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Narrative Abilities of Optimal Outcome Children and Adolescents with a Previous History of Autism Spectrum Disorder (ASD)

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Narrative Abilities of Optimal Outcome Children and Adolescents With a Previous History of Autism Spectrum Disorder (ASD)

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Abstract

Autism Spectrum Disorders (ASDs) have traditionally been considered a lifelong condition; however there appear to be a subset of people who make such significant improvements that they no longer meet diagnostic criteria for autism. The current study examines whether these "optimal outcome" (OO) children and adolescents continue to have subtle language and socio-cognitive deficits. The narratives of 15 children and adolescents with a history of ASD who achieved optimal outcomes (OO), 15 high-functioning children and adolescents with a current ASD diagnosis (HFA), and 15 typically developing peers (TD) were evaluated. We found that OO children and adolescents have few residual language and socio-cognitive deficits as measured by narratives. The two areas where OO and HFA individuals performed significantly worse than controls were greater use of idiosyncratic language and greater dysfluency. Children and adolescents with HFA also used more ambiguous pronouns and were less likely to name the characters in their stories. This suggests that there are a subset of OO children and adolescents, who, despite losing an autism diagnosis, continue to have higher-level language deficits. In addition, a subset of OO children and adolescents still produce idiosyncratic language, which may result in these individuals being perceived as idiosyncratic by their peers. Additionally, HFA children and adolescents have continued deficits in socio-cognitive functioning despite general IQ and language in the average range. Future research should explore how these factors impact the daily functioning of these individuals.

Narrative Abilities of Optimal Outcome Children and Adolescents with a History of Autism Spectrum Disorder (ASD)

Autism Spectrum Disorders (ASDs) are a heterogeneous group of neurodevelopmental disorders that have been behaviorally defined by impairments in reciprocal social interaction and communication, and restricted interests and repetitive behaviors (American Psychiatric Association, 2000). The prevalence of autism has been increasing, likely due to greater awareness of ASDs as well as better diagnostic instruments. Prevalence estimates for ASDs range widely, from 36 per 10,000 births (.36%) (Fombonne, 2005) to as high as 1 per 88 births (1.1%) (CDC, 2008). ASDs have traditionally been considered a lifelong condition; however there appear to be a subset of people who make such significant improvements that they no longer meet diagnostic criteria for autism (Fein, Dixon, Paul, & Levin, 2005; Helt et al., 2008; Kelley, Naigles, & Fein, 2010; Kelley, Paul, Fein, & Naigles, 2006; Sutera et al., 2007). This "optimal outcome" (OO) group generally scores in the average range in measures of cognition, language, adaptive behavior, and social skills and approximate the trajectory of typically developing children (Helt et al., 2008). The current study examines subtle aspects of language and socio-cognitive functioning of OO children and adolescents by comparing narrative performance to that of peers with high-functioning autism (HFA) or a history of typical development.

Autism: Deficits in Theory of Mind and Executive Functioning

Deficits in Theory of Mind (ToM) and executive functioning have been theorized to be contributors to some of the underlying deficits seen in autism. Theory of Mind (ToM) is the ability to understand that others' emotions, intentions, thoughts, and beliefs

may be different from one's own. Numerous studies have found that people with autism have deficits in ToM (e.g., Baron-Cohen, Leslie, & Frith, 2007; Beaumont & Newcombe, 2006; Happé, 1995; Kaland et al., 2002). Deficits in ToM are theorized to contribute to the social communication and language deficits in autism, as language learning involves joint attention and understanding of communicative intent. Some studies have found that it is possible for higher-functioning children with autism to pass theory of mind tasks; however, it requires greater effort and higher verbal abilities to do so (Happé, 1995). This was corroborated by Kaland and colleagues (2002), who found that people with Asperger's took a longer time to answer ToM tasks than their peers, and by Senju (2012), who used an eye-tracking paradigm and found that the process of answering ToM tasks was less spontaneous for people with Asperger syndrome than typically-developing controls.

Deficits in executive functioning have also been prominent in people with ASDs (e.g., Corbett & Constantine, 2006; Geurts, Verté, Oosterlaan, Roeyers, & Sergeant, 2004). Executive functioning encapsulates a wide range of abilities, including the ability to shift attention, inhibit impulses, be mentally flexible, plan, keep things in working memory, engage in tasks fluently, and modulate emotional responses (Eigsti, 2011). Deficits in cognitive flexibility and ability to shift attention have been theorized to impair the development of theory of mind, as well as the development of language skills (Rogers & Bennetto, 2000; Tager-Flusberg, 2007).

Language Functioning in Children and Adolescents with Autism

Communication and social functioning are intertwined, as the development of language is a social process requiring social motivation to communicate with others;

furthermore, children learn language by listening to and imitating other people (Eigsti, 2011). Individuals with ASDs display a wide range of language abilities: a significant subset are nonverbal or do not acquire functional speech (30-40%; Tager-Flusberg, Paul, & Lord, 2005), whereas others become verbally fluent but reach language milestones significantly later than their peers (Mayo, Chlebowski, Fein, & Eigsti, in press). Although studies show that phonology (producing and understanding different patterns of speech sounds), vocabulary (using and understanding a variety of words), and grammar (the combining of words and morphemes into phrases) develop later in individuals with ASD, these abilities are more likely to reach the average range or above in higher-functioning individuals with ASDs (Kjelgaard & Tager-Flusberg, 2001; Tager-Flusberg, 2001).

However, pragmatic language abilities have consistently been found to be resistant to remediation, and deficits in pragmatic language are considered a defining feature of autism (Kelley et al., 2006; Tager-Flusberg, 2001). Pragmatic language involves an ability to use language appropriately in a social context and to account for the knowledge and interests of the listener; this involves theory of mind (ToM) (Diehl, Bennetto, & Young, 2006; Tager-Flusberg, 2001). Pragmatic processes that are relevant in language are both nonverbal and verbal. Nonverbal pragmatics includes the appropriate use and modulation of eye contact, facial expressions, and gesture to communicate. Verbal pragmatics includes how one uses words appropriately in different contexts to communicate, such as appropriate and varied intonation (prosody), and planning and implementing an appropriate beginning and end to a conversation or discourse. Pragmatic skills are needed to appropriately engage in the social world. Deficits in pragmatic language impact how people with ASDs interact with others and

how others respond to them. This contributes to fewer positive social interactions and difficulty in social relationships.

There are several standardized measures to assess pragmatic language skills. Measures directly administered to an individual include: the Test of Pragmatic Language (TOPL; Phelps-Teraski, & Phelps-Gunn, 1992) and Comprehensive Assessment of Spoken Language (CASL; Carrow-Woolfolk, 1992). A commonly-used parent-report measure is the Children's Communication Checklist (CCC; Bishop, 2003). Volden and Phillips (2010) administered the TOPL (which assesses a child's ability to understand sarcasm, evaluate social situations, and understand abstract language) to 16 high-functioning children with ASD with average cognitive functioning and structural language skills: the assessment was only able to identify 9 out of 16 children (56%) as pragmatically-impaired. Young, Diehl, Morris, Hyman, and Bennetto (2005) also administered the TOPL to children with ASD and typically developing children (mean age: 9.5), and found that while children with ASD as a group had significantly lower scores than their typically-developing peers, some children in the two groups had overlapping TOPL scores. Furthermore, the TOPL has dichotomous scoring, so it could not capture the subtleties of the deficits. The Pragmatic Judgment and Inferences subtests of the CASL were found to significantly correlate with the Vineland Social and Communication scores (which asks parents how the child uses his or her language and his or her social skills in everyday life), which provides support that the CASL has some external validity. However, the test only addresses a very specific aspect of pragmatic language: how well the child can answer questions relating to language use in different contexts. The parent-report measure, the CCC-2, was able to identify 13 out of 16

children (81%) as pragmatically-impaired (Volden and Phillips, 2010). This is fair sensitivity, but the data suggest that pragmatic deficits in 19% of children were being overlooked; additionally, this measure relies on the accuracy of parent-report. Therefore, although these tests of pragmatic language help provide insight as to the pragmatic language deficits in children with ASDs, not all aspects of pragmatic language can be detected through standardized testing. Rather, the structured aspect of the measures may mask pragmatic language deficits that could present in spontaneous speech or in the non-structured settings of everyday life. As a result, researchers and clinicians have strongly recommended that these tests be supplemented with language sampling procedures when assessing pragmatic language deficits (Young et al., 2005).

