to those of typically developing controls found that the narratives of children with ASD were less likely to include terms that referred to cognitive (e.g., "know", "confused") or affective states (e.g., "laughed", "happy"; Baron-Cohen et al., 1986; Happé, 1994; Tager-Flusberg, 1992). Although these early studies have been criticized for inadequate matching procedures (i.e., children with ASD and controls were matched on receptive but not expressive language abilities; Tager-Flusberg & Sullivan, 1995; Crane, Goddard, & Pring, 2010), two recent well-controlled studies identified significant differences in children's use of internal state terms (Rumpf, Kamp-Becker, Becker, & Kauschke, 2012; Brown, Morris, Nida, & Ward, 2013). Moreover, even though

several studies failed to identify ASD-specific deficits in the use of internal state terms, findings from these studies show that children with ASD were less likely to identify the causes of the characters mental states, when compared to the narratives of matched controls (Capps et al., 2000; Losh & Capps, 2003; Tager-Flusberg & Sullivan, 1995).

Recent neuropsychological research suggests extensive functional overlap between the neural networks underlying narrative comprehension, autobiographical memory, and ToM (Mason, Williams, Kana, Minshew, & Just, 2008; Spreng, Mar, & Kim, 2008). To date, three observational studies have investigated associations between children's narrative practices and ToM abilities. Two studies found significant positive associations between children's use of cognitive terms and ToM abilities (Tager-Flusberg & Sullivan, 1995; Capps, Losh, & Thurber, 2000). Interestingly, Capps et al. (2000) reported that this association was evident for children with ASD but not children with other developmental delays, suggesting that in the latter group narrative abilities may be more closely related to cognitive factors such as information processing abilities. Finally, Losh and Capps (2003) found that children's use of mental state terms (cognitive or affective) were significantly associated with children's ability to define emotions, but not ToM abilities.

The current study aims to replicate and expand upon previous research using a wordless picture book to elicit narratives from 21 children with ASD and 24 typically developing controls, matched on IQ as well as receptive and expressive vocabulary. Although previous research has identified several global differences in the narrative production between children with ASD and typically developing controls, a rather inconsistent picture emerges with regards to children's use of internal state language. That is, while some studies found that the narratives of children with ASD were less likely to include terms that reference internal states (Baron-Cohen et al., 1986; Happé, 1994; Tager-Flusberg, 1992; Rumpf et al., 2012; Brown et al., 2013), other studies failed to identify such group differences (Capps et al., 2000; Losh & Capps, 2003; Tager-Flusberg & Sullivan, 1995; Crane et al., 2010). The first goal of the current study is to identify differences in the use of internal state language, by comparing well-matched samples of children with ASD and typically developing controls. The second goal of this research is to investigate relations between children's use of internal state language and ToM abilities. The few previous studies that have investigated this association reveal an inconsistent picture. In part, discrepant results may be attributed to the measures used to evaluate children's ToM abilities. That is, all three previous studies relied solely on tasks evaluating children's understanding of first-order false beliefs. By focusing on a single milestone in children's emerging ToM abilities, the distribution of children's scores may vary significantly based on the participants' age, developmental level, and severity of autism symptoms. To capture children's ToM abilities across a broad developmental spectrum, the current study uses a battery of seven tasks, covering a range of early, basic, and advanced ToM milestones (Steele, Joseph, & Tager-Flusberg, 2003).

2. Methods

2.1 Participants

A total of 45 children participated in this research, 21 children with autism spectrum disorder (ASD, $M = 86.25$ months, $SD = 18.28$ months) and 24 typically developing children

(TD, $M = 81.83$ months, $SD = 19.62$ months). The sample was ethnically diverse and included groups of European American (25%), African American (24%), Hispanic (20%), Asian (11%), and mixed (20%) ethnic or racial origin. Two participants, one from each group, did not participate in the narrative storytelling task and were thus excluded from all following analyses. This research was conducted in accordance to a protocol approved by the City University of New York Institutional Review Board. Written parental consent and verbal child assent was obtained before testing commenced.

