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Examination of Script and Non-Script Based Narrative Retellings in Children with Autism Spectrum Disorders

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EXAMINATION OF SCRIPT AND NON-SCRIPT BASED NARRATIVE RETELLINGS IN CHILDREN WITH AUTISM SPECTRUM DISORDERS

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ABSTRACT

This study compared the narrative abilities of 19 children with Autism Spectrum Disorder (ASD) and 26 neurotypical children (NT), between 6 and 12 years of age, on two story retelling tasks: a script-based story and a non-script based story. The script-based story contained the structural aspects of a narrative, but also had the internal framework of a script (Hayward et al., 2007). Given the reduced cognitive and linguistic demands of the script-based story, it was expected that the script-based narrative measure would minimize narrative differences between children with and without ASD. Additionally, the relation between narrative production, theory of mind (ToM), and linguistic abilities were examined. Unexpectedly, the narration of both story types was equally difficult for children with ASD for the majority of narrative variables, including syntactic complexity, structure, content, appropriate use of references, and causal connectivity, which resulted in narratives that were less coherent and cohesive than the NT group. Closer examination of the script-based story revealed that children with ASD were including the same number of script details as the NT children, but were less likely to include the non-script details. These findings suggested that the children with ASD had more general narrative impairments, instead of abnormalities in their representation of script knowledge. Among children with ASD, ToM uniquely predicted narrative coherence and cohesion for both story types. Implications for the understanding of common events and the need for narrative interventions are discussed.

THESIS

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Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by impairments in social communication, and restrictive or repetitive behaviors (American Psychiatric Association, 2013). As narrative production is an essential component of social communication, it is not surprising that past research has found that impairments in discourse skills, such as oral narration are pervasive in children with ASD (Tager-Flusberg, Paul, & Lord, 2005). This impairment is important to understand because narrative thought is considered a fundamental task of cognitive development that is essential to many psychological and social processes (Genereux & McKeough, 2007; McKeough, 1992).

Narrative thought allows us to make sense of our social environments, understand human actions and intentions, and organize our everyday experiences (Bruner, 1990). Furthermore, good narratives skills have been shown to have a positive effect on a wide array of language and social skills, including the comprehension of classroom language, selective listening skills, peer relations, and literacy (e.g., see Johnston, 2008, for a review). Therefore, children who have difficulty with narratives are at risk for poorer

reading development (Bourdeau & Hedberg, 1999), academic achievement (Feagans & Appelbaum, 1986), and lower social functioning (Spencer & Slocum, 2010).

In typical development, constructing oral narratives becomes an essential part of a child's social and academic environment. By 9 to 10 years of age, neurotypical (NT) children reach adult-like storytelling capabilities (Johnston, 2008). More specifically, at this point in development, children are able to utilize temporal and causal connectors, clearly mark shifts in reference, organize story events intro foreground and background information, and include evaluative comments about the mental states of the characters to produce a coherent and cohesive narrative (e.g., Berman & Slobin, 1994; Karmiloff-Smith, 1985). Although the developmental progression of narrative in NT children is well understood, the narrative development in children with ASD is not as clear, with some evidence suggesting that difficulties with narratives persist into adulthood (e.g., Barnes & Baron-Cohen, 2012; McCabe, Hillier, & Shapiro, 2013).

Given the influence of effective narrative skills on academic success and social functioning (e.g., Spencer & Slocum, 2010), gaining a better understanding of the narrative development of individuals with ASD is an imperative area of research. Specifically, in order to provide targeted and effective support for children with ASD, more research is needed to gain a clear and comprehensive understanding of 1) specific narrative strengths and weaknesses, 2) whether these strengths and weaknesses differ as a function of narrative task and/or genre (e.g., script, fictional), and 3) the individual differences in language and socio-cognitive functioning that present unique barriers to effective narrative production for children with ASD.

Narrative Impairments in Children with ASD

Past research has found that children and adults with ASD have a difficult time organizing plot structure and causally linking story events in a meaningful way that relays the overall 'gist', resulting in narratives that are less coherent than their NT peers (Barnes & Baron-Cohen, 2012; Diehl et al., 2006; King et al., 2014; Losh & Capps, 2003; Manolitsi & Botting, 2011; Sah & Torng, 2015; Suh et al., 2014). Additionally, studies have illustrated that appropriately utilizing linguistic devices that create a more cohesive, or locally connected, story is often a challenge for both children and adults with ASD. In particular, individuals with ASD often use fewer and less complex conjunctions (McCabe et al., 2013) and adverbials to provide connection between story events (Manolitsi & Botting, 2011), and often use more ambiguous or inappropriate references making it unclear who the referent is at a given point in the story (Collé et al., 2008, Manolitsi & Botting, 2011; Novogrodsky, 2013; Suh et al., 2014).

In contrast, at least a handful of studies have shown that other aspects of narrative language such as productivity (i.e., length), lexical diversity, semantic quality, and syntactic complexity, may be relative narrative strengths of children with ASD (e.g., Collé, Baron-Cohen, Wheelwright, & van der Lely, 2008; Diehl, Bennetto, & Young, 2006; Losh & Capps, 2003; Norbury & Bishop, 2003). Other studies, however, have found that children with ASD produce narratives that are shorter, and less semantically, and syntactically complex compared to their NT peers (King, Dockrell, & Stuart; 2013, 2014; Norbury, Gemmell, & Paul, 2014). A number of reasons may explain these findings, including the rigorousness of matching participants for age and/or language, and

the elicitation method used (spontaneous story construction versus narrative retelling), and the narrative structure/genre (fictional, personal). In particular, differences between groups may be minimized when children with ASD are closely matched to the NT children, and when the linguistic, cognitive, and social demands of the task are reduced For instance, past research has found that retelling a story is easier than spontaneously constructing a story (Naremore, 1997; Novogrodsky, 2013), and, at least for children with ASD, producing a fictional narrative appears to be less challenging than producing a personal narrative (e.g., Losh & Capps, 2003). However, more research is needed to understand the degree to which reducing task demands may minimize these narrative differences between children with and without ASD, and the specific narrative features that may be the most influenced.

Development of Script-Frameworks in Neurotypical Children

Everyday experiences include many predictable sequences of events. According to script-framework models, children form cognitive representations of these events that they experience repeatedly, either directly or indirectly (Nelson, 1986; Schank, 1975; Davidson & Jergovic, 1996; Schank & Ableson, 1977). Once an event is experienced enough that it becomes routine, an event schema is established which allows a child to know what to expect, and be free to focus on other aspects that are occurring within the context, such as social interactions or narrative production (Davidson, 2006; Davidson, Larson, Luo, & Burden, 2000). More specifically, it is believed that understanding event knowledge can help children predict what is likely to happen in a story, and may reduce

the cognitive resources needed to attend to other linguistic and/or story features (Constable, 1986).

Past research has shown that in typical development having prior knowledge of an event sequence allows one to produce more coherent and cohesive stories (Davidson, 1996; Davidson et al., 2000; Davidson, 2006; Shapiro & Hudson, 1991) because the individual is not tasked with constructing a script each time an event occurs, and instead can activate and elaborate on a previous event schema (Nelson, 1986; Davidson, 2006). Basic organization of a script framework is established at a young age, where children as young as 3 are able to relay the temporal order of invariant events (Hudson & Shaprio, 1991). By 7 to 8 years of age, children have mastered traditional script narratives, including optional or elaborative elements in addition to the obligatory elements (Davidson et al., 2000; McCartney & Nelson, 1981; Slackman, Hudson, Fivush, 1986).

Script frameworks can be powerful tools for arranging information about our world, specifically for providing a structure for understanding events that occur, and for understanding stories (Nelson, 1986). Therefore, incorporating script-frameworks into a story may in fact support the improvement of planning, inferencing, and predicting skills in children (Engel, 1995). Script-based stories "retain the internal structure of script-frameworks and include structural aspects of a narrative" (Hayward, Gilliam, & Lien, 2007; p. 237). Retelling a script-based story is believed to be less taxing than a typical fictional narrative due to its preexisting framework (Constable, 1986; Davidson, 1994; Naremore, 1997), and consequently may be a promising approach to examine the

narrative abilities of those who have trouble with fictional narrative tasks, such as children with ASD.

Development of Script-Frameworks in Children with Autism Spectrum Disorder

Across the spectrum, social deficits tend to be the most pronounced in unstructured real-life situations (e.g., Muller, Schuler, & Yates, 2008). Despite evidence that NT children rely on event-schemas to provide structure for social experiences, it is less clear whether children with ASD rely on or use event schemas to help them make sense of their social world. The failure to incorporate event schemas into everyday situations may present a unique challenge to those on the spectrum. If one cannot create a cognitive representation for a familiar everyday occurrence, the more difficult it becomes to "share in context and participate in our culture" (Trillingsgaard, 1999; pg. 49). One-way children and adults effectively participate in culture is through narrative discourse.