Narrative Studies of High-Functioning Children and Adolescents with Autism

Therefore, a way to capture a person's actual in-vivo language abilities is through the study of narratives. Narratives involve telling a story, whether fictional or non-fictional, and could be used to study language abilities and socio-cognitive understanding (Botting, 2002). Areas of language that have been examined in individuals with ASDs through narratives include grammar and syntax, as well as pragmatic language and higher-level language processes, which have been evaluated by analyzing semantic language, use of narrative devices, pronoun use, idiosyncratic language, and fluency.

Narratives allow the study of grammar and syntax. Studies of typically-developing children have found that as children develop more language skills, their narratives increase in length, include a greater variety of words, and have more complex syntax (Botting, 2002). Furthermore, when matched for language abilities, high-functioning individuals with ASD (aged 6 to 22) produce narratives that are similar in

length, structure, and syntactic complexity to narratives produced by peers without autism (Diehl et al., 2006; Tager-Flusberg & Sullivan, 1995).

Semantic language abilities have also been evaluated in narrative studies. The area of semantic language that has been most explored in narratives is the attribution of mental state verbs to characters in a story. The use of mental state verbs suggests some insight into what another person is thinking or how they are feeling, and therefore requires Theory of Mind (ToM). People with insight into others' mental states may be more likely to utilize mental state verbs in their narratives. This has been an important area of study, as one of the theories to explain the cognitive and social deficits seen in autism is that these individuals have deficits in their ability to understand others' perspectives (Baron-Cohen, Ring, Moriarty, & Schmitz, 1994). However, findings are mixed: while some studies have found that high-functioning individuals with ASDs are less likely to use such words in their narratives (e.g., Losh & Capps, 2003; Tager-Flusberg, 2000), other studies have found no significant difference between children with ASDs and non-affected controls in the number of mental state verbs expressed while telling a story (Beaumont &Newcombe, 2006; Capps, Losh, & Thurber, 2000; Norbury & Bishop, 2003; Tager-Flusberg & Sullivan, 1995). Nevertheless two of the latter studies found that while children with ASDs labeled emotions as frequently as controls, they were less likely to give a causal explanation as to *why* a character was thinking or feeling a particular way, consistent with a ToM account of ASD (Beaumont & Newcombe, 2006; Capps et al., 2000).

There are also narrative devices people can use to make a story more exciting and come alive to a listener: this includes audience hookers (e.g., 'when suddenly…!'), sound

effects, and character speech (e.g., "The frog went 'Ribbit'! Ribbit!'") (Capps et al., 2000; Slobin, 2004). The use of other narrative devices could assess social understanding: the use of *negation* (e.g., 'did not,' 'wasn't') can set up an expectation that runs counter to actual events; and the use of *hedges* (e.g., 'might,' 'seems') suggest narrator uncertainty and that there could be another explanation of events (Capps et al., 2000). In their seminal paper on narration in ASD, Capps and colleagues (2000) found that the frequency of use of specific narrative devices (e.g., hedges, negatives, character speech) did not differ among children with ASD, intellectual disability (ID) or typically-developing (TD) children matched on language ability (*M*(chronological age)= 12.6; 9.8; 6.0 for ASD, ID, and TD groups respectively); however, children with ASD and children with ID were more likely to utilize a narrower range of narrative devices than their language-matched peers, meaning they were more likely to use the same narrative devices repeatedly rather than vary their approach, suggesting decreased knowledge or desire to make the narrative more engaging for the listener (Capps et al., 2000). Furthermore, individuals with ASDs produce narratives that are less thematically-integrated and less coherent: the narrative is less likely to explain the 'gist' of the story or have explanations to explain the causal relationship between different events, making it more difficult for a listener to follow and understand the story (Diehl et al., 2006; Losh & Capps, 2003).

A compelling area of study has been the frequency of ambiguous pronoun references in narratives. An ambiguous pronoun reference occurs when a pronoun is used (e.g., 'he,' 'she,' 'it'), and it is unclear to whom the pronoun is referring (e.g., 'he was chasing him,' and it is unclear who is chasing and who is being chased). When telling a

story, social convention dictates that the first mention of a particular character uses the character's name or a specific description; the specific descriptor should be used again when reintroducing the character after discussion of a different character. However, it is appropriate to use a pronoun when engaged in continuing mentions of the same character, as it is clear to whom the pronoun is referring (e.g., 'The man was having a midnight snack. *He* was eating a peanut-butter and jelly sandwich.') When telling a story, the speaker must maintain a representation of what knowledge he has, and what knowledge the listener has (also known as "common ground" (Clark, 1996)) something that is difficult for children with ASD; in contrast, typically-developing children can appropriately use pronouns for reference in narration by 10 years of age (Karmiloff-Smith, 1985). When telling a story, new characters in the discourse may be known to the speaker but novel for the listener; therefore, to successfully tell a story the speaker has to utilize Theory of Mind (Colle, Baron-Cohen, Wheelwright, & van der Lely, 2008). However, Colle and colleagues (2008) suggested that the ability to appropriately reference pronouns could be confounded by language ability. Therefore, they conducted a study with 10 adults with Asperger's Syndrome (AS) and 2 adults with high-functioning autism (HFA) and compared their narratives to those of non-affected adults (matched according to age and IQ). Colle and colleagues found that even in this high-functioning sample, the AS/HFA group had more ambiguous pronouns than controls, and suggested that this group had a harder time utilizing ToM skills to communicate effectively while telling a story. However, there were several limitations to their study: the researchers assumed that the Asperger's participants had language ability in the average range (by definition people with an Asperger's diagnosis have average to above average language

functioning) and did not conduct formal language testing to assess language ability; furthermore, no formal ToM measures or executive functioning measures were utilized. Therefore, it is unclear to what degree the findings resulted from ToM deficits, or from deficits in other areas, such as an ability to keep the information in one's head and plan what one is going to say (i.e., executive functioning deficits). There have been few studies evaluating pronoun use in narratives of children with ASD. However, a preliminary study also found that children with autism produced significantly more ambiguous pronouns than controls (Edelson, 2012). Further research is needed to establish the degree to which referential ambiguity is associated with ToM and language ability.

One of the features that have distinguished people with ASD from language-impaired individuals without ASD has been the idiosyncratic and stereotyped language used by individuals with autism (Rapin & Dunn, 2003). People with autism are more likely to use words in unconventional ways and to have speech that is repetitive and restricted in content (Eigsti, Bennetto, & Dadlani, 2007; Ghaziuddin & Gerstein, 1996; Rapin & Dunn, 2003; Tager-Flusberg, 2001). Idiosyncratic language use includes stereotyped speech (such as lines from movies said in a consistent tone); neologisms (invented words); and overly pedantic speech (formal speech). Loveland and colleagues (1990) found that children with autism were more likely than verbally-matched children with Down's Syndrome (DS) to incorporate bizarre, inappropriate utterances in their narratives. When people communicate, they must use vocabulary of the appropriate level for the listener, and use the appropriate levels of politeness; failure to do so results in discourse that is distancing and perceived as odd.

There have been few studies on dysfluencies in discourse and narratives of individuals with autism. However, there are a few notable examples in the literature (e.g., Lake, Humphreys, & Cardy, 2011; Shriberg, Paul, McSweeny, Klin, & Cohen, 2001). Dysfluent speech refers to speech that is interrupted by *repetitions*, *self-corrections,* or *filler words. Repetitions* are the repeated use of words or part of words with no functional purpose (e.g., "*They all-* they all were flying"). *Self-corrections* occur when speech is stopped in the middle of an utterance and revised (e.g., "*They were all-* those crows were all sitting on the wires"). *Fillers* are sounds with no intrinsic meaning (e.g., 'uh,' or 'um'). A study by Shriberg and colleagues (2001) found that high-functioning children and adults with ASD were more likely than their typically developing counterparts to have repetitions and self-corrections in their discourse. Another study by Lake and colleagues (2011) evaluated the different types of dysfluencies in the speech of high-functioning adults with autism and tried to determine which type of dysfluencies may be *listener-oriented* (for the benefit of the listener) or *speaker-oriented* (serve no useful communicative function in speech). The authors concluded that filler works such as 'uh' or 'um' were more frequent in non-affected controls and seemed to serve a communicative function, such as indicating that the speaker had not finished talking and was thinking of what to say (also suggested by Fox Tree (2001) and Heeman, Lunsford, Selfridge, Black, & van Santen (2010)). *Self-corrections* were also more frequent in the control group. The authors hypothesized that self-corrections may have a *listener-oriented* function: the speaker is aware that he made a mistake, and revises it to help the listener. However, *repetitions* were more common in the ASD group, and were interpreted as non-communicative, or *speaker-oriented*. Different types of dysfluency

could be associated with ToM, with greater number of self-corrections indicating more advanced ToM skills, and greater number of repetitions indicating less advanced ToM skills (Lake et al., 2011). However, the study by Lake and colleagues (2011) did not directly assess ToM and how it related to fluency; rather, they assumed that all individuals with ASD had deficits in theory of mind, and considered any dysfluencies that were more common in that group to result from ToM deficits. However, other factors that could have contributed, such as executive functioning skills (e.g. the ability to inhibit impulses; "thinking before speaking") were not evaluated. A preliminary study of adults with autism and non-affected controls found no significant difference in number of fillers or self-corrections between groups, but found that, like the earlier study, adults with autism had significantly more repetitions than non-affected controls (Belardi & Williams, 2009).