All but one child in the ASD sample was referred to our project with a previous clinical diagnosis of ASD. Children's community diagnoses were confirmed using the *Autism Diagnostic Observation Schedule* (ADOS; Lord et al., 2000). Diagnostic classifications were determined using the revised ADOS algorithm (Gotham, Risi, Pickles, & Lord, 2007), which is compatible with the Diagnostic and Statistical Manual for Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association, 2013). All children except two met criteria for either autism or autism spectrum disorder on the ADOS. One child failed to complete the ADOS due to time constraints, and a second child missed diagnostic criteria for autism spectrum disorder by one point. Since both children entered the project with a community diagnosis of ASD and scored in the "severe range" on the Social Responsiveness Scale (SRS; Constantino, 2002), we decided to retain both children in the ASD sample. TD children were selected from a larger sample (Swanson, Serlin, & Siller, 2013) to match the children with ASD on measures of receptive and expressive language abilities. All children in the TD sample scored in the normal range on standardized measures of non-verbal cognitive abilities (standard scores above 70, see below) and scored negative for ASD on the SRS. Finally, none of the children in the TD sample had a first-degree relative with ASD or a related disorder (based on a medical history questionnaire completed by the child's parent).

2.2 Measures

2.2.1 Assessment of global development—Children were administered four standardized assessments of language, non-verbal cognition, and autism-related symptoms. Children's *receptive and expressive language abilities* were evaluated using the *Peabody Picture Vocabulary Test* (PPVT, 4th edition; Dunn & Dunn, 2007) and the *Expressive One-Word Picture Vocabulary Test* (EOWPVT, 4th edition; Brownell, 2000), respectively. Both language measures were standardized on large, representative national samples and provide extremely reliable scores, with reliability and validity coefficients above .80. The PPVT and EOWPVT provide age equivalent scores for children's language abilities as well as standard scores evaluating children's performance relative to the general population. Children's *non-verbal cognitive abilities* were evaluated with the *Differential Abilities Scales II* (DAS II; Elliott, 2007). The DAS II provides a Special Nonverbal Composite, a standard score derived from children's performance on four subscales (Picture Similarities, Matrices, Pattern Construction, and Copying). According to the manual (Elliott, 2007), the DAS II evidences excellent internal, test-retest, and inter-rater reliabilities as well as convergent validity with several established measures of intelligence, including the Stanford-Binet Intelligence Test (Thorndike, Hagen, & Sattler, 1986). Finally, to evaluate the *presence of autism-related behaviors*, children's parents were asked to complete the Social Responsiveness Scale (SRS; Constantino, 2002). This 65-item parent-report questionnaire

asks parents to report on children's social awareness, social cognition, social communication, social motivation, and autistic mannerisms, and provides norm-referenced T-scores. The psychometric properties of the SRS reveal excellent internal consistency (Chronbach alpha scores above .93) and clinical validity (sensitivity of 0.77, specificity of 0.75).

2.2.2 Assessment of Narrative Ability—Narratives were elicited using one of two wordless picture books, *Frog on His Own* (Mayer, 1973) or *Frog Goes to Dinner* (Mayer, 1974). These books depict several instances of deception and trickery, providing a rich context for describing the protagonists' cognitive and emotional states (Tager-Flusberg & Sullivan, 1995). After prompting the children to choose one of the two books, the experimenter briefly showed the book to the child and began to narrate the first two pages. The child was then prompted to continue telling the rest of the story. Once the children began their stories, the examiner only interrupted to request clarification of a statement or further elaboration of ideas. Children's narratives were video- and voice-recorded and transcribed by a trained undergraduate student. All transcripts were checked for accuracy by at least one additional undergraduate student, and the boundaries of distinct utterances (i.e., units of speech) were determined using cues such as a drop in tone at the end of a statement, an obvious change in prosody, or pauses. Inter-observer agreement was determined by comparing the utterance boundaries of two independent coders for 14 transcripts (32% of the sample). Results revealed that, on average, two independent coders agreed on the boundaries of 92.4% of the coded utterances (SD = 8.0; agreement ranged between 71% and 100% across the 14 transcripts included in this reliability analysis). In addition, we determined three indicators of narrative volume (i.e., the total number of utterances, the total number of words, and the total number of unique adjectives and verbs) and two indicators of children's use of internal state language (i.e., the number of descriptors referring to the characters' emotional states, the number of descriptors referring to the characters' cognitive states). Descriptors of emotional states included both verbs (e.g., "laughed") and adjectives (e.g., "happy"). Similarly, descriptors of cognitive states included both verbs (e.g., "know") and adjectives (e.g., "confused"). Inter-observer agreement for narrative volume and internal state indicators was determined by comparing the coding decisions of two independent coders for 19 transcripts (44% of the sample). Results revealed excellent agreement across all narrative volume and internal state indicators, with intra-class correlation coefficients ranging between .78 and .98. All narrative coding was completed by undergraduate research assistants, blind to the participants' diagnostic status.

