Beyond Sentences: Profiling Language and Communication in School-Aged Children with Autism Spectrum Disorder (ASD)

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Profiling Language and Communication in ASD

ABSTRACT

Purpose: This study explored whether the Expression, Reception and Recall of Narrative Instrument (ERRNI) could profile language abilities in children with ASD beyond the sentence level. We hypothesized the ERRNI would identify significant communication impairments in children with ASD above traditional language measures and predicted relationships between narrative content, and social and pragmatic skill.

Method: Narrative (ERRNI), language (CELF-4), pragmatic (SPP), and social skills (VABS-II, ADOS social affect), were examined in 74 school-aged children with ASD participating in a larger multisite longitudinal study (*Pathways in ASD).* Participants' narrative content scores were compared to the norming sample. Additionally, regression and correlation analyses were used to determine contributions of and relationships among scores.

Results: As expected, participants with ASD included less narrative content than those of the norming sample. Furthermore, narrative abilities were significantly weaker than structural language abilities and a large portion of the variance in narrative content was unaccounted for by structural language level. Increased proficiency in narrative production was related to pragmatic language skill and some aspects of social functioning.

Conclusions: Clinicians may find the ERRNI is a useful tool with school-aged children with ASD, as it measures skills other than those captured on traditional standardized language tests.

INTRODUCTION

Dysfunctional communication is a defining characteristic of ASD (American Psychiatric Association, 2013) but the presenting profile varies widely from children who have apparently age-appropriate grammar and vocabulary to children who remain nonverbal (Tager-Flusberg, Paul & Lord, 2005). For the majority, who learn to speak (Mash & Wolfe, 2010), accurate and reliable assessment of language status is essential as it is a key prognostic factor for long term outcomes (Howlin & Goode, 1998; Lord & Venter, 1992). For school-aged children though, most standardized language tests do not assess skills beyond the individual word or sentence level. For example, usually children are asked to complete a sentence frame with the appropriate word or to generate a sentence using a specific word. Such measures are likely to underestimate the extent of language difficulties that may arise when a person is required to generate a series of utterances that hang together coherently to describe an event (Bishop, 2004). Yet it is precisely in these situations that communicative productivity is most tested in everyday life. This ability – the ability to understand and use language in socio-communicative contexts - defines pragmatics (Diehl, Bennetto, & Young, 2006) and impairments in social communication or pragmatics have now been recognized as defining features of ASD (DSM-5, 2013).

Analyzing narratives provides an opportunity to assess children's language and communication skills at a level beyond the sentence (Norbury, Gemmell & Paul, 2014) and provides an index of discourse impairments that may not be captured on traditional tests (Botting, 2002; Tager-Flusberg & Sullivan, 1995). The ability to narrate, or tell a story, involves relating a sequence of events where an agent's plans are likely to be foiled but where the

conflict is ultimately resolved (Stein & Glen, 1979). In addition to the sophisticated syntax needed to establish causal and temporal relationships, children must learn how to introduce characters and how to manage shifts in reference so that the listener is able to understand the main events (Bamberg, 1987; Karmiloff-Smith, 1985). Telling a story also entails understanding and following a cognitive story schema governing overall story organization (Mandler, 1984; Peterson & McCabe, 1983), and having appropriate social-cognitive knowledge to guide interpretation of the story characters' intentions and motivations (Astington, 1990; Bamberg & Damrad-Frye, 1991). Overall, narratives provide a vehicle by which to evaluate a speaker's skills to engage in a complex cognitive-linguistic task embedded in a social context. Thus, they have emerged as a tool to examine language beyond the sentence level (Norbury et al., 2014).

In typical development, production and comprehension of narratives is related to text comprehension (Diehl, et al., 2006), academic success, (Bishop & Edmundson, 1987; Boudrea, 2008; Tabors, Snow & Dickenson, 2001), and positive social exchanges (Fox & Wright, 1997; Houston, 1997). Narrative difficulty has also been shown to predict persistent language impairment (Bishop & Edmundson, 1987; Pankratz et al., 2007; Stothard, Snowling, Bishop, Chipchase & Kaplan, 1998), reading comprehension difficulties, and responsiveness to reading comprehension intervention (Bowyer-Crane et al., 2008).

