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Narrative Language and the Use of Story Grammar and Evaluative Language in Children with
Williams Syndrome and 7q11.23 Duplication Syndrome

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Abstract

7q11.23 Duplication syndrome (Dup7) is a neurodevelopmental disorder caused by a duplication of the same set of genes that are typically deleted in individuals with Williams syndrome. As a result of this genetic difference, Williams syndrome and Dup7 tend to present differently in individuals, particularly in terms of cognitive characteristics, social behaviors, and language development. The purpose of this study was to gain a better understanding of these differences and their possible clinical implications by comparing narrative language samples from children with Dup7 to those from children with Williams syndrome. Video recordings of 45 children, ages seven to thirteen, telling a narrative using the wordless picture book, *Frog, Where are You?*, were used for the purposes of this project. Fifteen children with a Dup7 diagnosis were matched with one set of 15 children with Williams syndrome by expressive vocabulary level, and another set of 15 children with Williams syndrome by chronological age. Participant narratives were compared on the basis of several narrative measures including: (1) story length, (2) frequency of morphological (word grammar) errors, (3) elements, (4) the establishment and comprehension of the search theme, and (5) the use of evaluative language. The differences observed between the Dup7 and Williams syndrome narratives reflect the unique cognitive and social profiles typical of each disorder. Participants with Dup7 showed relative strengths in measures related to cognitive functioning, including maturity of story grammar, comprehension of search theme, and frequency of cognitive inferences made. Participants with Williams syndrome showed relative strengths in their use of evaluative language, particularly social engagement devices. Overall, the differences observed between Dup7 and Williams syndrome groups, as well as among participants within each group, speak to the importance of viewing each child as an individual with unique strengths and challenges.

Narrative Language and the Use of Story Grammar and Evaluative Language in Children with
Williams Syndrome and 7q11.23 Duplication Syndrome

Introduction

Williams syndrome and 7q11.23 Duplication syndrome, more commonly known as Dup7, are neurodevelopmental disorders affecting the genetic makeup of chromosome 7. Williams syndrome is estimated to occur in 1 out of 7,500 live births, and is caused by a microdeletion of about 26 genes on chromosome 7 (Stromme, Bjørnstad, & Ramstad, 2002). Dup7 is caused by a duplication of the same set of 26 genes that are typically deleted in individuals with Williams syndrome, and it is estimated to occur in somewhere between 1 in 7,500 to 1 in 20,000 live births (Berg et al., 2007). As a result of the genetic difference in the makeup of chromosome 7, the two syndromes present differently in individuals, particularly in terms of cognitive characteristics, social behaviors, and language development.

Individuals with Williams syndrome tend to have a mild to moderate intellectual impairment (Bellugi, Lichtenberger, & Jones, 2000; Stromme et al, 2002), while individuals with Dup7 tend to fall in the lower end of the average range on General Conceptual Ability, a measure similar to IQ (Velleman & Mervis, 2011). Children with Williams syndrome are extremely social and appear to have relatively strong expressive language skills (Bellugi et al., 2000); yet they have difficulty maintaining relationships, which may be linked to their struggle with pragmatic, or social, language (Hoffmann, Martens, Fox, Rabidoux, & Andridge, 2013). In contrast, children with Dup7 Syndrome typically have a severe speech delay and often experience extreme social anxiety; yet they appear to demonstrate appropriate non-verbal pragmatic skills in comfortable situations (Velleman et al., 2011).

More research is needed comparing the language of children with Williams syndrome to that of children with Dup7 to gain a better understanding of how the linguistic, cognitive, and social differences observed between the two syndromes affect overall communicative competence. Narrative productions are an ideal context in which to study language and communication skills because storytelling yields a quasi-naturalistic spontaneous speech sample that integrates social knowledge with linguistic and cognitive abilities (Reilly et al., 2004). Additionally, narrative skills play a significant role in classroom learning, particularly for younger children, and are important for effective everyday communication. (Losh, Bellugi, & Anderson, 2001; Norbury & Bishop, 2003; Reilly, Losh, & Bellugi, 2004).

Significance

Examining the narrative productions of children with Williams syndrome and Dup7 syndrome provides important insight into the areas of communication that these individuals excel in, and the areas of communication that could be improved upon through speech-language therapy. Because Williams syndrome and Dup7 differ in terms of linguistic, cognitive, and social profiles, an intervention strategy that works for a child with Williams syndrome might not necessarily be effective for a child with Dup7. Treatment plans must be individualized and carefully constructed so as to maximize the outcome for clients.

Although Williams syndrome has been well researched, much less is known about Dup7 and research comparing the two disorders is even sparser. The findings from this study help to fill the gaps in the literature and further document the complex characteristics typically associated with Williams syndrome and Dup7. Learning more about the similarities and differences between Williams syndrome and Dup7 has important clinical implications that could eventually lead to improved effectiveness of speech-language therapy for the individuals affected

by these disorders. Maximizing the outcome of speech-language therapy will help children with Williams syndrome and Dup7 to learn and participate more effectively in the classroom, to form and maintain peer relationships, and to develop essential communication skills.

Purpose Statement

The purpose of this study was to examine and compare the narrative language of children with Williams syndrome and children with 7q11.23 Duplication syndrome (Dup7). Previously recorded DVDs of 45 children, ages seven to thirteen, were used for the purposes of this project. Participants were instructed to tell a story using the wordless picture book, *Frog, Where Are You?* by Mercer Mayer (1969), as a guide. The DVDs of the children's narrative productions were originally filmed at the University of Louisville in Kentucky as a part of a larger ongoing set of studies headed by Dr. Carolyn Mervis (John & Mervis, 2010; Mervis & Velleman, 2011; Velleman & Mervis, 2011). The participants with Dup7 were matched with one group of participants with Williams syndrome by language age (based on Expressive Vocabulary Test (EVT) scores), and another group of participants with Williams syndrome by chronological age.

Research Questions

1. Does the narrative language of children with Williams syndrome differ from the narrative language of children with 7q11.23 Duplication syndrome (Dup7)?
2. If so, in what ways does the narrative language of children with Williams syndrome differ from the narrative language of children with Dup7?

Several variables were examined in participant narratives for the purposes of this study, including: (1) the length of the narrative, (2) the frequency of morphological (word grammar) errors made, (3) the inclusion of story grammar elements, (4) the establishment and comprehension of the search theme, and (5) the use of evaluative language to show how the child

connected with both the story and with the audience. The research questions were applied once to the language age-matched group and once to the chronological age-matched group.

Key Terms

7q11.23 Duplication Syndrome

a neurodevelopmental disorder caused by a duplication of about 26 genes on chromosome 7

Evaluative Language: how the narrator connects with the story and with the audience

(Losh, Bellugi, & Anderson, 2001)

Affective States/Behaviors

conveying an understanding of characters' emotions/feelings through the use of words like "feel, happy, sad," etc.