2.2.3 Assessment of Theory of Mind Abilities—Children's Theory of Mind (ToM) abilities were evaluated using an adapted version of an assessment battery developed by Steele et al. (2003). Tasks are divided into three batteries (early, basic, and advanced), with the early and basic batteries both containing gatekeeper tasks to determine if children were to proceed to the next battery. In the current study, we first administered the pretend and desire tasks (Kavanaugh, Eizenman, & Harris, 1997; Wellman and Woolley, 1990, respectively) from the early battery, evaluating simple mental state concepts. Only those children who passed the desire task were administered tasks from the basic battery ($n = 17$ for the ASD group, and $n = 19$ for the TD group). These two basic battery tasks included

two classic tests of false belief, intended to test a representational understanding of the mind: unexpected-contents false belief task (Perner, Leekam, & Wimmer, 1987) and the location-change false belief task (Wimmer & Perner, 1983; Baron-Cohen, Leslie, & Frith, 1985). Children who passed the location-change false belief task were also administered the advanced battery testing more complex social situations ($n = 10$ for the ASD group, and $n = 16$ for the TD group): the second-order false belief task (Sullivan, Zaitchik, & Tager-Flusberg, 1994), the moral responsibility task (Mant & Perner, 1988), and the lies and jokes task (Sullivan, Winner, & Hopfield, 1995). The administration of the ToM battery was videotaped and later scored by research assistants who were blind to the diagnostic status of the children. Each task was scored on a scale ranging from 0 to 6 points. Scores from all seven tasks were combined to create one composite ToM score ranging from 0 to 42 points. Thirty-two percent of the videotaped assessments were independently scored by two research assistants, demonstrating excellent inter-rater agreement (intra-class correlation coefficients above .90). All ToM coding was completed by undergraduate research assistants, blind to the participants' diagnostic status.

3. Results

3.1 Preliminary Analyses: Evaluating group differences in global development

Descriptive statistics on children's global development (i.e., receptive and expressive language, nonverbal cognitive abilities, autism-related behaviors) are presented separately for the ASD and TD groups (Table 1). To check that the two comparison groups were not different in terms of global development, independent-samples t -tests for continuous variables (e.g., receptive language standard scores) and Chi-square tests for categorical variables (e.g., child gender) were performed as appropriate. Results showed that the two groups (i.e., ASD, TD) were well matched in terms of gender ratio, chronological age, receptive language, expressive language, and non-verbal mental abilities (see Table 1 for effect size estimates). As predicted, children with ASD had significantly higher SRS T -scores than children in the TD group, $t(41) = 9.47, p < .001$.