Because narratives have been described as standing at the intersection of social cognition and language (Norbury et al., 2014), they provide a context in which to examine advanced language abilities and their relationship to other social-cognitive skills of children with ASD. Furthermore, Volden and colleagues (2009) found that, while structural language abilities predicted a large portion of variance in a standardized measure of pragmatic abilities, 30% of

the variance was not accounted for by nonverbal cognitive skills or structural language abilities. This further supports the notion that methods of evaluating social language ability, in addition to traditional measures of structural language, are necessary to form a comprehensive profile of language and communication abilities in children with ASD. Therefore, this is an important area for investigation (Norbury et al., 2014).

Research on narratives in ASD has largely focused on detailed analysis of narrative productions in small samples of high functioning children and adolescents with ASD (Bruner & Feldman, 1993; Landa et al., 1995; Losh & Capps, 2003; Norbury & Bishop, 2003; Tager-Flusberg & Sullivan, 1995). Overall, these studies found that when participants with ASD were matched rigorously on language abilities (Norbury & Bishop, 2003; Tager-Flusberg & Sullivan, 1995), very few quantitative differences were evident in narrative length, structure, or complexity (Capps et al., 2000; Norbury & Bishop, 2003; Tager-Flusberg & Sullivan, 1995), what Norbury and Bishop (2003) called the "local structure" level.

Despite the lack of significant differences in "local structure", most studies reported global, qualitative differences in the narratives of speakers with ASD. The precise nature of these differences has been elusive and in many cases, evaluation of qualitative differences took the form of anecdotal reports (Bruner & Feldman, 1993; Loveland, McEvoy & Tunali, 1990; Loveland & Tunali, 1993). In terms of empirical studies, Capps et al., (2000) and Losh and Capps (2003) found that high-functioning participants with ASD included fewer causal connections than controls in their narratives and used a restricted range of "evaluative devices", such as character speech. Diehl et al. (2006) reported that children with ASD had difficulty in communicating the "gist" of the story and documented a significantly poorer overall coherence

in the narratives of speakers with ASD. Loveland and colleagues (1990) noted that children with ASD were more likely to produce bizarre, inappropriate and irrelevant information when compared to controls. Norbury and colleagues (2014) evaluated a wide range of semantic and pragmatic characteristics of the narratives of children and adolescents with ASD. Using a Semantic-Pragmatic Relevance Index to measure the number of relevant and necessary propositions in a narrative, they found a clear trend for participants with ASD to produce fewer relevant utterances than typically developing peers. Thus, one finding that has consistently emerged is that the narratives of speakers with ASD tend to focus on minor details and descriptions, rather than "telling the story" in a coherent way (Diehl et al., 2006; Loveland et al., 1990; Capps et al., 2000; Losh and Capps, 2003; Norbury et al., 2014).

Many of these studies have limitations in methodology and/or sample selection. For example, narratives were frequently elicited by having participants retell the story depicted in a wordless picture book, but even here, some investigations (e.g., Capps et al., 2000; Norbury & Bishop, 2003; Tager-Flusberg, 1995; Tager-Flusberg & Sullivan, 1995) scaffolded the narrative production by having the book present during the narration while others (e.g. Diehl et al., 2006) removed the book. Having the book to look at reduces the cognitive demand of storytelling and may lead to longer and more complex narratives. In addition, participants in most of the studies spanned a wide age range (from preschoolers to adolescents or adults) which increased heterogeneity in the groups and may have reflected a developmental difference in narrative ability (Norbury et al., 2014). Most of these studies, due to the labour intensive nature of detailed narrative analysis, were conducted on relatively small sample sizes which limit the generalizability of the findings and statistical power.