There are many challenges in studying language and narrative abilities in individuals with ASDs. There is significant heterogeneity in language functioning, and language is also strongly influenced by development, with some language features developing more slowly in ASD. Different narrative tasks tap distinct skills, which may also account for some of the conflicting results in narrative studies of people with ASD. For example, in some studies the individual listens to and then retells the story (Diehl et al., 2006); this tests story recall and the ability to organize and make sense of a story. Less structured methods ask the individual to generate a story while looking through a book (Capps et al., 2000), which decreases working memory demands but makes it more difficult to evaluate overall structural and organizational aspects of the narrative. Other approaches involve telling stories after watching a puppet show or video skit (e.g.,

Loveland et al., 1990) or describing an autobiographical event (e.g., Causton-Theoharis, Ashby, & Cosier, 2009). Another influence on findings is the story that forms the basis of a narrative. For example, the book *Frog on His Own (*Mayer, 1973), which uses pictures to tell the story of a frog who escapes from a boy and goes on a series of misadventures, seems to elicit more mental state language than a similar book, *Frog, Where are You?* (Mayer, 1969), which uses the same characters and tells the story of the boy and his dog who go looking for the frog (Tager-Flusberg, 1995; Tager-Flusberg & Sullivan, 1995).

Despite these challenges, there have been some consistent findings in the literature regarding language and narrative skills of high-functioning individuals with ASDs as reviewed above. Specifically, high-functioning children and adolescents with autism are more likely to reach the average range in the following language characteristics: vocabulary, grammar, length, syntactic complexity, and number of narrative devices utilized when telling a story. However, people with autism consistently show deficits in pragmatic language, which has manifest in the following findings: narrower range of narrative devices utilized while story-telling; less coherent and thematically-integrated narratives; fewer causal explanations for a character's mental state; more ambiguous pronouns when telling stories; idiosyncratic and stereotyped language; and more dysfluency in the form of repetitions. Mixed findings in the literature include: the number of mental state verbs utilized in narratives and dysfluency in the form of self-corrections during spontaneous speech.

Autism Prognosis and "Optimal Outcome"

There has been debate over whether recovery is truly possible in ASDs, as it had previously been conceptualized as a life-long neurological disorder (Mundy, 1993).

Lovaas (1987) was the first to use the term "recovery" to describe children with autism. He conducted an outcome study of 19 children who received 40 hours of intensive Applied Behavior Analysis (ABA) therapy and found that 47% of those children achieved IQ scores in the average range and successfully completed first grade. However, social functioning was not evaluated, so it is unclear whether these children would still have met criteria for autism. Szatmari, Bartolucci, Bremner, and Bond (1989) added measures of adaptive functioning and social functioning and found that 4 out of 16 individuals no longer met criteria for ASD as adults and had adaptive functioning in the average range. Additionally, detailed clinical case studies have shown clear examples of children who formally had an autism diagnosis who no longer meet diagnostic criteria for autism (e.g., Fein et al., 2005; Perry, Cohen, & DeCarlo, 1995; Zappella, 2010).

More recent studies have employed more stringent criteria to define a subset of individuals who no longer meet diagnostic criteria for autism and function within the average range on a variety of cognitive and adaptive measures: these people have been characterized as having an "optimal outcome" (e.g., Kelley et al., 2006; Sallows & Graupner, 2005; Sutera et al., 2007; Zappella, 2010). Helt and colleagues (2008) proposed an operationalized definition for "optimal outcome." This included: no longer meeting diagnostic criteria for ASD; no longer being considered by the school system to have an ASD; having a full scale IQ greater than 77; and being mainstreamed in a regular classroom and not receiving more than 1 hour per week of speech, occupational or special educational services.

It is estimated that between 3% and 25% of children originally diagnosed with an ASD develop cognitive, language and social skills in the average range and no longer

meet criteria for an ASD (Helt et al., 2008). Although the precise factors that contribute to an optimal outcome are unclear, there are features that have been associated with better outcome. These include: earlier age of diagnosis; intensive early intervention; higher initial receptive language, non-verbal problem-solving and motor scores; greater imitation skills; and a previous diagnosis of Asperger Disorder (AD) or Pervasive Developmental Disorder- Not Otherwise Specified (PDD-NOS) (as opposed to a diagnosis of Autistic Disorder) (Helt et al., 2008; Sallows & Graupner, 2005; Sutera et al., 2007; Szatmari et al., 1989).

Studies have compared the profiles of optimal outcome children to children with ASD and typically-developing children to explore what autistic features persist in children characterized as achieving optimal outcome and which skills continue to lag behind those of their peers. For example, Fein and colleagues (2005) presented 11 cases of children with a clear diagnosis of PDD who lost their PDD diagnosis and now met diagnostic criteria for Attention Deficit Hyperactivity Disorder (ADHD). These children had mild residual social deficits, but they were noted to have more of an "ADHD quality" and were marked by impulsivity and immaturity rather than social aloofness. Fein and colleagues (2005) also noted several cases where the children continued to display mild perseverative behaviors and interests, such as during play or other preferred activities. Residual deficits include mild social problems, anxiety and tics, attention problems, and deficits in aspects of language functioning (Fein et al., 2005; Kelley et al., 2006; Sallows & Graupner, 2005; Zappella, 2010).

Evaluation of Language Abilities in "Optimal Outcome" Children

Considering the central role that communication impairment plays in the diagnosis of autism, it is critical to systematically evaluate language functioning in a group of "optimal outcome" (OO) individuals who no longer meet diagnostic criteria for autism. To what degree has this group attained normal language functioning, and are there any residual deficits?

There has been little systematic research to date on language functioning in this "optimal outcome" group. The most detailed analyses have come from Kelley et al. (2010, 2006). Kelley, Paul, Fein and Naigles (2006) studied 14 "optimal outcome" children ages 5 to 9 and matched them according to age and gender to 14 typically-developing children. They administered a battery of language tasks as well as a narrative task, where the children had to generate a story from *Frog Where are You?* (Mayer, 1969). Kelley and colleagues found that the optimal outcome children had intact grammatical abilities and did not significantly differ from controls on most lexical variables, but still struggled with pragmatic language deficits in the narrative task: the "optimal outcome" group was significantly less likely to identify the goals and motivations of the characters in the story, gave fewer causal explanations as to why certain things were happening in the story, and were more likely to misinterpret story events. These activities require communicating the story in a way that the listener can follow and understand, as well as an understanding and interest in the social dynamics of the story and characters. Kelley and colleagues also noted two factors that "approached significance"(p. 817) between the TD and OO groups: this included more ambiguous references to events and characters and greater repetition of story events with no

functional purpose in the OO group. Optimal outcome children also performed significantly worse on a Mental Verb task that examined the child's knowledge of the differences between the mental state verbs, *think, guess, and know,* as well as on a Theory of Mind task that examined whether the child was able to understand that what he or she knows might not be the same as what another person knows, tasks that also require social knowledge and understanding. This is significant, as it indicates that OO individuals who do not meet symptom criteria for ASD may continue to have subtle social deficits. However, a later study by Kelley, Naigles, and Fein (2010) of an older group of 13 optimal outcome children ages 8 to 13 (some of whom were the same children in the 2006 study) found that there were no significant pragmatic language deficits as measured by the *Test of Pragmatic Language (TOPL)* or the *Making Inferences* and *Figurative Language* subtests of the *Test of Language Competence (TLC),* two standardized tests that evaluate aspects of pragmatic language. There were also no language deficits as measured by standardized language tests, including: the *Comprehensive Assessment of Spoken Language (CELF), Peabody Picture Vocabulary Test (PPVT),* and *Wechsler Intelligence Scale for Children (WISC)*. The authors concluded that these OO children may be able to overcome some of the earlier-observed semantic and pragmatic deficits as they get older. However, the 2010 study did not evaluate narratives or other spontaneous language samples, whereas some of the pragmatic language deficits that were observed in the 2006 study were observed in the children's narratives. Therefore, a study with a spontaneous language sample is needed to better characterize an older group of children and adolescents to evaluate whether

pragmatic language deficits could truly remediate as optimal outcome children and adolescents age.