3.2 Evaluating group differences in narrative volume, internal state language, and Theory of Mind

To evaluate group differences in narrative volume (i.e., number of utterances, number of words, number of unique verbs and adjectives), internal state language (i.e., number of emotional state descriptors, number of cognitive state descriptors), and Theory of Mind (i.e., ToM Composite Score), we specified a series of Univariate ANOVAs with group (ASD vs. TD) as a fixed factor, and children's chronological age as a covariate. Results, including estimated marginal means (SE) for each group, F -values, statistical significance, and effect size estimates (η_p^2) are reported in Table 2. Results revealed group differences with large effect sizes ($\eta_p^2 = .25$) for all three indicators of narrative volume. When compared to the TD group, children with ASD used significantly fewer utterances, $F(1,40) = 13.6, p < .01$, fewer words, $F(1,40) = 16.7, p < .001$, and fewer unique verbs and adjectives, $F(1,40) = 14.3, p < .01$. With regard to children's use of internal state language, an analysis of variance showed significant and large ($\eta_p^2 = .25$) group difference for the number of descriptors referring to the characters' emotional states, $F(1,40) = 13.2, p < .01$. As predicted, children

with ASD used fewer words to describe the characters' emotional states than TD controls. In contrast, group difference for the number of descriptors referring to the characters' cognitive states were not statistically significant, $F(1,40) = 3.4, p = .07 (\eta_p^2 = .08)$. To evaluate whether this pattern of results can be attributed to inflated Type I error due to multiple comparisons, we confirmed these analyses using a Bonferroni correction. Results showed that group differences in narrative volume and the number of emotional state descriptors remained significant when controlling for the familywise error rate.

It is possible that significant group differences in children's use of descriptors referring to the characters' emotional states could be attributed to differences in the overall volume of children's narratives. Thus, we computed three proportion scores by dividing the number of descriptors referring to the characters' emotional states by (1) the number of utterances, (2) the number of words, and (3) the number of unique verbs and adjectives. A series of one-way between subjects ANOVAs was conducted to compare the effect of group (ASD vs. TD) on these three proportion scores; children's chronological age was entered as a covariate throughout. Results showed significant group differences on all three proportion scores, with effect sizes ranging from $\eta_p^2 = .12$ to $\eta_p^2 = .19$. Thus, group differences in the number of emotional state descriptors remained significant, even when the number of utterances, $F(1,40) = 9.3, p < .01$, the number of words, $F(1,40) = 6.1, p < .05$, or the number of unique verbs and adjectives, $F(1,40) = 5.5, p < .05$, were accounted for.

To evaluate group differences in children's Theory of Mind abilities, we conducted a one-way between subjects ANOVA to compare the effect of diagnostic group (ASD vs TD) on children's ToM composite score. Results revealed that the ToM composite scores of children with ASD were significantly lower than the scores of TD controls, $F(1,40) = 6.8, p < .05$. Effect size estimates revealed that the magnitude of the group differences should be interpreted as medium, $\eta_p^2 = .14$.

3.3 Association between internal state language and Theory of Mind

Preliminary analyses revealed significant bivariate correlations between children's ToM composite scores and both, the number of descriptors referring to the characters' emotional states, $r(43) = .37, p < .05$, and the number of descriptors referring to the characters' cognitive states, $r(43) = .44, p < .01$. In addition, children's ToM composite scores were significantly correlated with children's chronological age, $r(43) = .54, p < .001$, receptive language age, $r(43) = .64, p < .001$, expressive language age, $r(43) = .66, p < .001$, and expressive language standard scores, $r(43) = .35, p < .05$. To examine which variables were independent predictors of children's ToM abilities, relevant predictors were incorporated into a multiple regression model: children's diagnostic group and chronological ages were entered first; measures of children's language abilities (i.e., receptive/expressive language age equivalent and standard scores) were entered second; and measures of children's internal state language were entered last (i.e., for children's language referring to either the characters' cognitive or emotional states, we included three proportion scores controlling for differences in narrative volume). Improvements in model fit were evaluated by comparing fit statistics (R^2) across nested models. Results from fitting these models are reported in Table 3. At Step 1, children's chronological age and diagnostic group were entered, $R^2 = .$

394, $F(2,40) = 13.03$, $p < .001$. At Step 2, children's expressive language age equivalent scores were added, $R^2 = .146$, $F(1,39) = 12.42$, $p < .01$. Thereafter, none of the other measures of global development (i.e., expressive language standard score, receptive language age equivalent or standard score) significantly improved model fit. At Step 3, adding the proportion score for children's emotional descriptors that was adjusted for the total number of child utterances significantly improved model fit, $R^2 = .056$, $F(1,38) = 5.23$, $p < .05$. None of the other measures of children's internal state language improved the fit of the model thereafter.