Cognitive Inferences

describing characters' mental states and motivations; inferring causality

Hedges

indicating a level of uncertainty

Intensifiers

language and repetition intended to add emphasis

Social Engagement Devices

interaction with audience, use of sound effects, character speech

Morphological Errors

word grammar errors; include errors in: pronouns, auxiliaries (helping verbs), determiners (*the, a, etc.*), noun plurals, verb tenses, number markings, and prepositions

Story Grammar

the necessary components involved in telling a story including an introduction, setting the scene, describing the main events, and presenting a resolution at the end of the story (Reilley, Bates, & Marchman, 1998)

Williams Syndrome

a neurodevelopmental disorder caused by a microdeletion of about 26 genes on chromosome 7

Literature Review

Introduction

This section describes the literature relevant to the narrative language skills of children with Williams syndrome and 7q11.23 Duplication syndrome. The literature was primarily reviewed by using several online databases spanning diverse subject areas. The PubMed and

Web of Science databases were searched for resources on the genetics of Williams syndrome and 7q11.23 Duplication syndrome. Key words such as *Williams syndrome* and *7q11.23 Duplication syndrome* were used in conjunction with other search terms including: *genetics, language disorders, social profile, cognitive profile, etc.* Additionally, Online Mendelian Inheritance in Man, or OMIM, an online catalogue for human genetic disorders, also provided relevant information about the genetics of the two syndromes featured in this study.

To find information relating to story grammar, narrative language, and language impairments, the Linguistics and Language Behavior Abstracts (LLBA), Education Resources Information Center (ERIC), and Psych Info databases were searched. Search terms included *narrative language, story grammar, evaluative language, language impairment, pragmatic language, pragmatic language impairment, speech therapy, and speech-language intervention.* These same databases were also searched for studies that used Mercer Mayer's, *Frog, Where Are You?* (1969). Many studies in many languages exist using this design, so results were narrowed down by using terms such as: *English, children, Williams syndrome, Dup7, typically developing, story grammar, narrative language, pragmatic language, and language impairment.* Additionally, a book containing a collection of *Frog, Where Are You?* studies provided useful information.

The following review of literature is organized into 4 main sections: (1) Williams syndrome, (2) 7q11.23 Duplication syndrome, (3) Narrative Language & Story Grammar, and (4) Previous Research Using *Frog, Where Are You?*. Each section is further divided into subsections. At the end of each section, the relevance of the literature to the study design and research questions addressed in this thesis project will be discussed.

Williams Syndrome (WS)

Background. Williams syndrome is neurodevelopmental genetic disorder caused by a microdeletion of about 26 genes in what is referred to as the Williams-Beuren region of chromosome 7 (Bellugi et al., 2000; Haas & Reiss, 2012; Strømme et al., 2002). The genetic deletion observed in Williams syndrome occurs on chromosome band 7q11.23 (Ewart et al., 1993; Korenberg et al., 2000). Williams syndrome is associated with cardiovascular defects, growth deficiency, chronic ear infections, sensitivity to sound, and sometimes hearing loss (Mervis & Velleman, 2011; Morris, Lenhoff, & Wang (Eds.), 2006). Individuals with Williams syndrome often have distinctive facial features including full lips, a wide mouth, small widely spaced teeth, a medial eyebrow flare, and a flat nasal bridge (Bellugi et al., 2000).

Cognitive profile of WS. Individuals with Williams syndrome tend to have a mild to moderate intellectual impairment, with IQ scores falling between 50 and 70 (Bellugi et al., 2000; Strømme et al., 2002). Bellugi et al. (2000) reported that everyday activities involving mathematical computations, such as following a recipe when cooking, making change, and balancing a checkbook, can be challenging for individuals with Williams syndrome. Individuals with Williams syndrome also struggle with higher order cognitive functions involving Theory of Mind (the ability to attribute mental states to oneself and others, and further understand that other people have beliefs and desires different from one's own), perspective taking, and picking up on the mental and emotional states of others (Haas & Reiss, 2012). As a result of the mild to moderate intellectual disability typical of Williams syndrome, children with Williams syndrome may show difficulty making connections between events in a story. Additionally, children with Williams syndrome may struggle to understand the goals and motivations of the characters in a story due to challenges with perspective taking and Theory of Mind.

Linguistic/social profile of WS. Expressive language is a relative strength of individuals with Williams syndrome, which often comes as a surprise considering the mild to moderate intellectual disability typical of the disorder (Bellugi et al., 2000; Mervis & Velleman, 2011). Although quite talkative and expressive, children with Williams syndrome often experience an initial language delay (Bellugi et al., 2000; Mervis & Velleman, 2011; Osbourne & Mervis, 2010). Bellugi et al. (2000) compared children with Williams syndrome to children with Down syndrome (another genetically based disorder), and found that although mature individuals with Williams syndrome had much stronger expressive language skills than their peers with Down syndrome, this difference was not evident in early developmental stages. In the younger age groups, the expressive language of children with Williams syndrome and children with Down syndrome was similarly delayed in comparison to typically developing children (Bellugi et al., 2000). While expressive language delays were similar, the children with Down syndrome seemed to have better receptive language skills than the children with Williams syndrome. Parents reported that children with Down syndrome could understand many words but struggled to produce them, whereas children with Williams syndrome could produce many words, but did not appear to fully understand the meanings of the words (Bellugi et al., 2000).

Individuals with Williams syndrome are eloquent speakers; however, this does not necessarily mean their language skills are on par with those of their typically developing peers. Examining the language of children with Williams syndrome, Mervis & Velleman (2011) reported concrete vocabulary and phonological skills as relative strengths, grammatical abilities as being consistent with overall intellectual functioning, and relational vocabulary and pragmatic language skills as weaknesses. Several researchers who have published studies on Williams syndrome suggest that although individuals with Williams syndrome show an affinity for social

interaction, their pragmatic language skills tend to be significantly impaired (Bellugi et al., 2007; Doyle, Bellugi, Korenberg, & Graham, 2004; Haas & Reiss, 2012; John, Dobson, Thomas, & Mervis, 2012; Laws & Bishop, 2003; Philofsky, Fidler, & Hepburn, 2007). Pragmatic language impairment in individuals with Williams syndrome is likely linked to the difficulty they experience forming and maintaining relationships despite their extremely friendly and hypersocial nature (Hoffmann et al., 2013).

Research using the Test of Pragmatic Language (TOPL-2) and Children's Communication Checklist (CCC-2) assessment tools revealed overall pragmatic language delays in children with Williams syndrome consistent with what is typically observed in children with autism spectrum disorders (Hoffman et al., 2013; John et al., 2012; Laws & Bishop, 2003; Philofsky et al., 2007). Due to the social nature and relatively strong expressive language skills of children with Williams syndrome, pragmatic language impairments are easily overlooked and the need for speech-language therapy is often dismissed (John et al., 2012). Existing literature on children with Williams syndrome advocates for gaining a better understanding of their pragmatic language impairment so it can be targeted more effectively in speech-language therapy (Haas & Reiss, 2012; Hoffmann et al., 2013; Laws & Bishop, 2003; Philofsky et al., 2007). One way to assess a child's pragmatic language is to look at their use of evaluative language throughout a narrative sample. If and how the child engages with both the audience and with the characters in the story could help identify potential pragmatic and communicative weaknesses that can be improved upon through individualized speech-language therapy.

7q11.23 “Dup7” Syndrome

Background. 7q11.23 Duplication syndrome is caused by a duplication of about 26 genes in what is known as the Williams-Beuren syndrome region located on the long arm of

chromosome 7 (Somerville et al., 2005; Osbourne & Mervis, 2010). The 26 genes that are duplicated in individuals with 7q11.23 Duplication syndrome are the same genes that are deleted in individuals with Williams syndrome (Berg et al., 2007; Depienne et al., 2009; Osbourne & Mervis, 2010; Somerville et al., 2005; Van der Aa et al., 2009). 7q11.23 Duplication syndrome is therefore sometimes referred to as “a duplication of the Williams syndrome region,” or “Dup7” (Velleman & Mervis, 2011, p. 1). Based on the prevalence of Williams syndrome, which is about 1 in 7,500 live births (Strømme et al., 2002), and known genetic mechanisms involved in the deletion and duplication of chromosomes, Dup7 is estimated to occur in somewhere between 1 in 7,500 and 1 in 20,000 live births (Berg et al., 2007; Dixit et al., 2012; Van der Aa et al., 2009; Velleman & Mervis, 2010).