The Current Study: Aims and Hypotheses

The current study evaluated the narrative abilities of an older group of children and adolescents (ages 9 to 15) with a former diagnosis of autism ("optimal outcome" or "OO"), a current autism diagnosis ("high-functioning autism", or "HFA"), or no history of learning disability ("typically developing" or "TD").

Aim 1. The primary aim of the study was to better characterize the language trajectory of a subset of children and adolescents who no longer meet diagnostic criteria for autism. When these children and adolescents generate a narrative, will there be residual language and socio-cognitive deficits that could not be detected because of the structure provided by standardized tests? It was hypothesized that this older group of OO individuals would perform indistinguishably from their TD peers in all areas of socio-cognitive and language functioning.

Aim 2. A secondary aim was to probe for persistent and potentially subtle language deficits in a very well-defined group of high-functioning individuals with autism. What are pragmatic language and socio-cognitive deficits that are less likely to remediate even in a group with cognitive and standardized language scores in the average range (within 1.5 standard deviations from the mean) but who continue to display significant socialization difficulties and meet criteria for autism? It was hypothesized that HFA children and adolescents will have narratives that are similar in length, structure, and lexical diversity, and utilize a similar number of narrative devices and mental state verbs as their TD and OO peers. This is consistent with previous research on narrative

studies of individuals with high-functioning autism. However, it is hypothesized that there will be some pragmatic areas, such as pronoun use and idiosyncratic language where the HFA individuals will perform more poorly than their TD and OO peers. Additionally, as suggested by previous literature, HFA individuals are predicted to have more dysfluent narratives than their TD and OO peers.

Aim 3. A third aim was to evaluate whether there was a relationship between executive functioning skills and narrative characteristics. It was hypothesized that executive functioning characteristics would significantly correlate with narrative skills that could potentially be more reliant on working memory, the ability to organize and plan a narrative, and the ability to inhibit impulses. The narrative characteristics that were hypothesized to rely most on these abilities were pronoun use and language fluency.

A fine-grained understanding of language in "optimal outcome" and HFA groups will allow us to better understand the features of autism that are most resistant to remediation and to identify pragmatic language deficits in HFA which may not be detectable through standardized testing, but may manifest in the more unstructured setting of daily life and impact social functioning and quality of life.

Methods

Participants

The narrative abilities of 15 children and adolescents with a history of ASD who achieved optimal outcomes (OO), 15 high-functioning children and adolescents with a current ASD diagnosis (HFA), and 15 typically developing peers (TD) were evaluated. The participants in the study, selected from a larger sample in order to match precisely on age, ranged from 9 years, 3 months to 15 years, 8 months. Therefore, the three groups did

not significantly differ in age, *M*(age)=12.4, 12.9, 13.0 for OO, HFA, and TD, respectively, *p*=.61. The groups were also matched on gender, χ^2 (2) = 1.15, *p*=.57, with 3 females in the OO group (20%), 1 female in the HFA group (6.7%), and 2 females in the TD group (13.3%). Groups did not differ on verbal IQ, *M*(VIQ)= 110.8, 102.6, 112.1, for OO, HFA, and TD, respectively, *p*=.20, nor on nonverbal IQ, *M*(NVIQ)= 110.6, 105.9, 116.3, for OO, HFA, and TD, respectively, *p*=.06. However, the difference in NVIQ was nearly significant, with the TD sample with a somewhat higher NVIQ. The participants were predominantly Caucasian, with only three individuals in the TD group reporting other races or ethnicities. See Table 1 for participant characteristics.

All participants were part of a larger study of OO at the University of Connecticut. Participants were recruited through flyers and information distributed to New England autism associations, advertisements posted in newspapers and online forums, and presentations at conferences. Participants were also referred from the principal investigators' private practices, the Psychological Services Clinic at the University of Connecticut, and from other ongoing studies at the University of Connecticut. TD participants were additionally recruited through advertisements posted at local public schools and at the University of Connecticut. The study was approved by the Institutional Review Board of the University of Connecticut.

Enrollment criteria. To be included in the study, all participants were required to have verbal, nonverbal, and full-scale IQ standard scores greater than 77 (within one-and-a-half standard deviations of the mean IQ of 100) on the *Wechsler Abbreviated Scale of Intelligence (WASI)* (Wechsler, 1999). In addition, to be included in the OO group:

1. Participants had to have a documented written history of an ASD diagnosis made by a specialist in the field of autism, reviewed by an expert clinician to verify early diagnosis,
2. Participants could not currently meet criteria for any Pervasive Developmental Disorder according to the Autism Diagnostic Observation Schedule (ADOS) or clinical judgment.
3. Participants had to perform in the average range or higher on the communication and socialization domains of the Vineland Adaptive Behavior Scales (score at or above 77, within 1.5 SD of the mean).
4. Participants had to be included in regular education classrooms with no more than one hour of special education services to address deficits specific to ASDs. However, participants in this group could be receiving limited special education services to address impairments not specific to ASDs, including language deficits, learning disorders, and psychiatric disorders.

To be included in the HFA group:

1. Participants' behavioral presentation (ADOS and clinical judgment) and parent report of ASD symptomatology had to be consistent with a diagnosis of ASD at the time of assessment.
2. Participants had to be able to speak in full sentences.

To be included in the TD group:

1. Participants could not meet criteria for any ASD at any point in their development, by parent report, according to the ADOS or clinical judgment.

2. Participants had to receive a score of 77 or higher on communication and socialization domains of the Vineland Adaptive Behavior Scales.

Exclusion criteria. Potential participants were excluded from the study if (1) they exhibited symptoms of major psychopathology (e.g., active psychotic disorder) that would impede their full participation in the study, or (2) they had severe visual or hearing impairments, or (3) they had a history of seizure disorder, Fragile X syndrome, or significant head trauma that involved loss of consciousness. Two potential participants, one for the TD group and one for the HFA group were excluded because of a history of a seizure disorder.

Procedure

Following initial phone screenings, participants completed two or three testing sessions in a quiet room at the University of Connecticut, the Institute of Living of Hartford Hospital, or in the participant's home. At the end of each testing session, the participant received a monetary incentive for participation.

Measures.

Autism symptomatology. Autism symptomatology was evaluated using the *Autism Diagnostic Observation Schedule-Revised* (*ADOS*; Lord, Rutter, DiLavore, & Risi, 2000), which assesses social and communication skills, play behaviors, and repetitive and stereotyped interests. All individuals completed Module 3. During the ADOS, all participants completed the *Tuesday* (Wiesner, 1991) book description as a measure of narrative storytelling skills. Children were given the picture book and asked to tell the story to the examiner. In this study, the examiner introduced the activity with the following prompt:

> "This is a book called *Tuesday*. It has a lot of pictures, but not a lot of words. I'm going to start telling the story, and then I want you to tell me the rest of the story: 'It was Tuesday evening around eight, and Mr. Turtle was sitting on a log when suddenly he heard a sound. What could it be?'"

The participants were encouraged to finish telling the rest of the story

Cognitive and adaptive functioning. Participants completed the *Wechsler Abbreviated Scale of Intelligence* (*WASI;* Wechsler, 1999) to provide a measure of nonverbal reasoning and verbal ability. Parents completed the *Vineland Adaptive Behavior Scales* (*VABS*; Sparrow, Balla, & Cicchetti, 1984), a parent interview that assesses a child's adaptive functioning.

Language functioning. Participants completed core subtests of the *Clinical Evaluation of Language Fundamentals* (*CELF*; Semel, Wiig, & Secord, Wayne, 2003) a measure that assesses language skills and is used to diagnose language and communication disorders.

Executive functioning. Parents completed the *Behavior Rating Inventory of Executive Function* (*BRIEF*; Gioia, Isquith, Guy & Kenworthy, 2000), a parent-report measure that assesses executive functioning in everyday life.

Narrative coding. The *Tuesday* narratives were transcribed and analyzed (details given below) for a number of characteristics that have, in the past, been identified as important indices of pragmatic language competence.

Length. *Narrative length* was measured in three ways: (i) *total number of words (word tokens)*, (ii) *total number of utterances,* and (iii) *mean length of utterance*. An utterance was defined as "an independent clause and all the clauses that modify it." (Hunt

1965). The *mean length of utterance* (MLU) was calculated by dividing *the total number of words* by the *total number of utterances.* Comments extraneous to the story ("that was cool!") and dysfluencies (repetitions, self-corrections, and filler words) were not included in the total word count.