This study aimed to determine whether language skills beyond the sentence level could be evaluated in children with ASD by a standardized test of narrative language. The Expressive, Receptive, and Recall Narrative Instrument (ERRNI; Bishop, 2003) is one such test. The ERRNI tests story production and comprehension, providing scores on: (1) the amount of relevant story content or "gist" of the story (Ideas score), (2) comprehension (Comprehension score), and (3) grammatical complexity (mean length of utterance in words; MLUw). Validity studies for the ERRNI included 17 children with ASD, who scored significantly below age norms, but the small sample size and the lack of rigorous diagnoses limited generalizability (Bishop, 2004). This study examines the narrative language of a large cohort (*N* = 74) of 8- and 9-year- old children with ASD using the ERRNI. Because narrative abilities are expected to relate to other measures of social cognition and pragmatic functioning, this study also aimed to determine the relationship between scores on the ERRNI and other indices of language and social functioning.

Research Questions and Hypotheses:

The primary aim of this study was to examine the profile of ERRNI performance in a large sample of school-aged children with ASD, and to compare these scores to measures of structural language, cognition, and pragmatic ability, as follows:

1. Does the ERRNI reveal differences in narrative performance in 8- and 9-year-old speakers with ASD compared to the normative data? We expected mean standard scores on the ERRNI Ideas and Comprehension domains to be significantly lower than normative standard scores, while the MLUw domain might fall within normal limits because high functioning children with ASD reportedly often have structural language skills that are within normal limits (e.g., Tager-Flusberg & Sullivan, 1995).

2. What is the relationship between performance on the ERRNI and scores of cognitive skill and structural language ability? We expected that the ERRNI Ideas and Comprehension standard scores would be positively correlated with nonverbal IQ (NVIQ), as measured by the Wechsler Intelligence Scale for Children (WISC-IV) Perceptual Reasoning subscale (Wechsler, 2003), and Clinical Evaluation of Language Fundamentals-4 Core Language Score (CELF-4 CLS; Semel, Wiig, & Secord, 2003). However, we expect that average standard scores on the ERRNI will be significantly lower than the CELF-4 CLS. Further, when the effect of NVIQ is removed, we expect that CELF-4 CLS will account for some portion of the ERRNI Ideas standard scores but that a substantial proportion of ERRNI variance will not be accounted for by structural language skill.
3. What is the relationship between performance on the ERRNI and observed pragmatic behaviour as measured by the Semantic-Pragmatic Profile (SPP; Yitzhak et al., 2011)? We expected that ERRNI Ideas standard scores would be inversely correlated with the SPP, where higher scores indicate increased pragmatic impairment.

A secondary aim is to examine relationships between ERRNI scores and indices of autism severity and social skill, as follows:

4. We hypothesized inverse relationships between ERRNI Ideas standard scores with severity of ASD social symptoms as measured by the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) social affect domain score (Gotham, Pickles & Lord, 2009). We expected positive correlations between ERRNI Ideas standard scores and parents' perceptions of everyday communicative functioning as measured by the

Communication domain standard scores of the Vineland Adaptive Behaviour Scales-II (VABS-II; Sparrow, Cicchetti & Balla, 2005). We also expected positive correlations between ERRNI Ideas standard scores and parent perceptions of everyday social function as measured by standard scores on the Socialization domain of the VABS-II.

METHOD

Participants

Our sample consisted of 74 school-aged children with ASD participating in a larger multisite longitudinal study (*Pathways in ASD)*, examining developmental trajectories of children with ASD. Participants were diagnosed with ASD between the ages of 2 and 5 years and met the following criteria: (a) expert clinical diagnosis of ASD based on the criteria in the Diagnostic and Statistical Manual of Mental Disorders—Fourth Edition—Text Revision (DSM-IV-TR; American Psychiatric Association (APA), 2000), and confirmed by administration of the ADOS (Lord et al., 2000), and the Autism Diagnostic Interview Revised (ADI-R; Rutter et al., 2005); and (b) resided in homes where English was the primary language. Children were excluded from the study if they had (a) cerebral palsy or any other neuromotor disorder that might influence their ability to participate in study assessments, (b) any known chromosomal or genetic abnormality, or (c) severe visual or hearing impairments.