The first documented case of Dup7 was discovered by chance in 2005 when an 8-year-old boy with a severe speech delay underwent genetic testing for velocardiofacial syndrome (Somerville et al., 2005). Screening based on a polymerase-chain-reaction (PCR) assay detected a duplication of genes on chromosome 7. Site-specific nucleotide (SSN) dosage analysis confirmed that the duplication occurred in the same region as the deletion observed in Williams syndrome (Somerville et al., 2005). This child was the first confirmed case of Dup7; however, other individuals likely went undiagnosed before him, and will continue to go undiagnosed in the future if research working to better identify the Dup7 phenotype does not continue.

Cognitive profile of Dup7. Individuals with Dup7 syndrome tend to experience a developmental delay as toddlers (ages 1 to 4 years) (Velleman & Mervis, 2011). Velleman & Mervis (2011) evaluated the general intellectual abilities of 25 children with Dup7 syndrome ranging from age 4 to 15 years, and found that the children’s General Conceptual Ability scores ranged from moderate intellectual disability to the high average range, with the mean score

falling in the low average range. Van der Aa et al. (2009) evaluated the IQs of 14 children with Dup7 syndrome, and found that the majority of individuals fell within the mild to moderate intellectual disability range. Two participants showed normal intelligence with IQ scores of 97 and 110 (Van der Aa et al., 2009). Van der Aa et al. (2009), Osbourne & Mervis (2010), and Velleman & Mervis (2011) all found language delay to be a more marked feature of Dup7 than intellectual disability, especially in comparison to the Williams syndrome phenotype. These findings are relevant because the researchers suggest that although children with Dup7 may say fewer words and produce shorter narratives than children with Williams syndrome, children with Dup7 will likely show a better understanding of the plot and theme of the story.

Linguistic/social profile of Dup7. In contrast to individuals with Williams syndrome, individuals with Dup7 tend to be extremely shy and have significant speech-language delays and disorders (Berg et al., 2007, Depienne et al., 2009; Dixit et al., 2012; Osbourne & Mervis, 2010; Somerville et al., 2005; Van der Aa et al., 2009; Velleman & Mervis, 2011). The first child officially diagnosed with Dup7 showed a severe expressive language delay and was only able to pronounce a small set of words at age 8 (Somerville et al., 2005). This individual's receptive and expressive language abilities were tested using the Peabody Picture Vocabulary Test (PPVT), and results showed that while the boy's receptive vocabulary was in the low average range, his expressive vocabulary was in the severe impairment range (Somerville et al., 2005).

As more cases of Dup7 were identified, research continued to show evidence of language delay. All fourteen individuals included in Van der Aa et al.'s (2009) study and all seven individuals included in Dixit et al.'s (2012) study showed evidence of language delay, ranging from mild to severe. Expressive language impairment has been identified as a salient feature of Dup7; however, many individuals with Dup7 also show evidence of receptive language

impairment and verbal dyspraxia, or difficulty with the fine motor skills involved in producing speech (Van der Aa et al., 2009). The individuals with Dup7 initially included in the literature ranged from being essentially non-verbal communicators to having a small set of intelligible words and utterances (Berg et al., 2007; Dixit et al., 2012; Osbourne & Mervis, 2010; Somerville et al., 2005). Some individuals with Dup7 communicated using signs and gestures (Berg et al., 2007; Dixit et al., 2012). As more children have been studied, a wider range of language levels from moderate disability to above average ability has been identified (Velleman & Mervis, 2011). Regardless of the type and severity of language delay, it is important that individuals with Dup7 receive speech-language therapy as early as possible to help them develop essential communication skills (Velleman & Mervis, 2011). The goal of the current study is to contribute to a growing body of knowledge about the speech-language therapy needs of children with Dup7, which will hopefully lead to increased effectiveness in intervention strategies.

Dup7 and autism spectrum disorders. Due to the shyness, social anxiety, and language delay observed in the majority of individuals with Dup7, children with Dup7 are often screened for diagnosis of an autism spectrum disorder (Velleman & Mervis, 2011). Several participants in the studies reviewed were diagnosed with autism spectrum disorders in addition to a Dup7 diagnosis (Berg et al., 2007; Van der Aa et al., 2009). Originally diagnosed with an autism spectrum disorder, a male child screened in Depienne et al.'s (2009) study was found to have a duplication of the chromosomes in the Williams-Beuren region, and was consequently diagnosed with Dup7. Sanders et al. (2011) argue that there is a significant link between Dup7 syndrome and autism spectrum disorders; however, Velleman & Mervis (2011) contend that although children with Dup7 exhibit characteristics consistent with an autism spectrum disorder, they also evidence behaviors that contrast with the typical autism spectrum disorder diagnosis.

As the children with Dup7 involved in Velleman & Mervis's (2011) study became more comfortable in the research setting, they demonstrated a command of pragmatic (social language) skills. The children with Dup7 expressed behaviors not typically observed in children with autism spectrum disorders, including making appropriate eye contact, engaging in imaginative play, and enjoying the social interaction in particularly comfortable situations (Velleman & Mervis, 2011). Velleman & Mervis (2011) suggest that the initial reluctance to participate in social interaction observed in children with Dup7 is likely more strongly correlated with speech-language delays and general anxiety than with an autism spectrum disorder.

The narrative language skills and the use of evaluative language observed in the children with Dup7 participating in this study will provide additional insight into the communicative strengths and weaknesses typical of a Dup7 diagnosis. Understanding the unique communicative abilities of individuals with Dup7 is important for developing appropriate speech-language intervention plans. A treatment plan designed for a child with an autism spectrum disorder, or any other disorder for that matter, might not effectively address the needs of a child with Dup7.

Narrative Language & Story Grammar

Narrative productions provide a rich context for studying language development and communicative strengths and weaknesses. Narratives are an integral part of everyday communication; thus, they provide an ideal quasi-naturalistic sample of spontaneous speech (Reilly et al., 2004). Further, narratives require a greater mastery and a more abstract grasp of the basic building blocks of language than everyday conversational speech does (Green & Klecan-Aker, 2012). The storyteller's ability to use appropriate grammatical devices to set the scene of the story and create a logical sequence of events provides insight into the storyteller's "mastery and deployment of linguistic constructions" (Reilly, Bates, & Marchman, 1998, p.

346). Telling a story goes beyond using appropriate vocabulary and grammar to build a coherent series of events (Ukrainetz et al., 2005). A successful storyteller engages higher-level cognitive and linguistic skills to demonstrate how the events in a story relate to one another, to communicate how each event contributes to the goals and motivations of the characters, and to convey the overarching theme of the story (Losh et al., 2001; Reilly et al., 2004).

Story grammar. Nearly every story follows a basic story grammar structure. Through their research, Labov & Waletzky (1967) identified five main elements of story grammar: 1) orientation, which involves setting the scene and introducing characters; 2) complication, or more simply put, the series of events in the story; 3) evaluation of the events and character actions; 4) resolution, or bringing an end to the events; and 5) coda, which serves as a link between the story and the present moment in which the story is being told.