To explore whether other indicators of children's internal state language added independent information when added at Step 3, we fit five additional models adding one indicator of internal state language at a time. Results showed marginally significant improvements in model fit for the two remaining indicators of children's emotion descriptors, adjusting by the number of words, $R^2 = .034$, $F(1,38) = 3.04$, $p = .09$, or the number of unique verbs and adjectives, $R^2 = .034$, $F(1,38) = 3.08$, $p = .09$. In contrast, none of the three measures quantifying the children's use of cognitive descriptors significantly improved model fit, $p > .60$.

4. Discussion

Children are exposed to narratives from the earliest stages of development and begin forming simple narratives as young as two years of age. Over time, children acquire strategies for monitoring and maintaining listener involvement and start to elaborate a point of view concerning the emotions, thoughts, and actions of people or characters (Bruner, 1990; Ochs & Capps, 2001). While some children with ASD develop well-formed language, they tend to show difficulty in the social functions of language, including the formation of narratives. The current study evaluated storybook narratives of children with ASD and TD controls, carefully matched on IQ as well as receptive and expressive vocabulary. This research had three major findings. First, despite equivalent performance on standardized language assessments, the volume of children's narratives (i.e., the number of utterances and words, the range of unique verbs and adjectives) was lower in children with ASD than in TD controls. Second, after controlling for narrative volume, the children with ASD were less likely to reference the characters' emotions than TD controls. Interestingly, we found no significant group differences for children's use of cognitive terms. Finally, our results revealed a specific association between children's use of emotion terms and their performance on a battery of experimental tasks evaluating children's ToM abilities.

Group differences in the volume of children's storybook narratives are surprising, given that both groups performed similarly on standardized assessments of expressive vocabulary (Expressive One-Word Picture Vocabulary Test; Brownell, 2000). Compared to matched controls, children with ASD produced a smaller number of utterances, used fewer words, and incorporated a narrower range of different verbs and adjectives. Despite well-matched comparison samples, similar differences in the volume of children's storybook narratives have also been reported in several other studies that compared performance between children with ASD and TD controls (Capps et al., 2000; Rumpf et al., 2012). Interestingly, the few studies that compared the narratives of children with ASD to those of children with

other developmental delays (Capps et al., 2000; Tager-Flusberg, 1995) or children with Attention Deficit and Hyperactivity Disorder (ADHD; Rumpf et al., 2012) failed to identify significant group differences in narrative volume. Thus, reductions in the length of children's storybook narratives are shared across several diagnostic conditions, and may not be specific to children with ASD. In addition, several studies that evaluated autobiographical narratives (as compared to storybook narratives) also failed to identify significant differences in narrative volume (Brown et al., 2011; McCabe et al., 2013; Crane et al., 2010). A substantive interpretation of these differences between autobiographical and storybook narratives is that children with ASD may be more engaged when asked to describe personal as compared to fictional events. Alternatively, it is possible that the volume of personal narratives is more variable (compared to the more structured storybook narratives), making it more difficult to identify significant group differences.