Lexical diversity. *Lexical diversity* was calculated by dividing the *number of different words (word types)* by *total number of words* in the narrative *(word tokens).* This is the *type/token ratio* and a larger ratio is associated with greater use of varied language and vocabulary.

Story elements. *Story elements* were the events representing the "essential features" of the narrative. The researcher coded all story elements (shown in *Appendix I*). This enabled us to analyze how comprehensively participants described the story. The number of story elements in each narrative was counted.

Negatives. The number of *negatives* (e.g., 'the frog *was not* happy,') was measured.

Hedges. *Hedges* imply uncertainty about events in the narrative (e.g., 'the frog *might* be under the water'); the total number of hedges was counted.

Narrative devices composite. N*egatives* and *hedges* were combined to form a *narrative devices* composite.

Causal references. The number of references to a *causal connection* between events was coded (e.g., 'the frog was mad because he could no longer fly').

Mental state expressions. *R*eferences to mental states (e.g., 'thought', 'realized', 'didn't know,') as well as emotional states ('scared,' angry,' "excited') were quantified.

Reference analysis (ambiguous pronouns). *Ambiguous pronouns* are pronouns for which it is unclear to whom the pronoun is referring. We coded the total number of pronouns and the percentage that was ambiguous.

Naming of characters. We coded whether the participants named the characters in their narratives in a dichotic present/absent fashion.

Idiosyncratic language. *Idiosyncratic language* was defined as language that is used in an unconventional manner, such as overly formal speech (e.g., 'congregating around a human suburb'), scripted language ('stay tuned for the sequel!'), or made-up words (e.g., 'Aquamaratia Jacksonpetina Jr.'). Because there were a few individuals who frequently used idiosyncratic language, this was coded in a dichotic fashion.

Unusual references. We coded references to people, things, or events that were not directly relevant to the story (e.g., 'Department of Homeland Security,' 'Men in Black,' 'late-night Jeopardy'). This variable was coded in a dichotic manner,

Abnormal language composite. The number of people in each group (OO, HFA, TD) who utilized either *idiosyncratic language* or *unusual references* was tallied in an *abnormal language* composite.

Repetitions. The repeated use of words or parts of words with no functional purpose was tallied. Each repetition, regardless of the number of words involved, was considered one unit (e.g., "*They all*- they all were flying" was a single repetition)

Self-corrections. The use of words to self-correct one's speech was tallied. As above, each occurrence was counted as a single event (e.g., "*They were all*- those crows were all sitting on the wires" was one self-correction).

Dysfluency composite. The total number of r*epetitions* and *self-corrections* formed the *dysfluency composite.*

Filler words. *Filler words* such as 'uh' or 'um' were evaluated separately from repetitions and self-corrections as there may be a different process underlying their use (Lake et al., 2011). The total number of filler words was tallied.

Reliability

The narratives were transcribed from digital video using the Child Language Data Exchange System (CHILDES; MacWhinney, 2000) by the researcher, who was naïve to diagnosis. To establish the reliability of transcription, 20% were transcribed by a second transcriber. Comparing each word in the two transcriptions, there was agreement with 96% of the words from the first transcription. Intraclass correlations (ICC) were also conducted to determine inter-rater reliability in coding for number of utterances and were calculated at ICC = 0.72. An intraclass correlation of 0.70-0.80 indicates strong agreement and a coefficient of greater than 0.8 indicates almost perfect agreement (Shrout & Fleiss, 1979).

One third of the narratives were coded for multiple pragmatic qualities (including number of story elements, mentalizing and emotion terms, narrative devices, causal references, and measures of dysfluency, including self-corrections, repetitions, and fillers) by a second coder naïve to diagnosis. The ICC for number of story elements, mentalizing and emotion terms, narrative devices, and causal references were 0.83, 0.78, 0.87, and 0.87 respectively. The ICC for measures of fluency was: 1.00 for number of repetitions; 0.99 for number of self-corrections; and 0.99 for number of fillers. All intraclass correlations were > 0.70 and reached a level between "strong agreement" and

"almost perfect agreement." All of the transcriptions were coded for unclear pronoun use by the researcher and another naïve coder. The intraclass correlation was 0.92. All coding for idiosyncratic language and unusual references were consensus coded by the researcher and the second rater, who were naïve to diagnosis, and separately coded by a third rater who was also blind to diagnosis. Reliability was calculated between the consensus coding by the two blind raters and coding by the third rater using Cohen's kappa (*k)* for dichotomous variables ("present" or "absent"). The *k* for idiosyncratic language, unusual references, and the abnormal language composite (whether the subject used either idiosyncratic language or unusual references) were 0.80, 0.93, and 0.91 respectively. A $k = .61$-$.80$ indicates substantial agreement and $k > 0.80$ indicates almost perfect agreement (Landis & Koch, 1977).

Correlational Analyses

Bivariate correlational analyses were conducted between all narrative characteristics and scores on the *BRIEF*.

Results

One-way analyses of variance (ANOVAs) were used to evaluate differences among the HFA, OO, and TD groups in narrative length, lexical diversity, story elements, narrative devices, causal references, mental state expressions, clarity of pronoun references, and fluency. To control for narrative length, the number of narrative devices, causal references, mental state expressions, unclear pronoun references, and dysfluencies were divided by the total number of utterances. So as to not inflate the differences, character names, idiosyncratic language, and unusual references were dichotomized as either "present" or "absent;" therefore logistic regression was used to evaluate whether

group membership (HFA, OO, or TD) could predict the presence or absence of these characteristics in the participants' narratives.

Narrative Analyses

Narrative Length and Lexical Diversity. There were no significant group differences for any narrative length characteristic, including total number of words (word tokens), number of utterances, and MLU. The mean number of tokens was 247.1, 279.5, and 276.3 words for HFA, OO, and TD groups respectively, $F(2,42) = .51$, $p = .60$. The average number of utterances was 27.4, 29.2, and 28.4 for HFA, OO, and TD groups respectively, $F(2.42) = .16$, $p = .85$. There was no main effect for mean length of utterance (MLU) in the HFA, OO, or TD groups ($M = 9.2, 9.6, 9.7$ words respectively), $F(2,42) = .35$, $p = .70$.

There was no main effect for group for lexical diversity measures among the HFA, OO, and TD groups. The average number of *different* words (word types) used in the narratives were 124.5, 134.1, and 133.3 words for the HFA, OO, and TD groups respectively, $F(2,42) = .34$, $p = .71$. The *type/token* ratio (number of different types of words controlling for narrative length) was 0.51, 0.49, and 0.50 for the HFA, OO, and TD groups respectively, $F(2, 42) = .41$, $p = .67$. Narrative length and lexical diversity characteristics across groups are shown in Table 2.

Story Elements. There was a main effect for group for number of story elements identified, $F(2,42) = 4.74$, $p = .01$. The mean number of story elements identified by the groups was 16.6, 18.4, and 19.9 story elements for the HFA, OO, and TD groups respectively. Post-hoc tests showed that TD participants produced significantly more

story elements than the HFA group (t=-2.89, p=.01), whereas the OO group did not differ significantly different from either the HFA or TD groups.

Narrative Devices. The HFA, OO, and TD groups did not produce many negatives or hedges. There were: 0.05, 0.04, and 0.05 negatives per utterance for the HFA, OO, and TD groups respectively. There were no main effects for group for group, F(2,42)=.440, p=.18. There were 0.05, 0.02, and 0.02 hedges per utterance for the HFA, OO, and TD groups respectively. Group differences were not significant, F (2,42)=2.62, p=.08).

As a whole, the HFA, OO, and TD groups produced an average of 0.10, 0.05, and 0.06 narrative devices per utterance for HFA, OO, and TD groups, respectively, and groups differences were not significant, F (2,42)= 1.78, p= .18.

Causal References and Mental State Expressions. The HFA, OO, and TD groups did not produce many causal references. There were no main effects for group, F(2, 42)= 0.61, p=.55. The mean number of causal references was 0.03, 0.05, and 0.03 per utterance for the HFA, OO, and TD groups respectively.

There were no main effects for group for number of mental state expressions, F(2, 42)= .44, p=.65. The groups produced an average of 0.17, 0.20, and 0.17 mental state references per utterance for the HFA, OO, and TD groups respectively.