Stein & Glenn (1975) developed a similar story grammar model made up of a universal hierarchal network of categories. Stein & Glenn (1975) argued that the basic structure of any story is comprised of a setting category followed by an episode system. The setting category includes basic factual information used to introduce the main characters and the context in which the story occurs. Each episode system is defined as “an entire behavioral sequence,” consisting of “external and/or internal events, which influence the character, the character’s internal response, the character’s external response to his goals, and the consequences resulting” (Stein & Glenn, 1975, p. 12). Consistent with the goal-oriented, problem-resolution structure of most stories, each episode contains an initiating action that causes a response in the main character and motivates his behavior throughout the story (Stein & Glenn, 1975). Understanding and communicating the motivation behind a character’s behavior requires perspective taking and engaging social-emotional knowledge (Losh et al., 2001; Ukrainetz et al., 2005). A quality

narrative also includes evidence of “Theory of Mind,” the storyteller’s insight, or lack thereof, into what the characters are thinking and feeling (Bamberg & Damrad-Frye, 1991, p.706).

Analysis of narrative productions therefore accesses information about the social brain of the storyteller.

Evaluative language in narratives. Narratives should be evaluated holistically to examine grammar, vocabulary, and organization as well as strategies to engage both the narrator and the audience with the story (McFadden & Gillam, 1996). Labov & Walenstky (1967) refer to such strategies as “evaluative devices” (p.35). Evaluative devices include: 1) cognitive inferences providing insight into the character’s motivations and behaviors or mental states; 2) social engagement devices such as sound effects, dialogue, and addressing the audience directly; 3) references to affective, or emotional, states and behaviors; 4) hedges indicating a level of uncertainty; and 5) intensifiers adding emphasis (Losh et al., 2001).

Ukrainetz et al. (2005) contend that evaluative language is intrinsic to storytelling. Labov & Walenstky (1967) further argue that the role of evaluative language is as important as the referential, or informative, aspect of telling a narrative. A simple series of events followed by a resolution makes for an uninteresting and seemingly insignificant story. Evaluative language attributes meaning to the individual events and structures the events in a hierarchal way that contributes to the overall coherence of the narrative (Bamberg & Damrad-Frye, 1991; Labov & Walenstky, 1967). The narrator must communicate the message of the story to the audience in a logical and interesting manner, making storytelling a truly social experience (Bamberg & Damrad-Frye, 1991; Reilly et al., 1998; Reilly et al., 2004; Ukrainetz et al., 2005).

Clinical applications of narrative analysis. Children’s narrative productions are worthy of study because narrative language skills are important for everyday communication and

play a significant role in classroom learning, particularly for younger children (Losh et al., 2001; Norbury & Bishop, 2003; Reilly et al., 2004). Narratives serve instructional purposes and provide a context for the development of language and literacy skills (Ukrainetz et al., 2005). A child's ability to both comprehend and formulate a narrative has been strongly linked to socio-emotional development, communicative competence, and academic achievement (Davies et al., 2004; Green & Klecan-Aker, 2012; Hayward & Schneider, 2000; Losh & Capps, 2003). Narrative performance can therefore serve as a predictor of language development and an indicator of risk for future communication-related challenges and academic problems in both typically and atypically developing children (Davies, Shanks, & Davies, 2004; Losh et al., 2001; Paul, Hernandez, Taylor, & Johanson, 1996).

Narrative assessment has become a popular means of examining linguistic, cognitive, and social abilities because it is an engaging and entertaining activity for the child (Norbury & Bishop, 2003). Analyzing a child's mastery of grammar and vocabulary by way of narrative productions is relatively straightforward. It has been well established that children with language impairments tend to struggle with the referential aspect of what is happening during a series of events in a story. However, much less is known about how children with communication-related impairments compare to their typically developing peers in terms of the expressive aspects of storytelling, which involve emotional understanding and the use of evaluative language (Ukrainetz et al., 2005; Ukrainetz & Gillam, 2009). A child's ability to communicate an understanding of the emotions of others is an important predictor of social competence (Van Herwegen et al., 2014).

Linguistic, cognitive, and social deficits observed in children's narrative productions could serve as indicators of communication impairment. For similar reasons, story grammar

analysis has come to play an important role in designing speech-language intervention strategies for children with developmental delays and language disorders (Davies et al., 2004). To better understand how a child with Williams syndrome or Dup7 would benefit from speech-language therapy, the child's communicative competence must be evaluated as a whole, going beyond simple linguistic structures to incorporate theory of mind, emotional expression, and social engagement, all of which naturally occur in storytelling.

Previous Research Using *Frog, Where Are You?*

About *Frog, Where Are You?* It is well documented that narrative productions provide a rich context in which to study the linguistic, social, and cognitive knowledge and abilities of both typical and atypical populations (Bamberg & Damrad-Frye, 1991; Davies et al., 2004; Losh & Capps, 2003; Losh et al., 2001; Norbury & Bishop, 2003; Paul et al., 1996; Reilly et al., 1998; Reilly et al., 2004; Ukrainetz et al., 2005). Elicitation of narratives using wordless picture books is therefore an excellent means of assessing overall communicative competence in children. Personal or imaginative narratives also provide important insight into a child's communicative abilities; however, fiction-based narratives are more structured and therefore allow for a more precise analysis of linguistic, social, and cognitive skills (Bamberg & Damrad-Frye, 1991). One of the most popular stories used in research on narrative language is the 24-page wordless picture book, *Frog, Where Are You?* written by Mercer Mayer (Mayer, 1969). Because of its episodic structure, *Frog, Where Are You?* has been used in research around the world in several different languages and with several different populations (Berman & Slobin, 1994; Losh & Capps, 2003; Losh et al., 2001; Miles & Chapman, 2002; Norbury & Bishop, 2003; Reilly et al., 1998; Reilly et al., 2004).

Frog, Where Are You? is the story of a young boy whose pet frog escapes in the middle of the night. The boy wakes up to find that the frog is missing, so he and his dog set out on an adventure to find the frog. The story chronicles the various obstacles the boy encounters along the way through five main search episodes. In the end, the boy comes across a family of frogs, including the frog that escaped. Children are presented with the book and asked to tell a story using the pictures as a guide. This may seem like a fairly straightforward task; however, “linking the events in the book and understanding the relationship between them requires that the child infer a great deal of information that is not readily apparent from the pictures on the page” (Reilly et al., 1998, p.347). The child must engage linguistic, cognitive, and social knowledge in order to successfully demonstrate an understanding of how each search episode relates to the overall theme.

Variables of interest in frog story studies. Common variables examined in studies on narrative language that use the book, *Frog, Where Are You?* include: narrative length, measures of grammatical competence and complexity, coherence and overall structure of the narrative, and the use of evaluative language (Bamberg & Damrad-Frye, 1991; Losh et al., 2001; Losh & Capps, 2003; Norbury & Bishop, 2003; Reilly et al., 1998; Reilly et al., 2004). In all of the studies reviewed, narrative length was measured in propositions, or simple clauses corresponding to a single event. In studies involving atypically developing populations with various language and cognitive delays, propositions were commonly used as the unit of analysis in calculations because the lengths of the narratives were expected to vary significantly (Reilly et al., 2004).

The coherence and overall structure of a *Frog, Where Are You?* narrative appears to be assessed most effectively using the story grammar points system originally operationalized in Reilly et al.’s (1998) study. Story grammar was scored using a scale ranging from 0-8 points.