Previous research has shown that children and adolescents with ASD have impairments in event schema knowledge. However, the quality and severity of these impairments appear to differ in relation to age, verbal ability, and cognitive functioning (Loveland & Tunali, 1993; Trillingsgaard, 1999; Volden & Johnston, 1999; Loth, Goméez, & Happé, 2008; 2010; Loth, Happe, & Goméz, 2010). Individuals with more severe impairments in these domains have showed marked abnormalities in generating the essential elements of familiar events (Loveland & Tunali, 1999; Loth et al., 2008; Trillingsgaard, 1999). In comparison, higher-functioning individuals are able to describe familiar events in a generalized way, and produce the core elements of an event in the

correct temporal order, but have more difficulty with the flexible or variable aspects of an event (Volden & Johnston, 1999; Loth, Gomez, & Happé, 2008; 2010; Loth, Happé, & Gomez, 2010).

Differences in task difficulty may also contribute to the ability of children with ASD to generate the central elements of an event, more specifically, measures that require children to use more advanced social skills and spontaneously structure events may create an environment that is challenging for children with ASD to show their understanding of event knowledge. For instance, Loveland and Tunali (1991) found that children with ASD had trouble responding appropriately to conversational social scripts involving the distress of another individual. Furthermore, Volden and Johnston (1999) found that when asked to spontaneously construct core elements to define events children with ASD were less capable than their peers to provide the correct responses. However, when presented with a series of videos and asked about the next core activity, the individuals with ASD were as competent as the control group at predicting the next event.

Language, Theory of Mind, and Narrative Impairments

As is evident thus far, differences in linguistic and cognitive demands of a task may influence the ability of children with ASD to tell narratives, and even use event knowledge, in the same manner as their NT peers. This is because narration requires distinct and complex cognitive, linguistic, and social skills (Norbury & Bishop, 2003), and children with ASD may have significant impairments in one or more of these domains. Nevertheless, ASD is a heterogeneous disorder in which the severity of

impairments in these domains can vary substantially (e.g., Jeste & Geschwind, 2014), and may therefore contribute to notable differences in narrative ability among children with ASD. By examining how individual characteristics (i.e., language levels and theory of mind (ToM)), predict narrative production in children with ASD we can gain a better understanding of the mechanisms contributing to these impairments, and the variability of storytelling skills and script knowledge within this population.

Language and narrative. In order to tell an effective story children with ASD as well as NT children must master a range of language skills (Norbury et al., 2014), including the structure of language (e.g., phonology, semantics, and syntax), and the use of its meaning (pragmatics). Deficits in the social use of language, or pragmatics, are pervasive in children with ASD (Tager-Flusberg, Paul, & Lord, 2005), and these difficulties with pragmatics are believed to contribute to the discourse challenges children with ASD face. Pragmatics is needed in order to use appropriate narrative conventions, include contextual and referential information, and the ability to monitor listeners' comprehension and provide perspective on events during narration (e.g., Grice, 1975; Sperber & Wilson, 2002; Prutting, 1982). Thus children with ASD who have the most significant pragmatic impairments may experience the most difficulty imbuing their narratives with appropriate structure, content, and references that provides a coherent and cohesive mental representation of the story to their listener.

Structural language levels also play an important role in the ability to produce a well-formed narrative (Norbury et al., 2014). In particular when retelling a narrative, both children's competence in the production and comprehension of language are

important. Past research suggests that children with ASD who have greater difficulties with these oral language skills, such as receptive and expressive language, construct shorter less syntactically complex narratives that use fewer evaluative narrative elements (e.g., King et al., 2013; 2014). Furthermore, research examining narrative ability across different diagnostic groups (i.e., ASD, pragmatic impairment, specific language impairment) has found that core language abilities are likely to be more influential on good narrative skills than diagnostic status, and maybe even pragmatic ability (Norbury & Bishop, 2003).

Theory of mind and narrative. The ToM account of ASD proposes that individuals with ASD have impaired mentalizing abilities, making it more difficult for them to understand the mental states (e.g., thoughts, emotions, motivations) and perspectives of others (Nader-Grosbois & Day, 2011). Nonetheless, ToM skills are needed to understand the actions of story characters, and keep track of and edit the narrative in a way that makes it meaningful and comprehensible for the listener (Astington, 1991). However, only a handful of studies have directly assessed this relation among children with ASD, providing preliminary evidence that those with greater ToM skills use more connectors and propositions (Tager-Flusberg & Sullivan, 1995), provide better story grammar (Fisher, Happé, & Dunn, 2005), and have a higher frequency of attributing mental states to protagonists (Capps, Losh, & Thurber, 2000). There is also evidence to suggest that mentalizing abilities also play an important role in event schema representation, especially the ability of children with ASD to understand the variable aspects of common events (Loth et al., 2010). Consequently, it was of particular interest

in the present study to extend this line of research by directly examining the relationship between ToM and narrative coherence and cohesion in children with ASD.

Overview of the Present Study and Predictions

The first objective of the study was to gain a more comprehensive understanding of the specific narrative strengths and weaknesses of children with ASD by examining whether potentially reducing the demand of the narrative by incorporating a script-framework into a story would allow children with ASD to produce a more well-formed story. Additionally, the study sought to better understand whether children with ASD differed from their NT peers on the type of events (script, non-script) included during the script-based retelling task, specifically examining whether children with ASD utilized script-knowledge to retell their narratives in a manner similar to their NT peers. The final goal was to better understand the mechanisms underlying narrative impairments in children with ASD, more specifically the predictive power of individual characteristics (i.e., receptive language, pragmatic language, and ToM) on narrative production in children with ASD.

These aims were investigated by comparing the narratives of children with and without ASD (ages 6-12) on two retelling tasks: a novel script-based story and a traditional fictional story, or non-script based story. Narratives were coded for a variety of variables including structural linguistic skills, macrostructure, microstructure, overall coherence, and overall cohesion. Moreover, the script-based stories were coded for the number of script and non-script events included in the narrative retellings. Finally, the

relationship between linguistic, socio-cognitive characteristics, and narrative competence on these narrative measures was directly examined.

Predictions were as follows:

1) Children with ASD were expected to tell less well-formed script-based and non-script based narratives in comparison to the NT children. However, based on the script-frameworks model, the script-based stories of both groups of children were predicted to be more well-formed than non-script based retellings, especially in regards to narrative coherence and cohesion. Therefore, although children with ASD were expected to retell less well-formed script and non-script based stories in comparison to their NT peers, these group differences were expected to diminish when comparing the performance on the script-based retelling task.
2) Based on past research examining event schema knowledge in children with ASD (Loth et al., 2008; 2010; 2011), it was predicted that children with ASD would provide the same number of script details as their NT peers when retelling the script-based story, but may be less likely to incorporate as many non-script details.
3) Given the nature of impairments associated with ASD (American Psychiatric Association, 2013), receptive vocabulary, pragmatic language, and ToM ability were expected to predict narrative coherence and cohesion for children with ASD on both narratives. More specifically, for the ASD group it was expected that the greater receptive language levels, pragmatic skills, and ToM knowledge a child had the more coherent and cohesive his/her script-based and non-script based

narratives would be. Although NT children were expected to score higher on pragmatic language and ToM, groups were expected to have similar receptive vocabulary abilities (i.e., matching variable).

Methods

Participants

In total, forty-five children from middle to upper-middle class neighborhoods in two Midwestern cities participated. Children were included in one of two groups: a group of children with ASD ($N = 19$) and an NT group ($N = 26$). Children were eligible to participate if they were between 6 and 13 years of age, had an overall IQ ≥ 70, and were native English speakers. IQ was measured using the Full-Scale 2 Score from the Wechsler Abbreviated Scale of Intelligence, Fourth Edition (WASI-IV; Wechsler, 2011), which consists of the Vocabulary and Matrix Reasoning subscales.

Children with ASD. Children with ASD were recruited through local support groups serving families of children with ASD and school districts. Twenty children with ASD were identified; however, one child had little to no functional speech and was not included due to difficulties meeting the verbal requirements of the study. The final sample included seventeen males and two females ($M_{age} = 10{:}3$, Age range = 6;8 - 12;8). Children's diagnoses were corroborated by parent report on the Child Information Form (see Appendix A). The average age of an ASD diagnoses, as reported by parents, was 5 years and 5 months (SD = 1.8; range = 3-9 years). Additionally, ASD symptom severity was determined using the Childhood Autism Rating Scale, Second Edition (CARS-2;

Schopler & van Bourgondien, 2010), and the Social Responsiveness Scale, Second Edition (SRS-2, Constantino, 2012)

Childhood Autism Rating Scale. The CARS-2 (Schopler & van Bourgondien, 2010), is widely used 15-item behavior rating scale used to help identify children with ASD and determine symptom severity through quantifiable ratings based on direct observation by the examiner and information provided through parent report. Using a 4-point scale, the degree to which the child's behavior deviates from that of an NT child of the same age is rated, based on the frequency, peculiarity and duration of that behavior. The examiner was previously trained on using the CARS-2, experienced in psychological assessment, and has worked extensively with children on the spectrum. All children received an overall score that placed them in the mild-to-moderate ($N = 10$) or severe ($N = 9$) symptomatology group, lending further support for the current group classifications (see Table 1).