Ambiguous pronoun references. There were no main effects for group for total number of pronouns in the narratives, F(2, 42)=.361, p=.70. The means number of pronouns produced were 19.8, 23.0, and 22.7 pronouns for the HFA, TD, and OO groups respectively. The number of ambiguous pronouns was divided by the total number of pronouns to calculate the percent of pronouns that were ambiguous. There was a main

effect for group, F (2, 42)= 4.21, p=.02, with an average of 31%, 18%, and 17% of pronouns that were ambiguous for the HFA, OO, and TD groups respectively. Post-hoc analyses showed that the HFA groups produced a significantly larger percentage of ambiguous pronouns than either the TD (p = .03) or OO (p =.02) groups. There were no significant differences between the OO and TD groups (p=.81).

Dysfluency. There was a main effect for group for the number of repetitions per utterance, F (2,42)= 3.19, p= .05, with an average of 0.33, 0.14, and 0.11 repetitions per utterance for the HFA, OO, and TD groups, respectively. The HFA group produced significantly more repetitions than the TD group, (t=2.01. p=.05). The OO group did not significantly differ from either the HFA (p=.54) or TD groups (p=.10).

There was a main effect for the number of self-corrections in the narratives, F (2,42)= 3.76, p= .03. The HFA, OO, and TD groups made an average of 0.19, 0.24, and 0.10 self-corrections per utterance. Post-hoc analyses showed that both the HFA (p=.05) and OO (p<.01) groups made significantly more self-corrections than the TD group. There was no significant difference between the HFA and OO groups (p=.45).

The dysfluency composite consisted of the number of repetitions and self-corrections in the narratives. There was a main effect for group, F (2,42)= 3.23, p= .05), with an average of 0.52, 0.38, and 0.21 repetitions and self-corrections per utterance for the HFA, OO, and TD groups. The HFA (p=.03) and OO (p=.05) groups had significantly more repetitions and self-corrections than the TD group. There was no significant difference between the OO and HFA groups (p=.33).

Filler words (such as ‘uh’ and ‘um’) were analyzed separately. There was no main effect for group, F (2,42)= 1.69, p= .20. The HFA, OO, and TD groups had a mean number of 0.04, 0.15, and 0.10 fillers per utterance.

See Table 3 for a summary of results relating to: number of story elements, use of narrative devices, causal references and mental state expressions, pronoun use, and dysfluency.

Naming characters. The logistic regression model was significant, $\chi 2$= (2, N=45)= 11.92, p<.01, indicating that it was possible to distinguish between participants who did and did not name the characters; this explained between 23.3% (Cox and Snell R square) and 31.3% of the variance (Nagerlkerke R squared) and correctly classified 73.3% of the cases. The odds ratio between the TD and HFA groups was 17.88, suggesting that the TD group was almost 18 times more likely to name the characters in their narratives than the HFA group (p<.01). The OO group did not differ from either HFA, p =.11, or TD, p =.06, groups. See Table 4.

Idiosyncratic language and unusual references. The logistic regression model was significant, $\chi 2$= (2, N=45)= 10.85, p<.01, indicating the model was able to distinguish between participants who did and did not have idiosyncratic language in their narratives. The model explained between 21.4% (Cox and Snell R square) and 29.4% (Nagerlkerke R squared) of the variance and correctly classified 71.1% of the cases. The HFA group was 21 times more likely than the TD group to have idiosyncratic language in their narratives (p<.01), and the OO group was 9.33 more likely than the TD group to have idiosyncratic language (p=.05). There was no significant difference between the OO and HFA groups (p=.29). See Table 5.

Group membership did not predict whether the participants had odd specific references not apparent from the pictures ("unusual references"), $\chi 2= (2, N=45)= 3.83$, p=.15. See Table 6.

The *abnormal language and references* composite assessed whether group membership could predict whether a participant used either idiosyncratic language or made an unusual reference. The logistic regression model was significant, $\chi 2= (2, N=45)= 9.69$, p<.01, and explained 19.4% (Cox and Snell R square) to 26.0% of the variance (Nagerlkerke R squared) and correctly classified 68.9% of the cases. The HFA group was 13 times more likely to use abnormal language or make unusual references than the TD group. The OO group did not significantly differ from the HFA group (p-.27). The difference between the OO and TD group was marginally significant (p=.06, odds ratio=5.69). See Table 7.

See Table 8 for a summary of results relating to the naming of characters, idiosyncratic speech, and unusual references in the narratives of HFA, OO, and TD individuals.

Covariance Analyses

Analyses of covariance (ANCOVAS) were performed on all the factors above, covarying for age, FSIQ, NVIQ, and VIQ respectively to determine whether controlling for age and cognitive factors would eliminate group differences. Controlling for age did not eliminate any group differences. Controlling for FSIQ, NVIQ, and VIQ respectively did not eliminate group differences for ambiguous pronouns, self-corrections, naming characters, idiosyncratic language, or the abnormal language composite, and the relationship between groups remained the same. For story elements, controlling for FSIQ,

NVIQ, and VIQ resulted in p= .06, .12, and .04 respectively. For repetitions, controlling for FSIQ, NVIQ, and VIQ resulted in p= .06, .04, and .12 respectively. For the overall dysfluency composite, controlling for FSIQ, NVIQ, and VIQ resulted in p= .09, .05 and .12 respectively.

Correlational Analysis

Narrative characteristics and executive functioning. Bivariate correlational analyses were conducted between all narrative characteristics and the *Brief Rating Inventory of Executive Function (BRIEF). BRIEF* data was only available for 14 HFA, 15 TD, and 10 OO individuals. The number of story elements negatively correlated with executive functioning deficits, with moderate correlations, in the following areas*:* *General Executive Composite, Meta Cognition Index, Inhibition, Initiation, Plan/Organization,* and *Working Memory*. This indicates that including more story elements in the narratives was associated with fewer executive functioning deficits in these areas. Ambiguous pronoun use positively correlated with the following executive functioning deficits, with moderate correlations: *General Executive Composite, Meta Cognition Index, Inhibition, Plan/Organization,* and *Working Memory*. This indicates that greater ambiguous pronoun use was associated with greater deficits in executive functioning. Repetitions per utterance was also positively correlated with the following factors, with moderate correlations: *General Executive Composite, Meta Cognition Index, Shifting, Emotional Control, Inhibition, Initiation* and *Working Memory*. Self-corrections per utterance was moderately correlated with deficits in *Inhibition*, $r(43)=.36$, $p=.03$, and fillers were negatively correlated with deficits in ability to *Plan/Organization,* $r(43) = -$

..32, $p < .05$, and *Organization of Materials*, $r(43) = -.40$, $p < .01$. Significant correlations between narrative measures and the *BRIEF* are presented in Table 9.

Discussion

The current study examined language functioning and pragmatic language skills in a group of children and adolescents with a previous diagnosis of autism that no longer meet diagnostic criteria for autism (optimal outcome, or OO), a group of well-defined high-functioning children with autism (HFA), and their typically-developing (TD) peers. Because standardized testing may not reveal subtle language deficits, we analyzed a spontaneous narrative.

As predicted, there were no significant differences among the HFA, OO and TD groups with respect to narrative length and lexical diversity. All three groups had well-developed morphological and syntactic language skills. Consistent with previous research (e.g., Capps et al., 2000) there was no difference in the use of narrative devices such as negatives and hedges; in the number of references made to characters' emotions and cognitive states; and in the causal references made in the narratives. There were few references to mental and emotional states and very few causal references in the narratives, across all individuals, which prevented an exploration of causal attribution to characters' emotional and cognitive states, which had previously been found to be less common in the narratives of children with high-functioning autism (Capps et al., 2000).

The two areas where both the OO and HFA children and adolescents showed deficits relative to TD peers were in idiosyncratic language and dysfluency. Individuals with ASD produce more idiosyncratic language, potentially reflecting their more limited understanding of conventional ways of speaking. In this study, the HFA group was 21

times more likely to produce idiosyncratic language than their TD peers, and the OO group was nine times more likely than the TD group to do so. There was no significant difference between the OO and HFA groups. Furthermore, qualitative analysis of the subset of OO individuals with idiosyncratic language suggested that it was similar in quality to that in the HFA group (e.g., "human resistance team" by an OO child or "human suburb" from an HFA participant). The OO group also produced overly formal language ("excited by this new phenomenon"), neologisms ("electronical wires") and scripted speech ("stay tuned for the sequel!"). Nevertheless, idiosyncratic language was only observed in a subsample of OO individuals. This suggests that while individuals in the OO group no longer meet criteria for an ASD, a significant subset (6 out of 15) continues to produce idiosyncratic language.