Participants received two points for setting and instantiation (mentioning that the frog escapes and the boy goes looking for him), one point for each of the five search episodes (interactions with the bees, gopher, owl, and deer, and falling in the pond), and one point for the resolution, which occurs when the boy finds the family of frogs (Reilly et al., 1998). In addition to those eight points, children could receive up to four points for establishing and maintaining the search theme of the story. Participants received one point for mentioning that the frog was missing, one point for mentioning that the boy went looking for him, one point for one or two additional mentions of the search theme, and one point for three or more additional mentions of the search theme (Reilly et al., 1998).

Varying language abilities among populations with speech delays and cognitive delays were taken into consideration when establishing scoring guidelines. Miles & Chapman (2002) anticipated that the narratives of the children with Down syndrome involved in their study might be affected by restricted syntactic and lexical skills, so they developed scoring criteria to ensure that narrative elements would not be overlooked due to a lack of advanced syntactic and lexical understanding. Stories were judged based on content rather than the complexity of utterances, a rich interpretation of events was used, and vocabulary limitations were accommodated by counting inexact lexical items when appropriate (e.g., moose/deer, rat/gopher) (Miles & Chapman, 2002).

Relevant findings from frog story studies. Of particular interest were the findings from Losh et al.'s (2001) study and Reilly et al.'s (2004) study, which both compare children with Williams syndrome to typically developing children. The two studies revealed that the younger children with Williams syndrome (under age 7) told the shortest stories; however, when looking at the older groups, participants with Williams syndrome told stories comparable in length to

their typically developing peers (Losh et al., 2001; Reilly et al., 2004). Reilly et al. (2004) also found that children with Williams syndrome produced more morphological errors and fewer complex grammatical constructions than the typically developing participants. The children with Williams syndrome appeared to demonstrate a delay in the mastery of grammar similar to the delays observed in children with significant language impairments (Reilly et al., 2004). This finding supports Losh et al.'s (2001) previous research that revealed evidence of delayed morphosyntactic development in individuals with Williams syndrome.

In addition to looking at story length and grammatical complexity, Reilly et al. (2004) also assessed the coherence and overall structure of participant narratives. When comparing children with Williams syndrome to children with a significant language impairment (SLI) and children who are typically developing (TD), Reilly et al. (2004) found that children with Williams syndrome consistently performed worse on measures of narrative structure and story grammar in comparison to both the SLI and TD groups. Although the children with Williams syndrome and the children with SLI received comparable scores in the younger age group, the gap widened in the older groups, with the children with Williams syndrome falling behind significantly (Reilly et al., 2004).

Children with Williams syndrome most commonly excelled in the use of evaluative language in their narratives (Losh et al., 2001; Reilly et al., 2004). Losh et al. (2001) found that the two evaluative devices of particular interest when studying children with Williams syndrome are cognitive inferences and social engagement devices. In Losh et al.'s (2001) study, typically developing children included more cognitive inferences, whereas children with Williams syndrome surpassed typically developing children in their extensive use of evaluative language, particularly social engagement devices. Consistent with Losh et al.'s (2001) findings, Reilly et

al. (2004) found that younger children with Williams syndrome made fewer cognitive inferences than typically developing children and used a significantly greater proportion of social engagement devices (Reilly et al., 2004). The children with Williams syndrome gave elaborate descriptions of isolated events, failing to link the events together in a cohesive manner and make connections to the overall theme of the story (Reilly et al., 2004).

Due to their friendly disposition and outgoing nature, individuals with Williams initially appear to have good communication skills. However, it is evident that their linguistic, cognitive, and social skills are not consistent with those of typically developing children. Existing research suggests that the narrative language skills of children with Williams syndrome differ from those of typically developing children and children with other language or neurodevelopmental disorders. Additional research is needed to further identify these differences and gain a better understanding of the clinical implications in the field of speech-language pathology.

Summary of the Literature Review

Due to a genetic difference in the makeup of chromosome 7, individuals with Williams syndrome tend to differ from their peers with 7q11.23 Duplication syndrome (Dup7) in terms of cognitive abilities and social and language-related skills. Narrative analysis provides an ideal context in which to examine these differences because telling a story involves integrating linguistic, cognitive, and social knowledge. The wordless picture book *Frog, Where Are You?* by Mercer Mayer (1969), is a popular tool used for evaluating narrative language skills. Previous studies using *Frog, Where Are You?* as an assessment tool reveal that children with Williams syndrome tend to produce narratives with a great deal of elaboration and many social engagement devices, but they have difficulty making inferences about the content of the story and struggle to grasp the overall theme (Losh, Bellugi, & Anderson, 2001; Reilly et al., 2004).

Children with Dup7 are generally less social and expressive than children with Williams syndrome, and they tend to be less cognitively delayed. Children with Dup7 are therefore expected to produce shorter narratives and employ fewer social engagement devices, but perhaps make more cognitive inferences and demonstrate a better understanding of the plot structure and overall theme of the story.

Studies focusing on the communication abilities of individuals with Dup7 are lacking. Furthermore, although Dup7 and Williams syndrome affect the same genes on the same chromosome, little research has been done to compare the two syndromes. Examining the narrative productions of children with Williams syndrome and children with Dup7 will contribute to a growing understanding of the cognitive, social, and language related similarities and differences observed among individuals affected by these two syndromes. This area of research has important clinical implications that could help identify the specific speech-language therapy needs of children with Williams syndrome and Dup7. Increased individualization of speech-language therapy could lead to improved effectiveness in treatment, helping children with Williams syndrome and Dup7 to improve their overall communication skills.

Methods

Research Design

This study is cross-sectional and comparative in nature. Fifteen children with 7q11.23 Duplication syndrome were matched with a group of 15 children with Williams syndrome by chronological age and a group of 15 children with Williams syndrome by language age (based on Expressive Vocabulary Test scores), for a total of 45 participants. The participants are comprised of both males and females, ranging in age from seven to thirteen years old. Participants were drawn from a larger ongoing study headed by Dr. Carolyn Mervis at the

University of Louisville in Kentucky. Mervis' research compares the development of cognitive abilities, speech-language skills, and personality in children who are typically developing, children who have Williams syndrome, children who have 7q11.23 Duplication syndrome, children who have Down syndrome, and children with other neurodevelopmental disorders.

Data Collection

Previously recorded DVDs were used for the purposes of this research. The DVDs were originally filmed at the University of Louisville as a part of the larger study. Consent, assent, and HIPAA authorization were obtained from all participants and their legal guardians at the start of the study in Louisville. The DVDs contain footage of the children telling narratives using the wordless picture book, *Frog, Where Are You?* as a guide (Mayer, 1969). The examiner in the room handed the book to the child, explained that it was about a boy, a dog, and his frog, and told the child to look through the book quietly, paying close attention to the pictures on each page. The child was then instructed to tell the story starting from the beginning. The examiner was encouraged to stay silent while the child told the story.

The head researcher at the University of Louisville, Dr. Carolyn Mervis, granted permission for the use of the DVDs in the current study. Approval was obtained from the Institutional Review Board at the University of Vermont for the use of the DVDs in this project. The original DVDs remained locked in the Velleman Research Lab in Pomeroy Hall at all times, and any copies made of the DVDs were labeled with subject codes to protect confidentiality. All transcription and coding of the DVDs took place on a password protected computer at the University of Vermont. Only the principal investigator, faculty advisor, Dr. Velleman, and students listed as key personnel in the Velleman Research Lab were permitted to view the DVDs.