Social Responsiveness Scale. As an additional measure of severity of symptoms, parents of children with autism disorder were asked to complete the SRS-2 (Constantino, 2012). The SRS-2 is a 65-item questionnaire that assesses social awareness, social motivation, capacity for reciprocal social communication, social anxiety/avoidance, and stereotypical behaviors or highly restricted interests characteristic of ASD. The SRS-2 has high clinical validity and good reliability, and is highly correlated with gold standard diagnostic tools such as the Autism Diagnostic Observation Schedule and the Autism Diagnostic Interview, Revised (Bölte, Westerwald, Holtman, Frietag, & Poustka, 2011). On average, the children with ASD were evaluated to have moderate levels of social

impairment. As was expected, the parents of children with ASD rated their child with greater social impairment than parents of the NT children (see Table 1).

Table 1. Comparison of Matching Variables and Participant Characteristics

	Diagnostic Group	
	ASD (N=19)	***NT (N=26)***
Age	10:3 (1.7)	9:7 (1.7)
Males/Females	17:2	18:8
SRS-2 T-Score***	66.6 (5.5)	50.25 (5.9)
CARS-2 Raw Score	33.7 (3.9)	---
CARS-2 T-Score	50.2 (5.5)	---
WASI FSIQ**	95.1 (13.7)	102.0 (11.7)
Nonverbal Reasoning	47.8	50.1
VMA	9:9	9:10
PPVT Standard Score	100.4 (24.7)	105.1 (17.5)
Pragmatic Composite	61.1 (15.1)	85.0 (18.3)
ToM Total Score (out of 25)***	10.9 (7.7)	17.7 (3.7)

Note. T-scores greater than 59 on the SRS-2 indicates mild social impairment, and t-scores greater than 65 on the SRS-2 indicates moderate social impairment. A raw score of greater than 33.5 on the CARS-2 indicates mild-to-moderate symptoms of an ASD. A t-score of 50 indicates that symptomatology of the sample of children with ASD falls in at least the 50th percentile compared to other individuals with ASD. VMA refers to verbal mental age and was determined using the PPVT-4. The score on Nonverbal Reasoning indicates the mean scaled score on the matrix-reasoning subtest of the WASI-2. * $p < .05$.** $p < .01$. *** $p < .001$.

Neurotypical children. NT children were recruited through local school districts and from an existing database of research participants at Loyola University. The control group included 27 NT children, 19 males and 8 females (M_{age} = 9:7, age range = 6;11-12;11). One child who had returned a parent consent form was not included in the final sample or administered any of the tests because the child was below the age cutoff of 6 years, which was necessary to complete the a number of the measures (e.g., WASI-II), making the final sample 26 participants.

Group matching. Efforts were made to match the NT children with the children with ASD on verbal mental age, nonverbal ability, age, and gender. Verbal mental age was obtained from age equivalent scores from the Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4; Dunn & Dunn, 2007). Nonverbal ability was assessed using the Matrix Reasoning subtest from the Wechsler Abbreviated Scale of Intelligence, Second Edition (WASI-II; Wechsler, 2011). The standardized Matrix Reasoning subscale score was compared across groups. T-tests demonstrated that there were no significant overall group differences for receptive vocabulary ability, nonverbal ability, age, or gender (see Table 1).

Materials and Procedures

Each participating child was tested individually in a quiet room. Children were tested in a variety of locations depending on the wishes of the parent or school. Children recruited through support groups and a prior participant database were tested either in the comfort of their homes, a lab at Loyola University, or in quiet room in a local public library. Children recruited through schools were tested in a quiet area provided by the school, during school hours.

The two retelling tasks were administered first to ensure that the subsequent language used in the measures would not influence the stories. The order in which the retelling tasks were administered was randomized, as were the remaining experimental measures. The retelling tasks were recorded with a digital audio tape recorder (Olympus Digital Voice Recorder).

Children's Communication Checklist, Second Edition. Pragmatic language was assessed using the Children's Communication Checklist, Second Edition (CCC-2; Bishop, 2006). The CCC-2 is 70- item, norm-referenced parent report questionnaire that was developed to measure social language use. Although the questionnaire yields 10-scaled scores, assessing both structural and pragmatic language domains, only the pragmatic language subscales were of interested. Based on procedure from Norbury and Bishop (2003), the following five subscales were summed to form a pragmatic language composite: Initiation, Scripted Language, Context Nonverbal Communication, Social Relations, and Interests. Scaled scores range from 1 to 19, with a higher value indicating better communication.

Peabody Picture Vocabulary Test, Fourth Edition. Receptive vocabulary was assessed using the PPVT-4 (Dunn & Dunn, 2007). The PPVT-4 is a standardized assessment of language comprehension, which requires children to identify the picture that corresponds with a given word from an array of four pictures, presenting increasingly difficult vocabulary terms including nouns, verbs, and adjectives. Standard scores, were used to match diagnostic groups, and for all subsequent analyses.

Theory of mind battery. In order to examine the development of mindreading skills in children with and without ASD, ToM was measured using a battery of three measures that varied in complexity and the degree to which they required the individual to understand the perspective of others. The Unexpected Contents Task (Perner, Frith, Leslie, & Leekam, 1989) assesses an individual's understanding of first-order false belief (e.g. "John thinks…"). In the Unexpected Contents Task, the experimenter showed the

child a crayon box, and then asked the child what they thought was in the box. The child was then shown that the box actually contained an unexpected object (i.e., paper clips). The experimenter then closed the box and asked the child, "What did you think was in the box before they opened it?" Finally the experimenter asked the child, "Say your mom (or friend) came into the room, what would she (or he) think is in the box?" Children received a score between 0 and 3, one point for each correct answer.

The Birthday Puppy (Sullivan, Zaitchik, & Tager-Flusberg, 1994) was used to assess a child's understanding of second-order false belief (e.g., "John thinks that Mary thinks…"). Birthday Puppy is a story about a mother who deliberately misinforms her son about what he will receive for his birthday, in order to surprise him. Each child was read the story while being shown an illustration of the scenes being depicted. Two-dimensional cardboard figures of the characters were used to act out of the story. Throughout the story, subjects were presented with three probe questions, two control questions, and two test questions (ignorance, false belief), and a justification question in which children were asked to justify their response to the second-order false belief question. Children were scored between 0 and 6, one point for each correct answer. Answers to control questions were not included in the final score.

The Strange Stories Test (Happé, 1994) was used to measure advanced mentalizing abilities. The test consists of short stories of events related to the various motivations underlying everyday occurrences, such as pretence, jokes, white lies, misunderstanding, irony, etc. An abbreviated version Happé's original Strange Stories Test was used in the present study, where only eight of the mentalizing stories were

administered following the procedure used by White, Hill, Happé, & Frith (2009). The eight mental state stories were accompanied by two questions: a comprehension question, "Was it true, what s/he said?" and a justification question, "Why did s/he say that?" Participants' answers to the justification question were scored between 0-2 based on Happé's (1994) coding scheme. A maximum score of 16 was possible. Two experimenters (co-author and blind co-rater) coded the justification question, and good agreement was received (α =.90). The scores from all three ToM measures were then added together to form the ToM total score, which was used in all subsequent analyses. The maximum score was 25.

Retelling tasks. Two different retelling tasks were administered: *Peter and the Cat* (Leitao & Allan, 2003) and *A Day at the Movies*. During the retelling tasks, the experimenter read the story aloud to the child while showing them the accompanying illustrations. The experimenter then handed the child the picture book and instructed them to, "Please tell me the story back the best you can." When necessary, the experimenter redirected or prompted the child to continue using neutral questions, such as "What happened next?" or "What do you think happened after that?"

Peter and the Cat. *Peter and the Cat* (Leitao & Allan, 2003) is an 11-page, illustrated story about a boy (Peter) who finds a cat in a tree, decides to rescue the cat, and in turn gets stuck in the tree. *Peter and the Cat* was chosen instead of more traditionally used storybooks, such as *Frog Where Are You?* (Mayer, 1969) because it is shorter and had fewer events. Traditionally scripts are relatively short, just comprising the essential central details and a few optional or peripheral details that make up the

mental representation, or event schema. Therefore, using a shorter non-script based narrative for retelling, such as *Peter and the Cat*, allowed us to create a comparable script-based story (i.e., A Day at the Movies) that matches more closely on dimensions such as length and number of events. Additionally, using a non-script based story, such as *Frog Where Are You?,* with more events would make it more difficult to create a script-based story that maintained the script framework.

A Day at the Movies. *The Day at the Movies* is an 11- page illustrated story about a boy who goes to the movies with his father. The script-based retelling task was created specifically for this study, and was designed to be comparable to *Peter and the Cat* on all possible dimensions, including: length, types of different words, relative number of sentences, story events, linguistic features (e.g., vocabulary, conjunctions), number of illustrations, and Flescher-Kincaid Grade Level (see Appendix B). The activity of going to the movies was chosen as the script event because it is one of the most common event schemas (i.e., going to the grocery, restaurant), and was believed to be the most enjoyable of these activities for children. Typical movie script elements are included into the fictional story (e.g., standing in line to get a ticket, buying popcorn and a drink at the concession stand). See Appendix C and D for story transcript and an example illustration. Similar to *Peter and the Cat*, a problem occurs in the middle of the story that has to be resolved (i.e., boy gets locked in the bathroom and is rescued by the janitor). Once the conflict is resolved, the boy returns to the movie and the normal elements of movie-going resume.