In contrast, there were no significant group differences in the number of people in each group who made specific references to things or events outside of what was apparent from the book. However, a qualitative examination suggested that a subset of OO (4 out of 15) and HFA (5 out of 15) children and adolescents did produce unusual references, including references to movies and TV shows like "A Bug's Life," "Jeopardy" and "Men in Black," and references to specific institutions such as "the Department of Homeland Security;" only one TD participant made such reference. These participants may be relying less on pictures in the book and instead going with their own thoughts and interests, including introducing intense specific interests even when they are not directly relevant to the story.

The OO and HFA group produced significantly more dysfluencies (especially self-corrections) than the TD group. However, OO and TD individuals did not differ in

the number of repetitions, whereas the HFA group produced significantly more than both. This finding is consistent with the suggestion that repetitions are more *speaker-oriented*, which may be associated with deficits in theory of mind (Lake et al 2011). However, while Lake and colleagues (2011) found fewer self-corrections in adults with HFA, the current study found that both HFA and OO groups produced more self-corrections in their narratives than their TD peers. Therefore, there may be other reasons that the HFA and OO individuals produced more self-corrections. For example, self-corrections may reflect more general language deficits (Sherratt, 2007); they may also reflect greater impulsivity and deficits in other executive processes. Consistent with the latter hypothesis, there was a positive correlation between executive functioning deficits in inhibition, working memory, initiation, and shifting, and greater number of repetitions and self-corrections in the subsample of participants who had completed the BRIEF (n=14 HFA, 10 OO; 15 TD). Those who had more difficulty with inhibition, working memory, initiating activities, and task shifting were more dysfluent. This profile is also consistent with the presentation of a sample of children with optimal outcome who had residual deficits associated with ADHD, a condition associated with impulsivity and executive functioning deficits (Fein et al., 2005). In contrast, people who had more difficulty with organization and planning used fewer filler words. This is consistent with Lake and colleagues (2011), who suggested that filler words such as “uh,” or “um” might signal a break while the narrator tries to plan the narrative.

Three areas where the HFA group significantly differed from the TD group, but where the OO group did not, were in the analyses of story elements, ambiguous pronouns, and naming of story characters. More specifically, the HFA group utilized

fewer story elements than the TD group, while the OO group did not significantly differ from either group. This is consistent with previous studies that found that children with HFA were less likely to mention central themes in their narratives (Loveland et al., 1990). Instead, HFA participants were more likely to stray from the book and tell stories containing aspects and themes that *they* were interested in. Furthermore, HFA individuals were more likely to misinterpret parts of the story (thus not properly attending to the cues in the book), such as mistaking the grandmother as being awake when she was sleeping.

Current data suggests that children and adolescents with HFA are less likely to clearly communicate which characters they are referring to when telling the examiner the story, despite standardized language and IQ scores generally in the average to high average range. Therefore, ambiguous pronoun use is a potentially salient and subtle marker of an aspect of pragmatic language ability and theory of mind. However, executive functioning may also be implicated in this process: when one tells a story, one needs to maintain and update one's representation of who has been mentioned at all, and mentioned more recently, a process that seems potentially linked to broader executive functioning processes. Consistent with this hypothesis, there was a moderate correlation between worse scores in working memory and planning and organization and greater number of ambiguous pronouns in the narratives. It is possible that both executive functioning and theory of mind deficits are contributing to this finding.

HFA individuals were significantly less likely to name the characters in the story than their OO or TD peers. This may have to do with how the story-telling task was administered. During the task, the examiner introduced “Mr. Turtle” as one of the characters in the story; TD and OO children and adolescents were more likely pick up on

this cue and talk about "Mr. Turtle" and name other characters in the story. Furthermore, naming characters in a story makes the story more engaging for the listener; a previous study found that children with HFA were more likely to refer to characters in the story in a more formal or distant manner (Losh & Capps, 2003). Likewise, in this sample, HFA individuals were more likely to refer to the characters as "the man" or "the human" instead of giving them names. To date, there has not been a previous study that has evaluated whether participants would adopt an examiner's name for characters. This is a potential area of future study.

Implications for Treatment

Children and adolescents with a former diagnosis of autism who no longer meet criteria for autism have few residual language and socio-cognitive deficits as measured by narratives. The two areas where they performed significantly differently from controls were greater use of idiosyncratic language and greater dysfluency in their narratives. There were also variables (story elements, repetition) in which, although the OO group did not significantly differ from their TD peers, they also did not differ from their HFA peers: their performance fell between the two groups. Future research should explore whether these factors impact the daily functioning of these individuals. There may be a subsample of children and adolescents, who despite losing an autism diagnosis, would continue to benefit from extra services such as speech therapy. There is also the possibility that some OO children are perceived as more idiosyncratic by their peers. Given their strong social skills, and the presence of typical numbers of friendships and peer relationships, it is possible that their social skills permit them to compensate for such "quirkiness."

The children with HFA also had greater idiosyncratic language and dysfluency in their narratives. They used more ambiguous pronouns and were less likely to name characters, indicating continued deficits in socio-cognitive functioning despite general IQ and language in the average range. Therefore, despite strengths in general language and cognitive functioning, this group will continue to benefit from interventions aimed at improving social and communication skills.

Strengths and Limitations of the Study

While one of the strengths of the study was that the participants told the story while looking at the book, thus limiting working memory demands, this methodology also has its limitations. Because the participants were looking at the book for the first time when telling the story, the researcher did not have an opportunity to evaluate how the participants structured the story and what meaning or themes they may have incorporated into the story. Furthermore, a story-telling task comes with some structure: the participants are using a book to guide story-telling. While this provides important consistency across narrations, permitting comparison, children may perform differently in less-structured conversation. We hypothesize that the HFA group benefits most from such structure, and that a more spontaneous conversational interaction would highlight more strongly their pragmatic language difficulties.

Additionally, while the study found differences among the groups, it is unclear in what way these factors are related or how some of these findings manifest in day-to-day life. For example, OO children and adolescents utilized more idiosyncratic language than the TD group. However, it is unclear how this idiosyncratic language is interpreted by others or how frequently it occurs in everyday conversation. Idiosyncratic language could

be perceived as "odd" by others and more formal language could distance the speaker from the listener. However, it is possible that the optimal outcome group has learned to compensate for these factors through the use of other developed social skills, such as humor. Therefore it is unclear whether OO individuals will continue to display subtle social deficits and have a harder time "fitting in" with peers, or whether these children with idiosyncratic language may be more likely to be considered "quirky" or "creative" rather than "odd." Therefore, a future study would be to analyze how these optimal outcome children are perceived by peers and the quality of peer friendships.

There are sample characteristics that could serve as limitations. First is the small sample size of 15 participants per group. There could be variability as to specific outcomes within the "optimal outcome" group; a larger sample would allow a researcher to subgroup OO individuals by evaluating their pattern of strengths and weaknesses.

This study also has considerable strengths. First is that the OO, HFA, and TD groups were very well-characterized and defined. Furthermore, the HFA and TD groups were very high-functioning, such that the IQ and language functioning were in the average range or above. Therefore, language deficits should play less of a role in determining the quality of the narrative than in other studies of narratives in children with autism. Rather, we were able to investigate how socio-cognitive factors and executive functioning (rather than language factors) could impact the quality of a narrative.

Furthermore, few studies have been conducted on narrative abilities of high-functioning children and adolescents with autism, and only two known studies have been conducted on narrative abilities in optimal outcome children. Therefore, this study adds to the literature in terms of better understanding socio-cognitive functioning of a high-

functioning group of children and adolescents with autism, as well as of a strictly-defined group of children and adolescents who had a former diagnosis of autism but no longer meet diagnostic criteria for autism.