All eligible families from five regional referral centers across Canada (Halifax, Montreal, Hamilton, Vancouver, and Edmonton) were invited to participate in the study. The final sample consisted of 63 boys and 11 girls. As shown in Table 1, the mean chronological age of participants was 8.65 years (*SD* =0.15) and participants had a mean NVIQ as measured by the Perceptual Reasoning Composite score on WISC-IV (Wechsler, 2003) of 95.68 (*SD* = 16.94).

Table 1

Chronological Age, NVIQ and Language Level of Participants

Measure	Mean	Standard Deviation	Range
Chronological Age	8.65 years	0.15	8.39-9.10 years
NVIQ	95.68	16.94	62-130
CELF-4 CLS	89.45	16.36	42-114

Procedure

Participants in *Pathways* were assessed shortly after diagnosis, at six and 12 months post diagnosis, at school entry and two years later when participants were 8 to 9 years old. Cognitive and language assessments used in this study were all completed at the last time point, when they were between 8 and 9 years. However, the ADOS was last administered at school entry so where relationships between the ERRNI and the ADOS severity metric are investigated, the ADOS Severity score are taken from the assessment at school entry. Likewise, the SPP profile, derived from the ADOS, was taken from the ADOS administered at school entry.

Most children were evaluated at a university clinic, hospital, or research center with some, depending on site and parent preference, assessed at home or school, Parent report instruments were provided at the time of the assessment visit or mailed out prior to the visit. Forms were either completed at the time of the visit or returned by mail.

Measures

ERRNI*.* The Expression, Reception and Recall of Narratives Instrument (ERRNI; Bishop, 2004) is a narrative assessment instrument that tests story production and comprehension, providing scores on: (1) the amount of relevant story content (Ideas score), (2) comprehension

of salient ideas in the story (Comprehension score), and (3) grammatical complexity of utterances (mean length of utterance in words; MLU_w). Participants are given a wordless picture book where the central character has a false belief. After they look through the pictures, they are asked to generate a narrative from the picture book (Ideas - Initial). The examiner may provide general encouragement (e.g., 'mmh?'), or general prompts such as "tell me a bit more" if necessary. Following a 10-30 minute period where other assessment activities are completed, participants are asked to retell the story without the pictures (Ideas - Recall). Finally, a series of 9 questions are asked to assess comprehension of both specific details and ability to make inferences about the narrative (Comprehension). The ERRNI has good internal consistency with Cronbach's alphas of .86 for ERRNI Ideas Initial scores and .76 for Comprehension scores. The Pearson's product moment correlation between initial and recall MLUw scores was .77 (Bishop, 2004). Weak correlations with standardized measures of receptive language (ERRNI Ideas and Comprehension with CELF-3 [Semel, Wiig, & Secord 1995] Concepts and Directions, r = .135, r = .259, respectively) support the notion that the EERNI was designed to evaluate skills beyond receptive syntax.

ADOS. The Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) is a semi-structured play-based assessment that provides standardized contexts in which to elicit specific behaviours. The ADOS consists of 4 modules which vary according to an individual's expressive language level and chronological age. Only one module is administered at an assessment. The activities in the module are designed to allow the administrator to observe symptoms of ASD. Module 3 (fluent speech) was administered to all participants. The ADOS has good inter-rater reliability for all domains with correlations of .93 for the Social domain, .84 for the

Communication domain, .92 for the Social-Communication total, and .82 for Restricted and Repetitive Behaviours domain (Lord et al., 2000). Internal consistency ratings were high with Chronbach's alpha scores across modules of .86-.91 for the Social domain, .74-.84 for the Communication domain, and .91-.94 for the Social-Communication total. Internal consistency was low for Restricted and Repetitive Behaviours domain scores in Modules 3 and 4 (.47-.56). The ADOS social affect domain (Gotham, et al., 2009) is a standardized severity score derived from ADOS raw scores. It represents the social functioning of individuals separate from restricted and repetitive behaviours. Scores on this metric range from 0-20 where higher scores represent increased social impairment.