Transcription and Coding

Transcription. The DVDs were orthographically transcribed manually using the Systematic Analysis of Language Transcripts (SALT) conventions (see Appendix A). Transcribers could listen to an utterance up to three times to ensure that conditions for determining intelligibility were uniform across all narrative samples. Only complete and fully intelligible utterances were included in the analyses.

The unit of analysis was a proposition, or a simple clause made up of a verb and the arguments that help to complete that verb. “From a semantic perspective, each proposition corresponds roughly to a single event” (Losh, Bellugi, & Anderson, 2001, p. 272). Each clause in a complex sentence is considered a single event, and therefore one proposition (Losh, Bellugi, & Anderson, 2001). For example, the sentence, “The teacher was mad at the student for misbehaving in class” counts as two propositions in the same way that “The teacher was mad at the student. He misbehaved in class” would. Although the sentence, “The girl ran to greet her friend” contains two verbs, *run* and *to greet*, this utterance counts as one proposition because it represents a single event. The total number of propositions was counted for each transcript and that value was used as the denominator in all calculations of frequency regarding the variables of interest because story lengths and sentence lengths were expected to vary among participants.

Coding for morphological errors. Errors of omission and the use of the incorrect forms in each of the following grammatical categories were coded as morphological errors: pronouns, auxiliaries (helping verbs), determiners (e.g., “the or “a”), noun plurals, verb tenses, number markings, and prepositions. Please refer to Appendix B for a more detailed description of how morphological errors were coded, as well as examples of errors in each of these categories. A frequency of morphological errors score was calculated for each participant by dividing the

number of morphological errors (summed across all categories) by the total number of propositions in the narrative.

Coding for story grammar. Story grammar was scored based on an eight-point scale originally described in Reilly, Bates, & Marchman's (1998) study. Participants could receive zero to eight points based on the inclusion of certain plotline components in the narrative. Participants received one point for mentioning that the frog escapes, one point for mentioning that the boy goes looking for the frog, one point for each of the five main search episodes (interaction with the bees, interaction with the gopher, interaction with the owl, interaction with the deer, and falling in the pond), and one point for the story's resolution when the boy finds the frog. To receive a point for each of the five search episodes, the child had to specifically mention an interaction occurring in each of the scenes. For example, to receive a point for the scene in which the dog finds a beehive and is subsequently chased by the bees, the child would have to say something along the lines of "the dog saw the beehive" or "the dog was attacked by the bees." An utterance such as, "there are bees," with no elaboration would not receive a point because the child was labeling the objects in the picture rather than providing information that contributed to an understanding of the story.

Coding for search theme. To determine how well participants were able to establish and maintain the story's search theme, each narrative sample was scored using the four-point scale defined in Reilly, Bates, & Marchman's (1998) study. Participants received one point for communicating that the frog is missing, one point for communicating that the boy goes looking for the frog, one point for one or two additional mentions of the search theme, and one more point for three or more additional mentions of the search theme. Mentions of the search theme included participants explicitly talking about the boy or his dog looking for the missing frog, as

well as instances of character dialogue used to convey the search theme, such as “frog, where are you?” Search theme scores ranged from zero to four points.

Coding for evaluative language. The use of evaluative language in each narrative was coded using the five types of evaluative devices defined in Losh, Bellugi, & Anderson’s (2001) study. The types of evaluative language, as well as examples of each evaluative device, are presented in Table 1.

Table 1

Losh, Bellugi, & Anderson’s Evaluative Devices

Categories of Evaluative Devices
<p>1. Cognitive Inferences – “inferences of character motivation, causality, and mental states” (Losh, Bellugi, & Anderson, 2001, p. 273) ex) “The girl <i>accidentally</i> dropped her ice cream cone.” “The boy <i>thinks</i> the dog wants to play.” “The boy is <i>trying</i> to find his lost book.”</p> <p>2. Social Engagement Devices</p> <ol style="list-style-type: none"> a. sound effects b. character speech <ol style="list-style-type: none"> i. direct (“The girl yells, ‘<i>come here</i>’ to her friend”) ii. indirect (“The boy calls to his friend” or “The cat meows”) c. audience hookers (“Look at the cat.”) <p>3. References to Affective States or Behaviors – conveying an understanding of the characters’ feelings, emotions, and wellbeing</p> <ol style="list-style-type: none"> a. primary & secondary emotional states (happy, sad, annoyed, scared) b. emotion verbs (“He was crying”) c. physical pain, or lack thereof, (“The boy was hurt” or “He was not hurt”/“He was okay”) <p>4. Intensifiers</p> <ol style="list-style-type: none"> a. repetitions (“The boy <i>looked and looked</i> for his toy.”) b. emphatic markers (<i>very, really, deeply</i>, etc.) <p>5. Hedges – indicating a level of uncertainty (<i>maybe, might, probably</i>, etc.)</p>

Examples of evaluative devices across all five categories were summed to yield an overall frequency of evaluative language score for each participant. The frequency of evaluative language score was represented as a proportion of the total number of propositions in the participant narrative. Additionally, each of the five evaluative language categories was analyzed separately and represented as a proportion of the total number of propositions in the narrative. For the social engagement device category, frequency calculations for some individuals exceeded 100%. This was due to the fact that, while sound effects in isolation were counted as social engagement devices, they did not fulfill the requirements of a proposition. Therefore, a child's story could potentially have fewer propositions than instances of social engagement devices, resulting in a frequency greater than 100%.

Scoring criteria. Limited syntactic and lexical abilities could potentially affect the quality of the participants' narratives; therefore, the scoring criteria outlined in Miles & Chapman's (2002) study were used for the purposes of this study. Because the language abilities of the children were expected to vary, the complexity of the child's utterance was not important as long as the child was able to successfully communicate the message. For similar reasons, the transcriber had to use a rich interpretation at times, meaning that it was okay to infer relationships between simple, successive utterances. For example, although they differ in terms of grammatical complexity, the utterances "He look. Frog there," and "The boy looked over the log and saw that his frog was there" would both receive the story grammar point for acknowledging that the boy finds the frog at the end of the story. Finally, a loose interpretation of vocabulary was used to account for the children's limited lexicon. For example, a child referring to the gopher in the story as a "fuzzy little dog" would be acceptable.

Reliability. Dr. Velleman watched and re-transcribed 20% of the 45 videos of participant narratives included in the study for reliability purposes. These videos were chosen at random and consisted of narratives from six participants with Williams syndrome and three participants with Dup7. When calculating inter-rater reliability for transcription, differences that did not affect the coding (such as pronunciation differences that did not influence the intelligibility of the word) were ignored. Agreement between each of Dr. Velleman's transcriptions and the original transcriptions done by the principal investigator exceeded 90%.

An undergraduate research assistant re-coded 20% of the principal investigator's transcriptions for inter-rater reliability. These transcriptions were chosen at random and came from a different set of videos of participant narratives than the ones transcribed by Dr. Velleman for reliability. The principal investigator completed all of the initial coding of the transcripts based on the operational definitions of each variable outlined in Appendix B. The principal investigator then trained the research assistant to code for each variable using the same operational definitions. The research assistant recorded the number of propositions, the number of morphological errors, the story grammar score, the search theme score, and the number of examples of each type of evaluative device observed in the transcripts she re-coded. These values were then compared to the values recorded by the principal investigator in the initial coding of the transcripts. Agreement between the research assistant and the principal investigator for the coding of each of the DVDs selected reached at least 90% for each transcript.