Narrative Coding

Two trained researchers transcribed all audio recordings using the Computerized Language ANalysis Program (CLAN; MacWhinney, 2000) in the CHAT transcription and coding format. Twenty-five percent of all of the recordings were transcribed by both coders. This was believed to be sufficient based on past narrative research, where only 10% of the narratives are double transcribed (e.g., Diehl et al., 2006; Norbury et al., 2014). Using the CHAT transcription coding system, both stories were coded for number of total words, number of different words, and mean length of utterance (MLU). The transcription reliability between the two coders was .87 for *Peter and the Cat* and .88 for *A Day at the Movies*. In line with past studies, twenty-five percent of the stories were randomly selected and coded by the first author and a blind co-rater (King et al., 2014; Norbury et al., 2014). The two raters' scores were averaged. Inter-rater correlations were satisfactory for all quality rated narrative variables (macrostructure and microstructure) for both narrative tasks, and therefore were averaged across story condition (see Tables 2 and 3).

Narrative macrostructure. Narrative macrostructure, or coherence was measured using the coding scheme from the *Peter and the Cat* Manual (Leitao & Allan, 2003). Two components of macrostructure were measured: structure and content. Each of these domains is rated on 4-point scale from 0-3, with three marking the most proficient inclusion of the respective skill. Additionally, the ratings from each subscale were combined to create a Total Coherence Score (max score = 6). See Table 2 for the general details regarding the coding scheme.

Table 2. Coding of Macrostructure Variables

Composite	Rating	Scoring Criteria	IRR
Structure	0-3	Children's inclusion of narrative structure; ranging from narratives that simply labeled or described characters, objects or other picture features to narratives that provide comprehensive structure including initiating event, problem, plans, resolution, and ending.	.90
Content	0-3	Children's inclusion of narrative content; ranging from narratives that had extremely reduced utterances that required continuous prompting, or were tangential to narratives that integrated the character's plans and intentions within the plot.	.95
Total Coherence	0-6	Structure rating + content rating	----

Note. IRR= Inter-rater reliability. Specific descriptions of scoring levels can be found in the Peter and the Cat Manual (Leitao & Allan, 2003), with the exception of the total coherence score

Narrative microstructure. Narratives were additionally coded for the use of a variety of microskills using the *Peter and the Cat* (Leitao & Allan, 2003) manual including vocabulary, references, connectors, adverbials, and story register. Competence in each of these areas was scored between 0-3, following the procedure from the manual, where a score of 3 indicated the most proficient inclusion or use of the respective microskill. Additionally, the subscales scores for connectors, adverbials, and references were summed to provide a measure of overall story cohesion. See Table 3 for general details regarding the coding of microstructure skills. Furthermore, all stories were coded for productivity, lexical diversity, and grammar. Number of total words was used to measure productivity, marking the amount of information provided in the story (Allen, Kertoy, Sherblom, & Pettit, 1994). Number of different words is a measure of lexical diversity that provided a robust estimate of productive vocabulary (Miller, 1987; Miller

& Klee, 1995). MLU measures the average number of morphemes, and provided an estimate of general grammatical skills (Leadholm & Miller, 1992; Nippold, Duthie, & Larsen, 2005).

Table 3. Coding of Microstructure Variables from Peter and the Cat Manual

Microskills	Rating	Scoring	IRR
Vocabulary	0-3	Children's use of vocabulary in narrative; ranging from narratives that use non-specific or inappropriate vocabulary to narratives that use a wide range of descriptive and literate style vocabulary.	.95
Connectors	0-3	Children's use of connectors in narrative; ranging from narratives that lack intersentential links and connector use to those that use a wide variety of connectors including more causal connectivity and literate style vocabulary.	.86
Adverbials	0-3	Children's use of adverbials in narrative; ranging from narratives that fails to provide beginning orientation or between events to narratives that appropriately and consistently use time and manner adverbials in addition to place adverbials to maintain the listeners orientation.	.92
Referencing	0-3	Children's use of referents; ranging from narratives that do not clearly mark referents resulting in ambiguous and confusing retells to narratives that use referents consistently and appropriately.	.95
Story Register	0-3	Children's use of story register; ranging from narratives with few literate features that is highly informal to narratives that are narratives that are highly literate in style.	.88
Total Cohesion	0-9	Connectors + Adverbials + Referencing	---

Note. IRR= Inter-rater reliability. Specific descriptions of scoring levels can be found in the Peter and the Cat Manual (Leitao & Allan, 2003), with the exception of the total coherence score.

Inclusion of script versus non-script details. In order to gain a better understanding of children's knowledge of event schemas, the script-based story was coded for the inclusion of script (e.g., getting in line to buy tickets) and non-script details (e.g., getting stuck in the bathroom). Approximately equal numbers of script (12) and non-script details (13) were present in the story (see Appendix 3). However, before comparisons were made, scores on inclusion of script and non-script details were converted to Z-scores.

Results

Analysis of Narrative Variables by Story Type and Diagnostic Group

Mixed model Analysis of Variance (ANOVA) were conducted on all coded story elements. For all subsequent ANOVAs, the between-subjects variable was Diagnostic Group (ASD, NT) and the within-subjects variable was Story Type (Script-based, Non-script based).

Story macrostructure. Children with ASD scored significantly different on story structure compared to the NT children $F(1, 43) = 11.01$, $p = .002$, $\eta_p^2 = .20$, where, children with ASD provided less story structure overall compared to their NT peers. No main effect of Story Type, $F(1, 43) = 1.54$, $p = .22$, or interaction between story type and diagnostic group, $F(1, 43) = .30$, $p = .59$, was detected (See Figure 1.)

Analyses of story content revealed a significant between-subjects effect of diagnostic group, $F(1, 43) = 15.46$, $p = .0001$, $\eta_p^2 = .26$. In particular NT children provided more appropriate content in their retellings than the children with ASD. A significant main effect of Story Type, $F(1, 43) = 6.70$, $p = .01$, $\eta_p^2 = .14$, as well as a

significant Diagnostic Group x Story Type interaction, $F(1, 43) = 5.10$, $p = .03$, $\eta_p^2 = .11$, was also found. Pairwise comparisons with Bonferroni corrections revealed that children with ASD provided the same amount of story content when retelling the non-script based story and the script-based story, but NT children provided a greater amount of story content when retelling the non-script based story compared to the script-based story (see Figure 1).

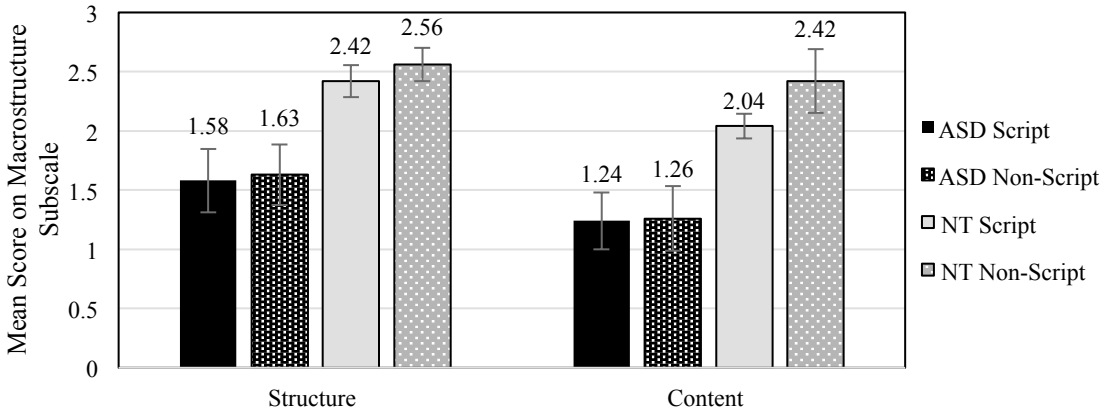


Figure 1. Children's mean scores on story coherence subscales: structure and content. ASD= Autism Spectrum Disorder. NT= Neurotypical.

The analysis on overall story coherence revealed a significant main effect of Story Type, $F(1, 43) = 5.75$, $p = .02$, $\eta_p^2 = .12$, where children's non-script based stories were more coherent than their script-based stories. There was also a significant effect of Diagnostic Group, $F(1, 43) = 13.67$, $p = .001$, $\eta_p^2 = .24$, revealing that the retellings of the children with ASD were less coherent than NT children. A significant interaction was not detected, $F(1, 43) = 3.12$, $p = .09$.