***SPP*.** The Semantic-Pragmatic Profile (SPP; Yizhak et al., 2011) is a subset of 17 ADOS Module 4 items relating to semantic-pragmatic impairments. This profile was developed in correspondence with the primary author of the ADOS (Catherine Lord) as a way to quantify semantic-pragmatic impairments in siblings of children with ASD. On the SPP, higher scores reflect poorer performance. In this study, data were taken from ADOS Module 3. The SPP was obtained by matching the original ADOS Module 4 items used by Yizhak and colleagues (2011) to identical items in Module 3, and calculating a score using the scores obtained from administration of the ADOS Module 3. The SPP, as a measure, has not been standardized, separate from the ADOS.

***CELF-4*.** The Clinical Evaluation of Language Fundamentals – Fourth Edition (CELF-4; Semel, Wiig, & Secord, 2003) is a comprehensive language assessment for individuals between 5-21 years. The CELF-4 Core Language Score (CLS) is used to determine problems in language development. It is comprised of the following subtests: Concepts and Following Directions (54

items), Word Structure (32 items), Recalling Sentences (24 items), and Formulated Sentences subtests (28 items). CELF-4 CLS scores of 77 or less (*M* = 100, *SD* = 15) indicated a communication impairment. Using this cut-off, the CELF-4 CLS manual reported a high sensitivity (100%) and specificity (89%) to children with communication disorders. In addition, the CELF-4 CLS showed an inter-rater reliability coefficient of greater than .95, for the age range of the participants in our study.

WISC-IV. The Perceptual Reasoning domain score of the Wechsler Intelligence Scale for Children- Fourth Edition (WISC-IV; Wechsler, 2003) was used as an index of nonverbal IQ. The perceptual reasoning domain is composed of four subtests, including Block Design, Picture Concepts, Matrix Reasoning, and Picture Completion, that evaluate children's' nonverbal reasoning. The reliability coefficient for the perceptual reasoning composite for 8-year-olds was .91 and for 9-year-olds was .88. Test-retest reliability for the perceptual reasoning composite was .88 (Wechsler, 2003).

***VABS-II*.** The Vineland Adaptive Behaviour Scales- Second Edition (VABS-II; Sparrow et al., 2005) assesses the adaptive behaviour skills of children including communication, socialization, daily living skills and motor function, resulting in an overall index of daily functioning. The VABS is administered to a parent or caregiver in a semi-structured interview gathering in-depth information from the respondent. The whole scale has high inter-rater reliability across subdomains (.71-.81; Sparrow et al., 2005). Good concurrent validity has been demonstrated for the VABS-II with the Adaptive Behaviour Assessment System- Second Edition (ABAS-II; Harrison & Oakland, 2003) with a correlation of .70 (Sparrow, Balla, & Cicchetti, 2005). The Communication domain evaluates expressive, receptive, and written language, primarily at

the word or sentence level. The Socialization domain is comprised of questions relating to interpersonal relationships, play and leisure time, and coping skills. Internal consistency for this domain ranged from .84 to .93 (VABS-II; Sparrow, et al., 2005). Previous studies have demonstrated that, independent of age and developmental level the socialization domain is a strong measure of social functioning in children with ASD (Carter et al., 1998; Fenton et al., 2003; Volkmar et al., 1993).

RESULTS

Hypothesis 1: ERRNI Participant Scores versus Normative Sample Scores

In order to examine participant narrative performance in relation to normative data, mean participant scores on each domain were compared to normative sample scores. We expected that average Ideas and Comprehension standard scores would be significantly lower than population norms, but that average MLUw might be within normal limits. Preliminary analyses indicated that ERRNI Ideas Initial and Ideas recall scores yielded similar results, this paper will only address ERRNI Ideas Initial scores. As shown in Table 2, participants' average Ideas Initial standard score was more than one standard deviation below the normative average standard score. By contrast, mean Comprehension scores and average MLUw were within normal limits. These results indicate that participants with ASD had significantly more difficulty including important story elements, but performed similarly to their normative peers in comprehension and sentence length.