Data Analysis

The narrative samples of the participants with Dup7 were compared to the narrative samples of two groups of children with Williams syndrome: a language age-matched group and a chronological age-matched group. The narratives were compared based on several factors

including: story length, frequency of morphological errors, story grammar score, search theme score, and frequency of use of evaluative language. The totals and scores for each variable were recorded in Microsoft Excel. The frequency of use of evaluative language involved a more in-depth analysis. Each example of evaluative language was recorded in the spreadsheet for that particular participant and categorized as one of the five types of evaluative devices: (1) cognitive inferences, (2) social engagement devices, (3) references to affective states and behaviors, (4) intensifiers, and (5) hedges. An overall frequency of the use of evaluative devices used was recorded, as well as individual frequencies for each of the five evaluative devices.

Statistical analysis included both descriptive and inferential statistics, and all analyses were run using SPSS software, Version 22. Both independent and paired t-tests were used to compare the Dup7 group to the language-age matched Williams syndrome group and to the chronological age-matched Williams syndrome group. Significance levels were set to $p < .05$ prior to data analysis. If significant between-group differences were observed for a particular variable, the group means for that variable were compared to determine how the children with Williams syndrome differed from the children with Dup7 on that narrative measure.

Results

Williams syndrome and 7q11.23 Duplication syndrome (Dup7) are neurodevelopmental disorders affecting the same set of genes on chromosome 7, via deletion in the case of Williams syndrome and duplication in the case of Dup7. Individuals with Dup7 tend to differ from their peers with Williams syndrome in terms of cognitive characteristics, social behaviors, and language development. The goal of this study was to gain a better understanding of these differences and their possible clinical implications by comparing narrative language samples from children with Dup7 to those from children with Williams syndrome.

Description of Sample

The final sample consisted of 45 participants, 27 male and 18 female, ranging in age from 7.01 years to 13.39 years. Expressive Vocabulary Test (EVT) raw scores were used to indicate language age and ranged from 132 to 185 ($M = 160$). Fifteen of the participants had a Dup7 diagnosis and 30 of the participants had a Williams syndrome diagnosis. Fifteen of the participants with Williams syndrome were paired with the participants with Dup7 by gender and language age, and the other 15 participants with Williams syndrome were paired with the participants with Dup7 by gender and chronological age. The chronological age ranges and Expressive Vocabulary Test (EVT) score ranges for the Dup7 group, the Williams syndrome group matched by language age, and the Williams syndrome group matched by chronological age are presented in Table 2.

Table 2

Characteristics of Participant Groups

Participant Group	<i>n</i>	Age Range (years)	EVT Scores
Dup7	15	7.01-12.95, $M = 9.79$	143-185, $M = 164$
Language Age-Matched WS	15	7.24-13.39, $M = 10.34$	142-183, $M = 163$
Chronological Age-Matched WS	15	7.04-12.91, $M = 9.74$	132-170, $M = 154$

Questions Guiding Research

Two research questions guided the statistical analysis for this study: (1) Does the narrative language of children with Williams syndrome differ from the narrative language of children with Dup7? and (2) If so, in what ways does the narrative language of children with Williams syndrome differ from the narrative language of children with Dup7? Both questions were applied in the language age-matched comparison and in the chronological age-matched comparison.

Language Age-Matched Group: Comparing Means of Narrative Measures

Group mean values for the dependent variables related to narrative language production were calculated for the participants in the Dup7 group and the participants in the language age-matched Williams syndrome group. The group means for each of the five dependent variables are displayed in Table 3.

Table 3

Group Means for Narrative Language Measures – Language Age-Matched Comparison

Variable	Dup7 Mean (SD)	WS Mean (SD)
Story Length (Number of Propositions)	30.07 (14.34)	31.07 (11.76)
Story Grammar Score*+	6.40 (1.24)	5.27 (1.44)
Search Theme Score+	3.07 (1.28)	2.40 (1.30)
Overall Freq. of Evaluative Language*+	0.23 (0.16)	0.55 (0.50)
Frequency of Morphological Errors	0.22 (0.23)	0.10 (0.08)

* $p < .05$ in independent t-test

+ $p < .05$ in paired t-test

Table 3 shows that in the language age-matched comparison, the Dup7 group had higher mean scores for maturity of story grammar and comprehension of the search theme than the Williams syndrome group. The Dup7 group also had a higher mean frequency of morphological errors in their narratives. The Williams syndrome group had higher mean values for story length and overall frequency of use of evaluative language as compared to the Dup7 group.

Independent t-tests revealed significant differences (marked with asterisks in Table 3) between the Dup7 group and the Williams syndrome group for story grammar score ($p = .028$) and overall frequency of use of evaluative language ($p = .031$). Compared to the Williams syndrome group, the Dup7 group had a higher mean story grammar score and a lower mean frequency of use of evaluative language score. The comparison of group means for frequency of morphological errors approached significance ($p = .06$), with the Dup7 group having a higher mean frequency of morphological errors than the Williams syndrome group.

In addition to examining overall group differences between the Dup7 and Williams syndrome groups, paired t-tests were run to examine the average differences between the matched pairs. Significant differences (marked with + in Table 3) were observed for three of the variables: story grammar score ($p = .016$), search theme score ($p = .045$), and overall frequency of use of evaluative language ($p = .017$). The frequency of morphological errors variable approached significance ($p = .059$) in the paired t-test.

A closer look at evaluative language. In addition to receiving an overall frequency of use of evaluative language score, participants also received separate frequency scores for each of the five evaluative devices. The frequency of use of each evaluative device was represented as a proportion of the total number of propositions in that participant's narrative. The group means for the frequencies of each evaluative device are displayed in Table 4.

Table 4

Group Means for Frequencies of Evaluative Devices – Language Age-Matched Comparison

Variable	Dup7 Mean (SD)	WS Mean (SD)
Frequency of Cognitive Inferences*+	0.06 (0.06)	0.02 (0.03)
Frequency of Social Engagement Devices*+	0.13 (0.10)	0.44 (0.52)
Frequency of Ref. to Affective States & Behaviors	0.03 (0.05)	0.07 (0.05)
Frequency of Intensifiers	0.01 (0.02)	0.02 (0.03)
Frequency of Hedges	0.01 (0.01)	0.01 (0.02)

* $p < .05$ in independent t-test

+ $p < .05$ in paired t-test

Independent t-tests revealed significant between-group differences (marked with an asterisk in Table 4) for frequency of cognitive inferences ($p = .037$) and frequency of social engagement devices ($p = .038$). As summarized in Table 4, the Dup7 group had a higher mean frequency of use of cognitive inferences, and the Williams syndrome group had a higher mean frequency of use of social engagement devices. The comparison of group means for frequency of references to affective states and behaviors approached significance ($p = .072$), with the

Williams syndrome group having a higher mean frequency of use for this variable. Paired t-tests also indicated significant differences (marked with a + in Table 4) in frequency of use of cognitive inferences ($p = .023$) and frequency of use of social engagement devices ($p = .035$).

Chronological Age-Matched Group: Comparing Means of Narrative Measures

Participant narratives in the chronological age-matched comparison were coded and analyzed based on the same narrative measures used for the language-age matched comparison.

Table 5 displays the group mean values for each of the five dependent variables.