Story microstructure. The examination of narrative vocabulary showed a significant main effect of Story Type, $F(1, 43) = 4.64$, $p = .04$, $\eta_p^2 = .10$., where children

scored significantly higher on vocabulary for the non-script based story compared to the script-based story. There was also a significant effect of Diagnostic Group, $F(1, 43) = 5.07$, $p = .03$, $\eta_p^2 = .11$, showing that children with ASD scored significantly lower on vocabulary than their NT peers. There was not a significant interaction between Diagnostic Group and Story Type, $F(1, 43) = .02$, $p = .89$ (see Figure 2).

The analysis of children's reference use detected a significant main effect of Diagnostic Group, $F(1, 43) = 20.95$, $p = .0001$, $\eta_p^2 = .34$, where NT children scored significantly higher on reference use compared to children with ASD (Figure 2). However, there was not a significant main effect of Story Type, $F(1, 43) = .99$, $p = .33$, or a significant Diagnostic Group x Story Type interaction, $F(1, 43) = .12$, $p = .73$.

The examination of children's use of connectors during the retelling tasks revealed a significant main effect of Story Type, $F(1, 43) = 5.48$, $p = .02$, $\eta_p^2 = .11$, Diagnostic Group, $F(1, 43) = 5.64$, $p = .01$, $\eta_p^2 = .12$, as well as a significant Diagnostic Group x Story Type interaction, $F(1, 43) = 10.30$, $p = .003$, $\eta_p^2 = .19$ (Figure 2). Pairwise comparisons revealed that NT children scored significantly higher on connectors than children with on the non-script based story, but relatively the same for the script-based story. Furthermore, the children with ASD scored relatively similarly on connector use for both stories, but NT children scored significantly higher on connector use for the non-script based story compared to the script-based story.

When analyzing the use of adverbials, there was a significant main effect of Diagnostic Group, $F(1, 43) = 13.35$, $p = .001$, $\eta_p^2 = .24$, where children with ASD scored significantly lower for both the non-script based story and script-based story compared to

their peers (Figure 2). A main effect of Story Type was approaching significance, $F(1, 43) = 3.48$, $p = .07$, $\eta_p^2 = .08$, where non-script based stories were rated more highly on adverbials. There was no significant interaction between diagnostic group and story type, $F(1, 43) = .99$, $p = .34$.

When examining story register, a main effect of Diagnostic Group was found, $F(1, 43) = 14.26$, $p = .0001$, $\eta_p^2 = .25$, revealing that children with ASD scored significantly lower than their peers on story register (Figure 2). However, there was not a significant main effect of Story Type, $F(1, 43) = .37$, $p = .55$, or a Diagnostic Group x Story Type interaction, $F(1, 43) = .68$, $p = .42$.

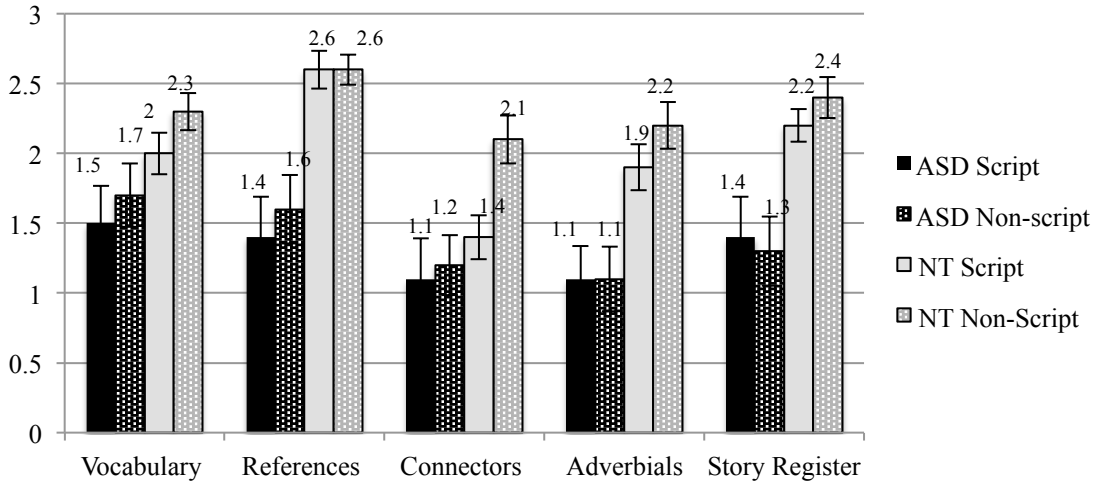


Figure 2. Children's mean scores on individual microskills. ASD= Autism Spectrum Disorder. NT= Neurotypical.

When examining overall story cohesion, a main effect of Story Type, $F(1, 43) = 5.39$, $p = .03$, $\eta_p^2 = .11$, and Diagnostic Group, $F(1, 43) = 14.04$, $p = .001$, $\eta_p^2 = .25$, were detected. In particular, all children scored higher on cohesion for the non-script based story ($M = 5.6$, SD = 2.9) compared to the script-based story ($M = 4.90$, SD =

1.87). Furthermore, NT children (M = 6.41, SD = 1.7) scored significantly higher on cohesion than children with ASD, M = 3.76, SD = 2.9. There was not a significant interaction detected, $F(1, 43) = 2.89$, $p = .10$.

When examining MLU, a significant main effect of Diagnostic Group was found, $F(1, 43) = 14.10$, $p = .001$, $\eta^2 = .25$. Children with ASD provided fewer words per utterance than NT children. The main effect of Story Type, $F(1, 43) = 3.19$, $p = .08$, $\eta^2 = .07$, was trending towards significance, where children provided a slightly greater number of words per utterance when retelling the script-based story. A significant Diagnostic Group x Story Type interaction, $F(1, 43) = .22$, $p = .64$, was not detected (see Table 4).

When examining the total number of words used in a story, no main effect of Story Type, $F(1, 43) = 1.54$, $p = .22$, or Diagnostic Group, $F(1, 43) = .95$, $p = .34$, was found. Furthermore, the number of different words did not differ between story condition, $F(1, 43) = .56$, $p = .98$, or by diagnostic group, $F(1, 43) = .64$, $p = .43$ (see Table 4).

Table 4. Group Means and Standard Deviations for Structural Linguistic Narrative Variables for Non-script and Script-Based Narratives

	Diagnostic Group	
	ASD	NT
Number of Total Words	.	
Non-script based	130.4 (91.9)	150.7 (58.3)
Script-based	140.8 (91.8)	161.2 (60.5)
Number of Different Words		
Non-script based	67.7 (37.9)	73.5 (23.4)
Script-based	66.9 (35.2)	74.2 (21.9)
MLU		
Non-script based	6.6 (3.8)	10.0 (2.5)
Script-based	7.2 (4.2)	11.0 (3.5)

Note. MLU = Mean Length of Utterance. ASD=Autism Spectrum Disorders. NT= Neurotypical.

Examination of Script and Non-script Details in Script-Based Story

Paired samples t-tests revealed that children with ASD did not differ in the number of script or non-script events included during retelling the script-based stories t (18) = .41, p = .69. However, NT children included more non-script events into their script-based retellings than script events, t (25) = 3.11, p = .01. Independent samples t-tests revealed that while children with ASD did not differ from their NT peers in the number of script-based events included, t (43) = 1.31, p = .20, they provided significantly fewer non-script events, t (43) = 2.25, p = .03 (see Figure 3).

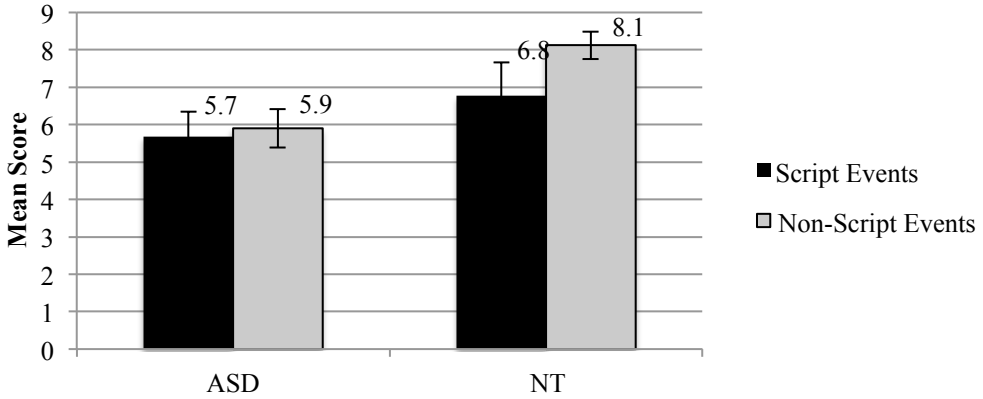


Figure 3. Children's mean scores on inclusion of script and non-script details during script-based retelling. ASD = Autism Spectrum Disorder. NT = Neurotypical.

Group Differences in Age, Receptive Vocabulary, Pragmatic Language, and ToM

Independent samples t-tests revealed that children with ASD scored significantly lower on the Total ToM Score, t (43) = -3.90, p =.0001, and pragmatic language as measured by the CCC-2, t (43) = -7.00, p =.0001, than NT children. However, children with ASD did not significantly differ from NT children on PPVT, t (43) = 3.46, p = .08, or age, t (43) = .29, p = .60 (see Table 1).