Table 2

ERRNI Domain Scores

Measure	Mean	Standard Deviation	Range
Ideas Initial	78.74*	13.71	64.9-119
Comprehension	87.53	15.76	64.9-122
MLUw	89.20	14.50	64.9-128

Note: Normative average standard scores have a mean of 100 (*SD* = 15).

* Greater than one standard deviation below the mean

Hypothesis 2: Relationship between the ERRNI and cognitive skill and structural language ability

In order to examine the relationship between performance on the ERRNI and measures of cognitive skill and structural language ability, Pearson's product-moment correlations were run between ERRNI domain scores (Comprehension, Ideas Initial), and (1) WISC-IV Perceptual Reasoning composite scores and (2) CELF-4 CLS. Our hypothesis was that ERRNI Ideas Initial and Comprehension standard scores would be positively correlated with NVIQ and with CELF-4 CLS. As shown in Table 3, ERRNI Comprehension standard scores were significantly correlated with both a) WISC-IV Perceptual Reasoning Composite scores and b) CELF-4 CLS such that better comprehension scores were related to higher nonverbal reasoning and structural language scores. ERRNI Ideas Initial standard scores also were significantly correlated to both WISC-IV Perceptual Reasoning Composite and CELF-4 CLS such that better Ideas Initial scores were related to higher nonverbal reasoning and structural language scores.

While ERRNI Ideas Initial standard scores were correlated with CELF-4 CLS, the ERRNI is designed to measure language above the word or phrase level. Thus, it is important to determine whether the ERRNI assessed skills other than those assessed on a traditional test of

structural language. In order to test this, average ERRNI Ideas Initial scores were compared to average CELF-4 CLS using a paired samples *t*-test, hypothesizing that ERRNI Ideas Initial standard scores would be lower than the CELF-4 CLS. As expected, ERRNI Ideas Initial scores (*M* = 78.74, *SD* = 13.71) were significantly lower than CELF-4 CLS (*M* = 89.45 *SD* = 16.36, *t*(73) = -1.10; $p < .05$), indicating that the ERRNI evaluates skills beyond those assessed in more traditional, structural language measures. In addition, we hypothesized that when the effect of NVIQ was removed, CELF-4 CLS would account for some portion of ERRNI Ideas Initial standard scores but a substantial proportion of ERRNI variance would not be accounted for by structural language abilities. A multiple linear regression with CELF-4 CLS and WISC-4 Perceptual Reasoning as predictors and ERRNI Ideas Initial as the criterion variable, revealed that together WISC-4 Perceptual Reasoning composite score and CELF-4 CLS accounted for 15.5% of the variance in ERRNI Ideas Initial ($R^2 = .155$; $F(2,71) = 7.69$, $p = .001$). Once effect of nonverbal reasoning was removed, 11.56% of the variance in ERRNI Ideas Initial scores was accounted for by CELF-4 performance ($\eta^2 = .11$, $t(71) = 3.05$, $p < .05$). Thus, while a portion of the variance in the ERRNI Ideas Initial scores was accounted for by structural language skill, a significant amount of variance was still unaccounted for.

Hypothesis 3: Relationship between the ERRNI and pragmatic ability

The possibility of using the ERRNI as a measure of pragmatic skill was evaluated by calculating Pearson's product moment correlations between ERRNI domain scores and the SPP, an index of semantic and pragmatic ability calculated from the ADOS. We hypothesized that ERRNI Ideas Initial standard scores would be negatively correlated with the SPP, where higher scores indicated more impairment. Pearson product-moment correlations were run between

ERRNI Ideas Initial standard scores and the SPP. As shown in Table 3, ERRNI Ideas Initial scores were inversely correlated with SPP scores such that increased inclusion of story elements was related to decreased pragmatic language difficulty.