As reviewed in the introduction of this manuscript, studies on personal or storybook narratives that evaluated children's use of ISL reveal a somewhat inconsistent pattern of results. While some studies report that children with ASD are less likely than TD controls to use ISL terms, other studies emphasize that children with ASD may reference mental states as frequently as matched controls, but fail to specify the causes of people's thoughts or emotions. In initial studies, differences between study findings have been attributed to differences in matching procedures (Tager-Flusberg & Sullivan, 1995). However, findings from the current study, as well as findings from several recent, well-controlled studies (Brown et al., 2011; Rumpf et al., 2012), provide increasing evidence for an ASD-specific deficit in the use of internal state terms. Findings from the current study revealed that children with ASD used fewer terms that referred to the characters' emotions than TD controls ($\eta_p^2 = .25$, large effect size). Importantly, these group differences remained significant after controlling for various indicators of narrative volume (i.e., number of utterances, number of words, number of unique verbs and adjectives). No significant group differences emerged for children's use of cognitive terms, although the effect size was medium ($\eta_p^2 = .08$, ns). Consistent with the current study, Brown et al. (2011) reported larger group differences for children's use of affective ($\eta^2 = .07$, sig, medium effect size) as compared to cognitive terms ($\eta^2 = .03$, sig, small effect size). In contrast, Rumpf et al. (2012) reported larger group differences for children's use of cognitive (Glass's $d = 1.13$, sig, large effect size) as compared to affective terms (Glass's $d = .45$, ns, medium effect size). Thus, despite increasing evidence for an ASD-specific deficit in children's use of ISL terms, additional research with larger sample sizes is necessary to determine whether these deficits involve children's use of cognitive or affective terms to a greater extent.

Beside differences in children's use of affective terms, the current study also revealed significant group differences in children's performance on the Theory of Mind battery ($\eta^2 = .14$, sig, medium effect size). Importantly, our results revealed a specific association between children's use of affective terms and their ToM abilities that could not be attributed to variation in narrative volume, children's chronological age or language abilities. These results replicate results from two previous studies (Tager-Flusberg & Sullivan, 1995; Capps et al., 2000), and are consistent with recent neuropsychological research that emphasizes the functional overlap between the neural networks that underlie narrative and ToM abilities (Mason et al., 2008; Spreng et al., 2008). Evidence for an association between ToM and ISL

is intriguing because it provides information about the nature of narrative deficit in ASD. As discussed in detail by Diehl et al. (2006), current theories attempt to account for pragmatic language deficits in ASD by referring to underlying deficits in ToM (Tager-Flusberg & Sullivan, 1995), weak central coherence (Frith, 1989) or executive functioning (Pennington & Ozonoff, 1996). Although findings from the current study do not allow the direct comparison of these theoretical orientations, our findings support the notion that the poor narrative skills of children with ASD may at least in part be attributed to deficits in the ability to interpret others' thoughts internal states. At the same time, our findings also provide support for intervention approaches that use narratives as a context for enhancing children's social understanding. That is, interventions aimed at supporting children's ability to sequence events, make inferences about underlying thoughts and emotions, and predict the actions of other people or characters may be well suited to promote children's ToM abilities. Moreover, early narrative abilities have also been linked to academic outcomes, including text comprehension (van den Broek, Kremer, Lynch, Kendeou, White, et al., 2003).

Several limitations of the current study suggest directions for future research. First, it is possible that the structured context of storybook narratives underestimates narrative deficits in less structured situations, including personal or autobiographical narratives (Losh & Capps, 2003). Second, to determine the extent to which narrative deficits are specific to children with ASD, future research should include various comparison groups, especially children with neurodevelopmental, mental or behavioral disorders whose phenotype may overlap with children with ASD, including children with ADHD (Rumpf et al., 2012), specific language impairment (Kaderavek & Sulzby, 2000), or learning disability (Humphriesa, Cardya, Worlingb, & Peetsd, 2004). Past research suggests that key narrative deficits may be shared across multiple disorders (Capps et al., 2000; Tager-Flusberg, 1995; Rumpf et al., 2012). Finally, research on narrative performance in ASD has identified several distinct areas of deficit, including causal attributions of mental states (Capps et al., 2000), coherence (Diehl et al., 2006), and highpoint macrostructure (Goldman, 2008; McCabe et al., 2013). Larger samples would be necessary to investigate associations between these different deficits, and compare relations to current cognitive theories of ASD (e.g., ToM, weak central coherence, executive functioning).

Acknowledgments

We would like to thank the families for participating in this study. This study was supported by a Grant-In-Aid of Research from the National Academy of Sciences, administered by Sigma Xi The Scientific Research Society, and a Doctoral Student Research Grant from The Graduate Center of City University of New York both awarded to MRS. This research was also supported by a fellowship from the RISE Program at Hunter College, GM060665-11, awarded to GS.