Relation between Individual Characteristics and Narrative by Diagnostic Group

Age. Among children with ASD, there was no significant relation between age and story coherence, or age and cohesion, for either story type, r (19) < .36, p >.13. Although, there was a significant relation between age and overall cohesion for the script-based narrative, $r(26) = .50$, $p = .01$, and non-script based story for NT children, $r(26) = .40$, $p = .05$, the relation between coherence and age was not significant for children in the NT group for the script-based story, $r(26) = .32$, $p = .11$, and the non-script based story, r (26) = .36, $p = .07$.

Receptive vocabulary. Pearson correlations revealed that, for children with ASD, receptive vocabulary as measured by the PPVT standard score was significantly correlated with overall story coherence and overall story cohesion for both story types (see Table 5). For NT children, receptive vocabulary was only significantly related to story coherence on the non-script based task (see Table 5).

Pragmatic language. Correlational analyses showed that the Pragmatic Language Composite score was not significantly related to narrative coherence or cohesion for either story type for children with ASD, r (19) < .31, p > .21, and NT children, r (26) < .30, p >.15.

ToM. Analyses showed that ToM had a significant positive association to narrative coherence and cohesion for children with ASD for both story types. For the NT group, only cohesion of the non-script based story was significantly related to ToM (see Table 5).

Table 5. Correlations between Receptive Vocabulary, ToM, and Story Elements

ASD Group	**1**	**2**	**3**	**4**	**5**	**6**
1. Receptive Vocabulary	---					
2. ToM	.80**	---				
3. Script Story Coherence	.79**	.86**	---			
4. Non-Script Story Coherence	.76**	.83**	.93**	---		
5. Script Story Cohesion	.79**	.75**	.85**	.95**	---	
6. Non-Script Cohesion	.77**	.78**	.94**	.92**	.88**	---
NT Group	**1**	**2**	**3**	**4**	**5**	**6**
1. Receptive Vocabulary	---					
2. ToM	.37	---				
3. Script Story Coherence	.36	.38	---			
4. Non-Script Story Coherence	.39*	.33	.80**	---		
5. Script Story Cohesion	.37	.38	.80**	.62**	---	
6. Non-Script Cohesion	.36	.43*	.77**	.82**	.61**	---

Note. * p= .05 , ** p=.01 , *** p=.001.

Predicting Overall Story Coherence and Cohesion from Individual Characteristics

Based on the correlational analyses examining the relation between individual characteristics and narrative coherence and cohesion, only PPVT and ToM were significantly related to story performance for the children with ASD. Based on these results, and the relatively small sample sizes for each group, only PPVT and ToM were examined as predictors of narrative performance.

Simultaneous multiple regression analyses were conducted to determine how children's ToM ability and receptive language uniquely predicted overall story coherence and cohesion for children with and without ASD. The ToM total score and PPVT

standard score were used in all subsequent models. Regression analyses were run separately for each group. Prior to conducting the regressions analyses, the relevant assumptions of this statistical analysis were tested. Firstly, the sample sizes of both groups ($N_{ASD} = 19$; $N_{NT} = 26$); were deemed adequate given two independent variables to be included in the analysis (Tabachnick & Fidell, 2007). The assumption of singularity was met as the independent variables were not a combination of any of the other independent variables in the model. An examination of correlations revealed that none of the independent variables in the models were highly correlated ($r > .90$) with one another for either group (see Table 5). Collinearity statistics were all within accepted limits, the assumption of multicollinearity was deemed to have been met (Coakes, 2005). Finally, residual and scatter plots indicated the assumptions of normality, linearity and homoscedasticity were all satisfied (Pallant, 2001).

Predicting Overall Story Coherence from Individual Characteristics among the ASD Group. Using the enter method it was found that ToM and receptive vocabulary predicted a significant amount of variance in children with ASD scores on overall story coherence for both script-based and non-script based stories (see Table 6). In the two-predictor model, ToM and receptive language explained 69% of the variance in story coherence for the script-based story, and 75% of the variance in story coherence for the non-script based story for children with ASD. However, the analysis showed that for both script-based and non-script based stories, only ToM significantly predicted overall coherence in children with ASD. Children's score on the PPVT did not significantly predict coherence for either narrative.

Table 6. Summary of Regression Analyses for Variables Predicting Coherence Among Children with and without Autism Spectrum Disorders

	ASD						NT					
	Script			Non-Script			Script			Non-Script		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
ToM	.19	.06	.65***	.20	.07	.68***	.09	.06	.29	.08	.07	.21
PPVT	.02	.02	.25	.02	.02	.18	.02	.01	.25	.03	.02	.32
R^2		.75			.69			.20			.19	
F		22.80***			16.5***			2.83			2.75	

Note. *$p < .05$., **$p < .01$., ***$p < .001$.

Predicting Overall Story Cohesion from Individual Characteristics among the ASD Group. Regression analyses showed that the two-variable model predicted a significant amount of variance in scores on story cohesion for both the script and non-script based stories in children with ASD (see Table 7). This indicates that together ToM and PPVT explained 64% of the variance in cohesion for script-based stories and 63% of variance for non-script based stories in children with ASD. The analysis shows that ToM significantly predicted non-script based story cohesion, but it did not predict script-based story cohesion. PPVT did not significantly predict cohesion for either script or non-script based stories in children with ASD (see Table 7).

Table 7. Summary of Regression Analyses for Variables Predicting Cohesion Among Children with and without Autism Spectrum Disorders

	ASD						NT					
	Script			Non-Script			Script			Non-Script		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
ToM	.18	.12	.40	.21	.09	.60**	.12	.10	.23	.19	.11	.34
PPVT	.02	.03	.44	.02	.03	.22	.03	.02	.28	.03	.02	.23
R^2		.64			.63			.20			.23	
F		13.5***			12.8**			2.55			3.42	

Note. *$p < .05$., **$p < .01$., ***$p < .001$.

Predicting Overall Story Coherence and Cohesion from Individual Characteristics among the NT Group. Analysis of the two-predictor model revealed that together ToM and receptive vocabulary did not account for a significant amount of variance in NT children's scores on overall story coherence or story cohesion for either narrative type (see Tables 6 & 7).

Discussion

Previous literature suggests that narrative construction is a difficult task for children with ASD, specifically creating a coherent and cohesive story. Given the fact that narrative production has important academic and social implications, it raised the question of how narrative skills may be supported for children with ASD, specifically can narrative performance be improved by reducing the task demand and providing more

structure within the story, such as a script-framework. Although more recently research has begun to examine the link between language abilities and narrative competence by rigorously matching children with ASD to their NT peers (e.g., Diehl et al., 2006), few studies have examined how variability in language levels may contribute to differences in narrative performance among children with ASD (Norbury et al., 2014; Sah et al., 2015). Furthermore, given the relative paucity of research directly examining the relationship between ToM ability and narrative competence in children with ASD, it is still unclear the extent to which differences in ToM may contribute to reported narratives impairments, and even understanding of common events. The current study contributes to this line of investigation by comparing the narrative production of children with ASD to NT children on two different types of retelling tasks (script-based story and non-script based story), and examining the influence of individual differences in socio-cognitive and linguistics abilities on narrative performance.

The four main findings of the study were that (a) children with ASD constructed narratives that were significantly impoverished in regards to grammar, microstructure, and macrostructure compared to their NT peers; (b) unexpectedly, children with ASD produced script-based stories that were just as impaired as the than non-script based stories, if not more so; (c) compared to NT children, children with ASD were just as likely to include the script-details, but less likely to include non-script details when retelling the script-based story; and (d) only ToM was a significant predictor of narrative coherence and cohesion for children with ASD.

Narrative Impairments in Children with ASD

The results of this study provide an increase in knowledge regarding the pervasiveness of narrative impairments in children with ASD, highlighting the difficulty of children with ASD to not only retell fictional narratives using a novel narrative measure, but also retell script-based narratives, which have been relatively unexplored in this population. In line with previous research, children with ASD who were matched on age, language, and cognitive ability, produced narratives that were less syntactically complex than their NT peers (e.g., King et al., 2013; 2014; Capps et al., 2000). In contrast, groups did not differ on measures of productivity and lexical diversity. Interestingly, while the number of different words used to narrate did not differ between groups, children with ASD were rated as using less complex and literate style vocabulary. Taken together these results suggest that children with ASD said as much as the NT children but using less complex language. Although lack of group differences in productivity contradicts some recent research showing productivity differences even when controlling for language and age (e.g., King et al., 2013; 2014), the present study examined narrative retelling instead of spontaneous story constructing, which may reduce the linguistic and cognitive demands of the task and mitigated these differences in productivity.