Hypothesis 4: Relationship between the ERRNI and autism severity and social skills

In order to examine the relationship between ERRNI performance and indices of social skills, Pearson's product-moment correlations were run between ERRNI Ideas Initial standard scores, the ADOS social affect domain scores, and VABS-II Communication and Socialization domain standard scores. We expected inverse relationships between ERRNI Ideas Initial standard scores and the ADOS social affect domain scores and positive correlations between ERRNI Ideas Initial standard scores and VABS-II Communication and Socialization domain standard scores. As shown in Table 3 and consistent with the hypothesis, ERRNI Ideas Initial standard scores were inversely related to ADOS social affect domain scores. As expected, ERRNI Ideas Initial standard scores were significantly correlated with VABS-II Communication domain standard scores. This indicates that as inclusion of story elements improves, so does observed social functioning and parent report of adaptive communication abilities. Contrary to expectations, ERRNI Ideas Initial standard scores were not significantly correlated with VABS-II Socialization domain scores indicating that inclusion of story elements are not related parent report of everyday social functioning.

Table 3

Pearson's product moment correlations for ERNNI Ideas Initial and Comprehension standard scores with other domains of functioning

Measure	ERRNI Ideas Initial	ERRNI Comprehension

	standard scores	standard scores
WISC-IV Perceptual Reasoning composite score	.27 **	.41 ***
CELF-4 CLS	.42 ***	.57***
SPP	-.32 **	---
ADOS Social Affect Domain score	-.25*	---
VABS-II Communication domain	.24 *	---
VABS-II Socialization Domain	.19	---

Note: Pearson's product moment correlation coefficients of .1 represent a weak effect, .3 represent a moderate effect, and .5 represent a large effect (Cohen, 1988).

** p < .05. ** p < .01.*** p < .001.*

DISCUSSION

This study examined the ERRNI's contribution to evaluating communication skills in a large sample of school-aged speakers with ASD. Narrative has been previously explored as a point of intersection between language ability and social-cognitive functioning, allowing the exploration of language abilities above the level of the sentence. It requires combining an appropriate sequence of events, accounting for listener knowledge and perspective, and combining information in a coherent way. Previous research has suggested that school-aged children with ASD may have more pronounced deficits in narrative ability when compared to standardized structural language measures (e.g., Diehl et al., 2006; Loveland et al., 1990; Norbury et al., 2014; Peng, 1988; Waterhouse & Fein, 1982). Thus, the primary aim was to evaluate narrative performance in relation to typically developing peers and other measures of

structural language, cognitive ability, and social and pragmatic functioning in order to determine the ERRNI's ability to inform a more complete language profile of school-aged children with ASD.

When narrative performance of 8- and 9-year old participants with ASD was compared to normative performance for typically developing peers, ERRNI Ideas Initial standard scores were significantly lower than normative standard scores. Although participants with ASD performed similarly to same age peers in terms of a gross measure of syntax, that is, mean length of utterance in words (MLUw), when they were asked to produce a narrative, they included fewer elements of relevant information than their age-matched peers. This finding supports previous research, indicating that few differences exist between high-functioning school-aged children with ASD and their typically developing peers when compared solely on syntactic length and complexity (Capps et al., 2000; Diehl et al., 2006; Norbury & Bishop, 2003; Tager-Flusberg & Sullivan, 1995) but that differences emerge when comparisons of coherence and narrative content are performed such that participants with ASD include fewer relevant details and have greater difficulty relaying the 'gist' of a narrative (e.g., Diehl et al., 2006; Loveland et al., 1990; Norbury et al., 2014; Peng, 1988; Waterhouse & Fein, 1982).

Interestingly, ERRNI Comprehension scores were within normal limits. This was unexpected as in the normalization study Bishop (2004) indicated that a high proportion of children with Specific Language Impairment and ASD had difficulties with ERRNI comprehension questions. Although only 17 participants with ASD were included in the normative sample, we would expect our results to parallel those of Bishop (2004). Furthermore, all participants in the normative sample had a Non-verbal Mental Age (NVMA) of at least 80, indicating it was high-

functioning group similar to the one in this study. Further exploration may be necessary to determine why this larger sample of participants with ASD scored within the normal range on the ERRNI Comprehension domain.