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Highlights

- Storybook narratives of children with ASD are shorter than those of typical controls
- Children with ASD use fewer terms to describing emotions than typical controls
- Children's use of emotion terms is associated with their Theory of Mind abilities

Table 1

Descriptive Characteristics of the Sample

Variable	ASD group (<i>n</i> = 20)	TD group (<i>n</i> = 23)	<i>t</i> value	Effect Size ^{<i>I</i>}
Gender, M/F, No.	17/3	19/4		
	Mean (SD)	Mean (SD)		
Chronological Age, m	86.25(18.28)	81.83 (19.62)	0.76	.23
Receptive Language Age, m	87.05 (29.72)	87.17 (23.46)	−0.02	.00
Receptive Language SS	100.15 (19.21)	103.74 (9.33)	−0.76	−.24
Expressive Language Age, m	85.50 (28.62)	82.09 (26.55)	−0.40	.12
Expressive Language SS	100.60 (16.31)	99.43 (10.92)	0.28	.09
Non-verbal DQ	100.28 (18.28)	108.26 (22.53)	−1.26	−.39
SRS Total T-Scores	77.05 (11.79)	49.61 (6.87)	9.14**	2.9

Abbreviations: m, Months; SS, Standard Score; DQ, Developmental Quotient; SRS, Social Responsiveness Scale.

^{*I*} Hedges' *g* was used to calculate effect size.

Table 2

Mean Scores for Performance on Narrative Abilities and Theory of Mind

Variable	ASD group (<i>n</i> = 20)	TD group (<i>n</i> = 23)	<i>F</i> value	Effect Size ^{<i>I</i>}
	Mean ² (SE)	Mean (SE)		
Measures of Narrative Volume				
Number of Utterances	19.65 (2.41)	31.87 (2.25)	13.6**	.25
Number of Words	138.16 (24.45)	275.03 (22.78)	16.7***	.29
Number of Unique Verbs & Adjectives	24.95 (3.52)	43.18 (3.28)	14.3**	.26
Measures of Internal State Language				
Number of Emotional State Descriptors	1.65 (.45)	3.87 (.42)	13.2**	.25
Number of Cognitive State Descriptors	2.13 (.47)	3.32 (.44)	3.4 ⁺	.08
Measure of Theory of Mind				
Theory of Mind Composite Score	20.16 (2.14)	27.80 (2.00)	6.8*	.14

Abbreviations: ASD, Autism Spectrum Disorder; TD, Typically Developing.

^{*I*}Partial Eta Squared (η_p^2), by convention, $\eta_p^2 \approx .01$ is considered small, $\eta_p^2 \approx .09$ is considered medium, $\eta_p^2 \approx .25$ is considered large²Estimated Marginal Means.⁺
p < .08*
p < .05**
p < .01***
p < .001

Table 3

Summary of Hierarchical/Stepwise Regression Analysis for Variables Predicting Children's Theory of Mind Composite Scores ($N = 43$)

Variable	<i>B</i>	<i>SE B</i>	β
Step 1			
Constant	-2.92	6.72	-
Chronological age	.37	.08	.58 ***
Diagnostic group	-7.64	2.94	-.32 *
Step 2			
Constant	-2.73	5.93	-
Chronological age	.13	.10	.20
Diagnostic group	-7.39	2.59	-.31 **
Expressive Language Age	.24	.07	.54 **
Step 3			
Constant	-9.13	6.29	-
Chronological age	.15	.09	.24
Diagnostic group	-4.67	2.73	-.20
Expressive Language Age	.22	.06	.50 **
Proportion score: Number of emotional state descriptors divided by number of utterances	46.59	20.38	.27 *

Note. $R^2 = .394$ for Step 1; $R^2 = .146$ for Step 2; $R^2 = .056$ for Step 3 ($ps < .05$).

*
p < .05

**
p < .01

p < .001.