Cohesion was another aspect of narrative in which it was suspected that children with ASD would have significant difficulties. Indeed, the referential expressions of children with ASD were often inappropriate or ambiguous making it unclear who the referent was at a given point in the story. Children with ASD were also more likely to use

simple, temporal connectors in lieu of causal connectors to link events. Likewise, difficulty maintaining the listener's orientation throughout the story was also a problem for children with ASD as they often used a narrower range of adverbials in comparison to NT children, focusing primarily on place instead of time or manner adverbials. In line with past research (e.g., Novogrodsky et al., 2013; Norbury & Bishop, 2003, Suh et al., 2014,), these results illustrate that children with ASD have a difficult time utilizing linguistic devices to create a cohesive story in both non-script and script-based contexts.

As predicted, children with ASD did not provide the same degree of narrative structure or content as NT children when retelling stories. In particular, children with ASD were less likely than the NT group to include information about the character's goals, plans, and intentions, and the character's internal responses to conflict within their story, which resulted in overall lack of causal explanations between events. Narrative coherence may have been additionally reduced, in part, due to the relative lack of causal connectors (e.g., because, so) used in the story. Effective storytelling depends on the inclusion of these causal links between otherwise disconnected events, and the inability to do so may hinder the capability of developing narrative skills. Taken together with a substantial body of research documenting significant impairments with narrative coherence in children with ASD (see Stirling et al., 2014, for review), failure to include causality between one event and another raises important questions concerning the extent to which impairments understanding causal relationships may impede development more generally, such as in social, communicative, and academic settings.

Script-Based versus Non-script based Retellings

Perhaps the most surprising finding to emerge from the narrative analyses was the general lack of differences between narrative type for children with ASD, and the increased performance on several narrative variables for the non-script based story for both children with and without ASD. In contrast to my predictions, during the non-script based story both groups used a wider range of descriptive and literate style vocabulary, and produced stories that were generally more coherent and cohesive in comparison to the script-based story. Instead for most of the features, children with ASD performed equally poor for both narrative types (i.e., productivity, lexical diversity, syntactic complexity, structure, content, connectors, references, adverbials, and story register). Therefore, the internal script-framework in the script-based story did not appear to support children's ability to tell a more coherent and cohesive script-based narrative. Instead, narrative impairments seem to be pervasive across story type for children with ASD, at least for these two particular narrative assessments.

One possible explanation for the slightly increased performance during the non-script based narrative retelling may be both groups of children had prior knowledge of the type of information that is necessary to include in different narrative genres. More specifically, fictional narratives contain richer, formal language, have a plot that revolves around a conflict, and references the goals, intentions, and thoughts of the characters. Typically scripts are told temporally with little elaboration about the events, causal connectivity provided between events, and minimal references to the individuals involved. Although the script-based story was a fictional narrative, both groups of

children may have relied on this previous knowledge of scripts, resulting in less well-formed script-based stories.

Event Knowledge in Children with ASD

An in-depth analysis of the type of information children included during the script-based retellings indicated that children with ASD were on par with NT peers in regards to recalling the essential elements of the event schema. The lack of differences between groups in regards to the inclusion of script-details in the script-based retelling corroborate previous work suggesting that, at least higher functioning, children with ASD have an adequate understanding of core elements of familiar events (Trillingsgaard 1999; Loth et al., 2008; 2010; 2011). Despite speculation regarding the difficulty children with ASD may have generating these core elements in tasks with high verbal demands (e.g., Loth et al., 2011), at least in the context of narrative recall children were able to utilize event schema knowledge in the same way as their peers.

Although children with ASD appeared to realize the importance and saliency of the event schema knowledge for the script-based story, they had difficulty including the non-script details in comparison to the NT children. One possible interpretation could be that, like past research on event schema knowledge, children with ASD may have difficulty with the optional or variable aspects of an event (Loth et al., 2008; 2010; 2011). Likewise, Hayward et al. (2007) found that when examining the script-based retellings of children with and without an language impairment (LI), the children with LI also focused more on the script details, and were less likely to include causal connectivity elements, suggesting a potential difficulty with the more flexible applications of the script

knowledge. Unlike Hayward et al. (2007), the current script-based retelling task incorporated a more traditional story structure (e.g., contained beginning/ending, conflict, resolution), and the non-script details that the children with ASD were failing to include were essential to the plot of the story. Therefore the failure to incorporate the non-script details appears to be reflective of more general fictional narrative impairments, rather than abnormalities in the representation of event schemas.

Relationship between Individual Characteristics and Narrative Ability

In partial support of my predictions, together ToM and receptive vocabulary ability accounted for a significant amount of variance in narrative coherence and cohesion in children with ASD. However, surprisingly, only ToM understanding was significantly predictive of the ability of children with ASD to tell coherent non-script based and script-based narratives, and cohesive non-script based narratives. This finding provides further support for the ToM account of ASD. Likewise, these findings are consistent with Hale and Tager-Flusberg (2005) who found, using hierarchical regressions, that independent of age, language, and IQ, ToM contributes unique variance in discourse skills among children with ASD. The only narrative measure that ToM did not uniquely predict was cohesion of the script-based story, which may have been due to the reduced variability among cohesion scores in children with ASD on this task in comparison to the non-script based story. Nevertheless, a significant relationship was found between language and narrative coherence and cohesion, confirming that language is related in important ways to narrative production in children with ASD. Furthermore, the strong association found between ToM and language was not surprising, and

corroborates previous research, which has established a dynamic relationship throughout development between these two constructs (e.g., Slade & Ruffman, 2005).

In line with previous studies reporting narrative deficits in adults with ASD (e.g., Barnes et al., 2009; McCabe et al., 2013), age was not related to narrative ability in children with ASD. However, age was related to narrative cohesion in NT children. This finding is supported by research showing that as children get older there is clear development sequence in the sophistication of cohesive linguistic devices used in narrative contexts (Berman, 2009).

Although it was predicted that greater pragmatic language ability would be related to increased narrative competence, there was not much support for this hypothesis. Mirroring the results of Norbury & Bishop (2003), no relationship was found between pragmatic ability as measured by the CCC-2 and narrative measures for either group despite significant differences in pragmatic scores between groups. These null findings may have resulted from inflated ratings on the CCC-2 by the parents of the children with ASD. Upon closer examination, a substantial minority of parent's of children with ASD rated their child more favorably than would be expected based on direct observation of communication skills by the primary investigator, and thus their narrative performance did not appear to align with their reported pragmatic ability.

Limitations and Future Directions

Although I believe the results are compelling, several limitations should be mentioned. Although a methodological strength of the study was the use of a retelling task, which limited working memory demands, a possible limitation may be that children

with ASD provided stories that are impoverished in terms of overall coherence, and cohesion, due to expectations about the experimenter's prior knowledge about the story. As discussed in Stirling et al. (2014), if the child is asked to tell the story to the same experimenter who read them the story, they may be less likely to incorporate some aspects of narrative due to the belief that the listener already knows the information (Capps et al., 2000; Tager-Flusberg, 1995; Thurber & Tager-Flusberg, 1993), thus reducing the well-formedness of the narrative.

Furthermore, because the script-based story used in this experiment was a highly structured task with the experimenter highlighting the relevant script events, it is not clear from the present findings whether children with ASD would be able to spontaneously work out what aspects of the environment are important in more real-world situations in which narration occurs. Taking into consideration the importance of scripts for organizing and making sense of social experiences (Trillingsgaard, 1999), future research is needed to determine the ability of children with ASD to access relevant script knowledge, and determine the difficulty they have with the flexible application of script-frameworks in more spontaneous discourse settings.

It is also possible that other measures of language proficiency (e.g., expressive, pragmatic language) will reveal additional relations with narrative abilities. More specifically, future research may benefit from using a multi-measure approach of assessing pragmatics to fully capture children's pragmatic language ability (i.e., parent report, direct pragmatic measure).

Conclusions

The present results provide evidence that impairments in narrative coherence and cohesion are pervasive across narrative type for children with ASD. The findings from this study also provide a better understanding of script, or event-schema knowledge in children with ASD, and the potential ability of children with ASD to distinguish to some degree between the types of linguistic information needed for different narrative formats. Furthermore, the present study confirms the importance of considering the severity of linguistic and socio-cognitive impairments, especially ToM, when studying the narrative ability of children with ASD.

These findings also highlight the need for narrative interventions that specifically encourage clarity of pronoun use, and overtly teach story coherence, causal relations, and connectivity. Furthermore, providing repeated opportunities for children with ASD to engage in different genres of narrative thought could help them to not only develop better narrative skills, but also gain a better understanding of common human actions and events. Given the effect narrative skills have on a wide array of language and social skills (see Johnston, 2008 for review), fostering narratives ability in children with ASD could facilitate better academic, communicative, and social outcomes for these children. As such, developing interventions to support the narrative abilities and event knowledge of children with ASD may have widespread consequences.