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Table 1 Demographic, IQ, CELF, and Vineland Adaptive Behavior Scores for HFA, OO, and TD participants

	HFA (SD) (n=15)	**OO (SD)** (n=15)	**TD(SD)** (n=15)	**F**	***p***	**Post-Hoc Test (p-values)**
Age (range)	12.9 (1.6) (10.5-15.7)	12.4 (1.8) (9.3-15.6)	13.0 (1.6) (9.9-15.6)	.50	.61	
Sex Ratio (M/F)*	14/1	12/3	13/2		.56	
Full Scale IQ (FSIQ) (range)	104.6 (11.0) [1] (80-117)	112.0 (15.2) (82-134)	116.3 (12.1) (101-142)	3.00	.06	
Nonverbal IQ (NVIQ) (range)	105.9 (12.9) [1] (78-120)	110.6 (15.6) (87-131)	118.4 (12.7) (89-139)	3.06	.06	
Verbal IQ (VIQ) (range)	102.6 (14.6) [1] (81-133)	110.8 (16.1) (80-137)	112.1 (14.1) (93-136)	1.70	.20	
CELF (range)	99.8 (14.5) [1] (70-124)	109.5 (12.9) (79-126)	120.9 (7.4) [a] (109-132)	10.79	<.001	HFA<TD OO<TD OO=HFA
Vineland Communication (range)	85.2 (12.4) (51-100)	94.4 (11.9) (79-110)	93.9 (7.9) [a] (85-115)	3.27	.04	HFA<TD OO=TD OO>HFA
Vineland Socialization (range)	80.9 (16.7) (54-119)	98.8 (7.6) (80-109)	103.6 (8.5) (91-119)	15.67	<.001	HFA<TD OO=TD OO>HFA

[1] Data only available for n=14 participants

*Pearson chi-square

Table 2 Narrative Length and Lexical Diversity in Narratives of HFA, OO, and TD Participants

	HFA (SD) (n=15)	**OO (SD)** (n=15)	**TD(SD)** (n=15)	**F**	***p***	**Post-Hoc Test (p-values)**
Total Number of Words (Word Tokens)	247.1 (83.3)	279.5 (89.2)	276.3 (113.1)	.516	.60	
Number of different words (Word Types)	124.5 (34.5)	134.1 (31.2)	133.3 (40.2)	.340	.71	
Number of Utterances	27.4 (8.3)	29.2 (8.8)	28.4 (8.6)	.166	.85	
Mean Length of Utterance (MLU)	9.2 (2.0)	9.6 (1.6)	9.7 (1.8)	.354	.70	
Type/Token ratio	.513 (.056)	.493 (.069)	.501 (.056)	.406	.67	

Table 3 Narrative Characteristics of HFA, OO, and TD Participants

	HFA (SD) (n=15)	**OO (SD)** (n=15)	**TD(SD)** (n=15)	**F**	***p***	**Post-Hoc Test (p-values)**
Story Elements	16.6 (3.7)	18.4 (2.6)	19.9 (2.5)	4.74	.01	HFA<TD OO=TD OO=HFA
Negatives	.05 (.05)	.04 (.04)	.05 (.06)	.440	.65	
Hedges	.05 (.07)	.02 (.04)	.01 (.02)	2.62	.08	
Narrative Devices composite (Negatives and Hedges)	.10 (.08)	(.05) (.05)	.06 (.06)	1.78	.18	
Causal References	.03 (.04)	.05 (.06)	.03 (.06)	.610	.55	
Mental State Expressions	.17 (.10)	.20 (.10)	.17 (.12)	.439	.65	
Number of Pronouns in Narrative	19.8 (12.4)	23.0 (8.9)	22.7 (12.7)	.361	.70	
Ambiguous Pronouns (Percentage of pronouns that were ambiguous)	31% (16.6%)	18% (10%)	17% (15%)	4.21	.02	HFA>TD HFA>OO OO=TD
Repetitions	.33	.14	.11	3.19	.05	HFA>TD OO=TD OO=HFA
Self-Corrections	.19	.24	.10	3.76	.03	HFA>TD OO>TD OO=HFA
Dysfluency Composite (Repetitions	.52 (.48)	.38 (.24)	.21 (.21)	3.23	.05	HFA>TD

and Self-Corrections)					OO>TD OO=HFA
Filler Words	.04 (.13)	.15 (.20)	.10 (.12)	1.69	.20

Table 4
Logistic Regression Predicting Likelihood of Group Membership (HFA, OO, TD)
Likelihood of Naming the Characters in their Narratives[1]

	B	S.E.	Wald	df	*p*	Odds Ratio	95.0% C.I. for Odds Ratio	
							Lower	Upper
HFA			9.30	2	.010			
TD	2.88	.96	9.06	1	<.01	17.88	2.73	116.88
OO	1.47	.93	2.52	1	.11	4.33	.94	34.46
Constant	-1.87	.76	6.07	1	.014	.154		

[1]compared to HFA group
(no sig dif b/w OO and TD group)

Table 5
Logistic Regression Predicting Likelihood of Group Membership (HFA, OO, TD)
Likelihood of using Idiosyncratic Language[1]

	B	S.E.	Wald	df	*p*	Odds Ratio	95.0% C.I. for Odds Ratio	
							Lower	Upper
TD			6.94	2	.03			
OO	2.23	1.16	3.70	1	.05	9.33	.958	90.94
HFA	3.05	1.16	6.87	1	<.01	21.00	2.16	204.61
Constant	-2.64	1.04	6.50	1	.01	.071		

[1]compared to TD group
(no sig dif b/w OO and HFA groups)

Table 6

Logistic Regression Predicting Likelihood of Group Membership (HFA, OO, TD)

Likelihood of having Unusual References[1]

	B	S.E.	Wald	df	*p*	Odds Ratio	95.0% C.I. for Odds Ratio	
							Lower	Upper
TD			2.78	2	.25			
OO	1.63	1.19	1.88	1	.17	5.09	.50	52.29
HFA	1.95	1.17	2.76	1	.10	7.00	.71	69.49
Constant	-2.64	1.04	6.50	1	.01	.071		

[1]compared to TD group
(no sig dif b/w OO and HFA groups)

Table 7

Logistic Regression Predicting Likelihood of Group Membership (HFA, OO, TD)

Abnormal Language and References Composite[1]

	B	S.E.	Wald	df	*p*	Odds Ratio	95.0% C.I. for Odds Ratio	
							Lower	Upper
TD			7.51	2	.02			
OO	1.74	.92	3.58	1	.06	5.69	.94	34.5
HFA	2.57	.94	7.50	1	.006	13.00	2.07	81.5
Constant	-1.87	.76	6.07	1	.01	.154		

[1]compared to TD group
(no sig dif b/w OO and HFA groups)

Table 8

Idiosyncratic Language	9/15[a]	6/15[b]	1/15[a, b]	HFA>TD OO>TD OO=HFA
	HFA (SD) (n=15)	**OO (SD) (n=15)**	**TD(SD) (n=15)**	
Unusual References	5/15	4/15	1/15	
Named Characters	2/15[a]	6/15	11/15[a]	HFA<TD
Abnormal Language Composite (Use of Idiosyncratic Language and/or Unusual References)	10/15[a]	7/15	2/15[a]	HFA>TD OO=TD OO=HFA

Number of People who Named Characters, had Idiosyncratic Language, and made Unusual References in their Narratives

[a] p<.01
[b] p=.05

Table 9 Significant Correlations[1] Between Narrative Measures and Executive Functioning (BRIEF)

	Number of Story Elements	Percent Ambiguous Pronoun	Repetitions Per Utterance	Self-Corrections Per Utterance	Fillers
BRIEF GEC	-.35*	.39**	.40**		
BRIEF META COG	-.40**	.37*	.37*		
BRIEF Shift			.38*		
BRIEF Emotional Control			.33*		
BRIEF Inhibition	-.35*	.43**	.34*	.36*	
BRIEF Initiation	-.38**		.43**		
BRIEF Organization					-.40*
BRIEF Plan/Organization	-.40**	.36*			-.32*
BRIEF Working Memory	-.32*	.36*	.36*		

[1]N=14 HFA, 10 OO, and 15 TD
*p<.05
**p ≤01
*** p<.001

Appendix I

Coding of Story Elements

Page 1
1) Something about Mr. Turtle (how he feels, what he does)
2) Frogs flying on lily pads

Page 2
3) Frogs doing tricks/having fun on lily pads
4) Frogs scaring/chasing birds

Page 3
5) Frogs flying/floating (toward houses, etc)

Page 4
6) Man eating a sandwich
7) Man sees frog
8) Frog waves at man

Page 5
9) Frog flying into clothesline

Page 6
10) Frog with cape
11) Frogs flying through window
12) Frogs flying through chimney

Page 7
13) Grandmother sleeping
14) Frogs watching TV
15) A frog changing the channel with his tongue

Page 8
16) A frog flying
17) A dog chasing the frog

Page 9
18) Frogs chasing the dog

Page 10

19) Frogs and lily pads falling/ frogs landing on houses

Page 11

20) Frogs fall

21) Frogs are back in the water

Page 12

22) Detective investigating/trying to figure out what happened

23) Dog sniffing lily pad (or mention of the dog)

24) Mention of police, ambulance, other dogs.

25) Man telling the newswoman what had happened

Page 13

26) Shadow by the barn

27) The sun is setting

Page 14

28) Pigs are flying