Taken together, comparing ERRNI scores of participants with ASD to those of the normative sample yields differences in the inclusion of relevant story information, but not on utterance length or comprehension of narrative content. This supports the notion that in school-aged, high functioning children with ASD, differences in language production may emerge more clearly when language is evaluated beyond the sentence level (Diehl et al., 2006; Loveland et al., 1990; Norbury et al., 2014).

Relationships were found between ERRNI Ideas Initial scores and measure of structural language (CELF-4 CLS) and nonverbal IQ (WISC-IV Perceptual Reasoning Composite), but the ability to include story elements was relatively weaker than structural language abilities. In other words, when language was evaluated beyond the level typically assessed by structural language measures, i.e. the sentence level, performance was relatively poorer. Finally, although structural language (CELF-4 CLS) accounted for some of the unique variance in ERRNI performance, there was still a large portion of the variance unaccounted for. This suggests that, once the effect of NVIQ is removed, the ERRNI is measuring language skills beyond sentence-level structural language abilities.

Narrative is a potential point of intersection between language ability and social-cognitive functioning (Norbury et al., 2014), requiring a certain level of pragmatic ability. While previous research has reported bizarre and irrelevant information in the narratives of children with ASD, this information has been difficult to quantify (e.g., Diehl et al., 2006; Loveland et al.,

1990; Tager-Flusberg & Sullivan, 1994, 1995). The ERRNI provides a potential avenue to investigate the pragmatic abilities of children with ASD in a narrative context. Poorer narrative quality was related to weaker pragmatic skills as assessed by the SPP. It appears that the requirements of generating a narrative, that is, to unite coherent ideas and share them with a listener, reveals pragmatic weaknesses in the children with ASD.

This finding is consistent with the work of Norbury and colleagues (2014) who found that increased pragmatic errors accounted for significant variance in story macrostructure, such that those participants with more pragmatic errors had less coherent narratives. The authors suggested that pragmatic ability may be fundamental to understanding how a story should be structured (Norbury et al., 2014). As the ERRNI Ideas Initial score is a general domain score, it does not have the ability to identify the type of pragmatic difficulties present in the narratives of children with ASD. Clinicians may find that using the ERRNI to screen school-aged children will effectively identify pragmatic impairment. Depressed scores on the Ideas domain could then serve as the signal for detailed narrative analysis.

The relationship between performance on the ERRNI and widely used measures of autism symptomatology and social functioning was also investigated to determine what contribution, if any, administering the ERRNI could make to evaluating school-aged children with ASD. As expected, narrative skill was related to observed social affect abilities as measured by the ADOS, and general communication ability as measured by parent report (VABS-II). A significant relationship was not found between the ERRNI Ideas and VABS-II Socialization scores. The social affect domain of the ADOS taps into observable social behaviours including narrative tasks. Thus, similar skills are required for higher performance on

both the ADOS and ERRNI. The social skills assessed by the VABS-II may be more related to everyday social functioning than to the social skills required for telling a story. Furthermore, different discourse tasks may tap different social abilities and the lack of a relationship may reflect the differences in social requirements for a conversational (VABS-II) versus narrative (ERRNI) task. Our findings suggest that the ERRNI may be useful as an index for communicative skill and certain domains of social functioning.

Conclusion

Much of the research in ASD has focused on early diagnosis and intervention (Gerhardt & Lainer, 2011). As a result, the challenges faced by school-aged children have been somewhat ignored. This study was the first to assess whether a standardized narrative instrument, such as the ERRNI, designed to test higher-level language skills was useful in identifying significant communication impairments that would not be evident on more traditional language measures.

In our sample, narrative abilities were significantly weaker than structural language abilities and a large portion of the variance in the ERRNI was unaccounted for by structural language. Thus, the ERRNI assesses communication abilities beyond the sentence level in children with ASD. Clinicians may find that the ERRNI, particularly the Ideas domain, serves as a useful tool to identify (1) pragmatic impairment and (2) the need for more detailed narrative analysis in school-aged children with ASD.

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