APPENDIX A

CHILD INFORMATION FORM

Child Information Form

Child's Name: _____ Gender: Male Female

Child's Date of Birth: _____/_____/_____
Month/Day/Year

Medical History:

Has your child ever been diagnosed with an Autism Spectrum Disorder (please specify approx. age):

_____
_____

How was your child's Autism Spectrum Disorder diagnosis determined? If you were given a report when you received a diagnosis, the names of any tests used should be included in the report. Please place an X next to the test(s) listed below:

_____. Childhood Autism Rating Scale (CARS)
_____. Gilliam Autism Rating Scale/2nd edition (GARS/GARS-2)
_____. Modified Checklist for Autism in Toddlers (M-CHAT)
_____. Social Responsiveness Scale (SRS)
_____. Screening Tool for Autism in 2-Year-Olds (STAT)
_____. Autism Diagnostic Interview - Revised (ADI-R)
_____. Autism Diagnostic Observation Schedule (ADOS)
_____. Vineland Adaptive Behavior Scale (VABS)
_____. Diagnostic & Statistical Manual - IV-TR Autistic Disorder Checklist (DSM-IV-TR)
_____. Gilliam Asperger's Disorder Scale (GADS)
_____. Asperger Syndrome Diagnostic Scale (ASDS)
_____. Other (please specify): _____

If you have a record of the diagnostic report, please provide your child's scores on the test that was used to determine diagnosis:

_____
_____
_____
_____
_____
_____
_____

Who provided you with an Autism Spectrum Disorder diagnosis?
_____. Pediatrician
_____. Psychiatrist
_____. Psychologist
_____. Neurologist
_____. Speech Language Pathologist
_____. Other (please indicate): _____

Additional Medical History:
Has your child ever been diagnosed with (please specify age):

Tourette's: _____
Dyslexia: _____
Epilepsy: _____
ADHD:_____
Language Impairment (Please specify):_____
Learning Disorder (please specify):_____
Other Diagnosis (please specifiy):_____
Major illnesses not listed above?_____

How was diagnosis determined (e.g., Which tests/questionnaires were used?) You can also mark your selections on the back of the form:
_____
_____
_____
_____

Who provided the diagnosis?
____. Pediatrician
____. Psychiatrist
____. Psychologist
____. Neurologist
____. Speech Language Pathologist
____. Other (please indicate):_____

School History
Child's Present School_____Grade_____
Name of School District _____
Has your child been mainstreamed? Yes No Partial

APPENDIX B

SIDE-BY-SIDE COMPARISON OF RETELLING TASKS

	Peter and the Cat	**A Day at the Movies**
Total Word Count	214	269
Total Number of Different Words	135	135
Total Sentences	19	22
Flesch-Kincaid Grade Level	4.3	4.2
Total Number of Animate Objects (4)	Cat Peter Mom Man watering his garden	Jack Dad Ticket-taker Janitor
Vocabulary		
Adjectives	Kind Long Tall Little	Large Good Small Nice
Mental/Cognitive Verbs	Loved Heard (2) Know Saw Decided Explained Thought Wondered	Saw Looking (2) Thought Wondered Heard Decided (2) Explained
Modals	Will Could (2)	Was (2) Could
Connectors	And (8) But (2) So That Because When (3)	And (7) But (2) So (2) That Because When (3)
Adverbials (20/22)		
Time (10/8)	Once Again (3) One day After a long After school time At first Next Time Very late	One morning After a long Once time After (2) Now Halfway through All the way
Place (8/11)	Behind him Down the Up a tree street Get down Home (3)	In the car In the middle In his row Movie theater (4) In line Under the door Concession Home stand
Manner (2/3)	Quickly Louder	Excitedly Quickly Politely
Referencing (41/39)	Peter (14) He (9) Boy (2) It (3) Cat (6) I Man (3) Him Mom (1) Her	Jack (10) (his)Dad (4) Boy (1) Jack's dad (1) Ticket-Taker (1) He (6) The people (1) His (5) Janitor (3) Him (2) They (5)
Direct Quotes	Mom says, "OK, but climbing tall trees is dangerous. Next time get an adult to help you."	Dad says, "Would you like to go see a movie?"

APPENDIX C

A DAY AT THE MOVIES

A Day at the Movies

Page 1. Once there was a boy named Jack (NS). One morning, Jack's dad asked, "Would you like to go see a movie?" (NS) Jack excitedly said, "Yes!", so they got in the car, and drove to the movie theater (S).

Page 2. When they arrived at the movie theater (S), they got in line to buy tickets (S).

Page 3. After paying for the tickets (S), Jack bought popcorn and a large soda at the concession stand (S). Then Jack handed the tickets to the ticket-taker (S), and they went into the theater (S).

Page 4. They walked down the aisle, looking for good seats (S). Right when the previews started, Jack saw two seats in middle of the theater (S).

Page 5. Halfway through the movie, Jack really had to go to the restroom because he had finished his large soda and popcorn, so he politely walked past the people (NS).

Page 6. After Jack had gone to the bathroom, he tried to open the door, but the lock was stuck! (NS) He wondered how he would get out (NS). He tried to crawl under the door, but the space was too small (NS). Really afraid now, Jack yelled for help (NS).

Page 7. After a long time, a janitor heard Jack (NS). The janitor quickly got his tools, and opened the door (NS). Jack thanked the janitor for helping him (NS).

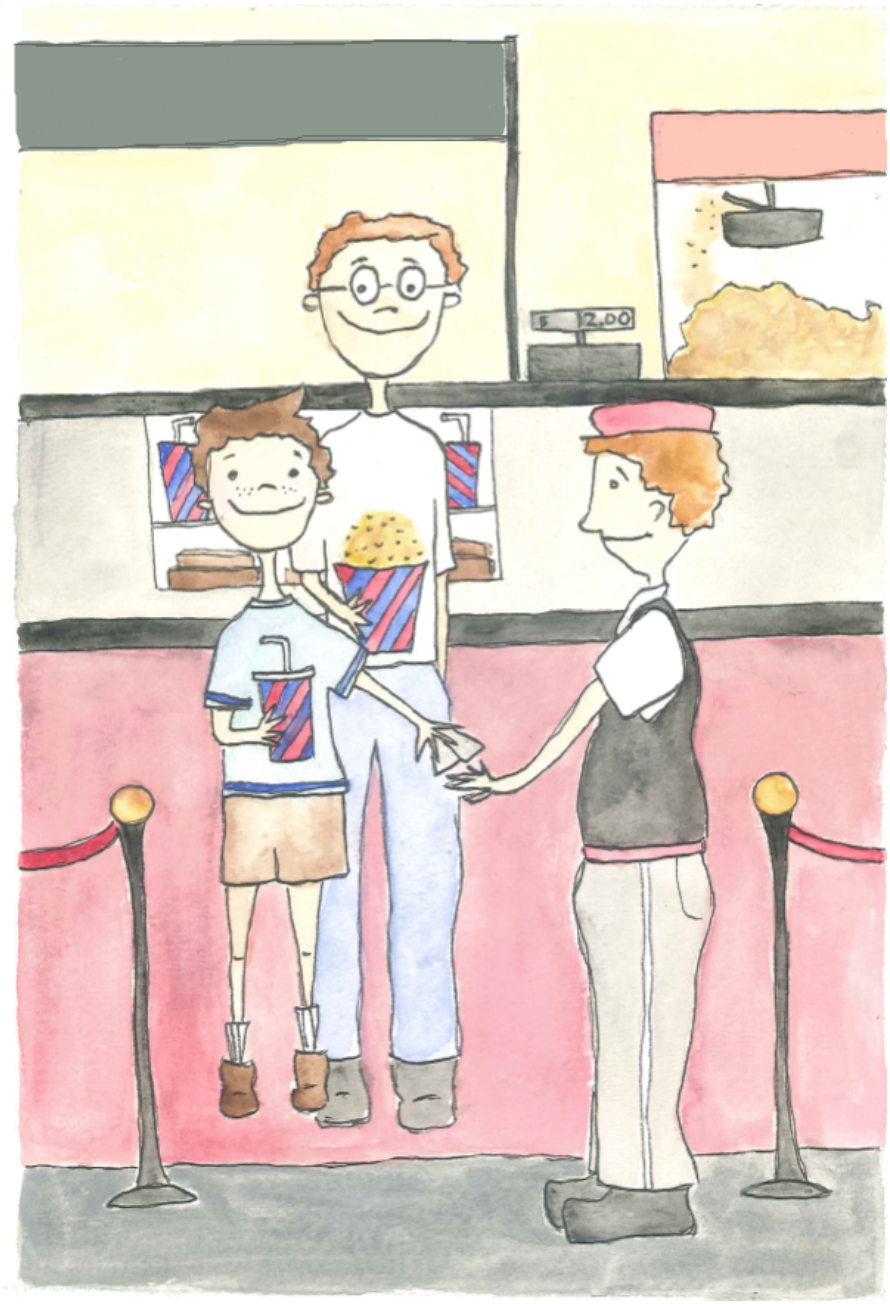
Page 8. On his way back to the theater, Jack ran into his dad who had come to look for him (NS). Jack explained what had happened (NS). His dad was very relieved that he was ok (NS). Jack and his dad returned to the theater to finish the movie (NS).

Page 9. When the movie ended, the lights turned on (S). Jack and his dad left the theater and drove home (S), talking about the movie the whole way (S).

***Note: (S)= script detail; (NS)= non-script detail**

APPENDIX D

EXAMPLE OF A DAY AT THE MOVIES ILLUSTRATION


$ 2.00

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