Table 5

Group Means for Narrative Language Measures – Chronological Age-Matched Comparison

Variable	Dup7 Mean (SD)	WS Mean (SD)
Story Length (Number of Propositions)	30.07 (14.34)	22.87 (14.81)
Story Grammar Score*+	6.40 (1.24)	4.33 (2.92)
Search Theme Score+	3.07 (1.28)	2.07 (1.79)
Overall Freq. of Evaluative Language*+	0.23 (0.16)	0.46 (0.38)
Frequency of Morphological Errors	0.22 (0.23)	0.23 (0.20)

* $p < .05$ in independent t-test

+ $p < .05$ in paired t-test

Table 5 shows that for the participants matched by chronological age, the Dup7 group had a higher mean value for total number of propositions and higher mean scores for story length and search theme than the Williams syndrome group. The Williams syndrome group had higher mean values for frequency of morphological errors and overall frequency of use of evaluative language as compared to the Dup7 group.

Independent t-tests revealed significant between-group differences (marked with an asterisk in Table 5) for story grammar score ($p = .021$) and overall frequency of use of evaluative language ($p = .037$). Compared to the Williams syndrome group, the Dup7 group had a higher mean story grammar score and a lower mean frequency of use of evaluative language score. The

comparison of group means for search theme score approached significance ($p = .091$), with the Dup7 group having a higher mean search theme score than the Williams syndrome group.

Paired t-tests were also run to examine the average differences between each of the Dup7/Williams syndrome pairs matched by chronological age. Results indicated significant differences (marked by a + in Table 5) between matched pairs for three of the variables: story grammar score ($p = .016$), search theme score ($p = .038$), and overall frequency of use of evaluative language ($p = .05$). The average difference in story length between matched pairs approached significance ($p = .087$).

A closer look at evaluative language. As in the language age-matched comparison, the evaluative language observed in the narratives of the participants in the chronological age-matched comparison was further analyzed by looking at the frequencies of each of the five evaluative devices separately. The group means for the frequency of use of each evaluative device are displayed in Table 6.

Table 6

Group Means for Frequencies of Evaluative Devices – Chronological Age-Matched Comparison

Variable	Dup7 Mean (SD)	WS Mean (SD)
Frequency of Cognitive Inferences	0.06 (0.06)	0.04 (0.06)
Frequency of Social Engagement Devices	0.13 (0.10)	0.29 (0.32)
Frequency of Ref. to Affective States & Behaviors	0.03 (0.05)	0.07 (0.10)
Frequency of Intensifiers	0.01 (0.02)	0.01 (0.02)
Frequency of Hedges	0.01 (0.01)	0.05 (0.17)

Independent t-tests indicated that there were no significant between-group differences for any of the five evaluative devices. The frequency of social engagement devices variable did, however, approach significance ($p = .07$), with the Williams syndrome group having a higher mean frequency of use of social engagement devices. Paired t-tests indicated that there were no

significant differences between matched pairs, but the frequency of social engagement devices variable again approached significance ($p = .074$).

Summary of Results

The results from this study indicate that the narrative language of the participants with Williams syndrome differed from the narrative language of the participants with Dup7 with respect to some, but not all of the narrative measures examined. In both the language age-matched and chronological age-matched comparisons, the Dup7 participants received higher mean scores for maturity of story grammar, and the Williams syndrome participants received higher mean scores for overall frequency of use of evaluative language. Paired t-tests revealed significant differences between matched pairs for search theme score, with the Dup7 participants receiving higher scores on average than their language age-matched and chronological age-matched peers with Williams syndrome. In the language age-matched comparison, the participants with Dup7 differed from the participants with Williams syndrome in terms of the types of evaluative devices used most frequently in their narratives. On average, the participants with Dup7 made more cognitive inferences, and the participants with Williams syndrome used more social engagement devices.

Discussion

The goal of this project was to look for differences in the narrative language of children with Williams syndrome versus children with 7q11.23 Duplication syndrome (Dup7) by using a series of narrative measures designed to assess cognitive abilities, social behaviors, and language skills. For the most part, the observed differences in narrative language reflect the unique cognitive, social, and linguistic characteristics typical of individuals with Williams syndrome and individuals with Dup7. The results were also consistent with existing literature on the

narrative language of children with Williams syndrome (Haas & Reiss, 2012; Losh et al., 2001; Reilly et al., 2004).

During data analysis, additional questions arose related to morphological development and narrative length. Post-hoc correlations were run to examine the relationship between age and expressive vocabulary score, and age and frequency of morphological errors among the participants with Williams syndrome and among the participants with Dup7. In addition, to examine whether or not the length of a participant's narrative had an effect on the other narratives measures, ANCOVA's were run for the participants involved in the language age-matched comparison and the participants involved in the chronological age-matched comparison.

Story Length

No significant differences were observed in story lengths when comparing the Dup7 group to either of the Williams syndrome groups. In the language age-matched comparison, the Williams syndrome group had a slightly higher mean number of propositions than the Dup7 group; however, in the chronological age-matched comparison, the Dup7 group had a higher mean number of propositions. Overall, story lengths varied considerably among individual participants regardless of diagnosis. Previous *Frog, Where Are You?* studies involving children with Williams syndrome also resulted in participant narratives that varied in length (Losh et al., 2001; Reilly et al., 2004). The range of narrative lengths among participants was accounted for by analyzing variables of interest as a proportion of the total number of propositions in previous studies (Losh et al., 2001; Reilly et al., 2004), as well as the current study.

Potential Effect of Number of Propositions

Although not included as one of the original research questions, it was suspected that the length of a participant's narrative could have an underlying effect on the other variable examined

in the study. Therefore, post-hoc ANCOVAs were run for both the language age-matched comparison and the chronological age-matched comparison to investigate this question. This analysis was carried out for variables that were of particular interest in the study, including: (1) number of morphological errors, (2) story grammar score, (3) search theme score, (4) total number of evaluative devices, (5) number of cognitive inferences, and (6) number of social engagement devices.

Language age-matched comparison. The results from the ANCOVAs run in the language age-matched comparison are displayed in Table 8.

Table 8

ANCOVA – Language Age-matched Comparison

Variable	Group Effect (<i>p</i> -value)	Effect of # of Propositions (<i>p</i> -value)
# of Morphological Errors	.109	.311
Story Grammar Score	.006*	.001*
Search Theme Score	.111	.017*
# of Evaluative Devices	.111	.001*
# of Cognitive Inferences	.035*	.001*
# of Social Engagement Devices	.085	.066

* $p < .05$

A significant group effect was observed for story grammar score and the number of cognitive inferences made throughout the narrative. The group effect for the number of social engagement devices included in the narrative approached significance. This was fairly consistent with the results from the independent and paired t-tests. The ANCOVAs also revealed that the number of propositions had a significant effect on story grammar score, search theme score, total number of evaluative devices, and number of cognitive inferences. The effect of the number of propositions on the number of social engagement devices approached significance.

Of particular interest are the ANCOVA results for search theme score and the total number of evaluative devices. The independent t-test did not indicate that there was a significant between group-difference for search theme score, which is supported by the ANCOVA. Search theme does, however, appear to be influenced by story length, which might help to explain why the paired t-test indicated a significant difference in search theme scores between chronological age-matched pairs. As for overall use of evaluative language, the ANCOVA did not show a significant group effect, which contradicts the findings from both the independent and paired t-tests. Evaluative language was, however, influenced by story length. This was accounted for in the original statistical analysis because evaluative language was represented as a proportion of the total number of propositions.

Chronological age-matched comparison. The results from the ANCOVAs run in the chronological age-matched comparison are displayed in Table 9.

Table 9

ANCOVA – Chronological Age-matched Comparison

Variable	Group Effect (<i>p</i> -value)	Effect of # of Propositions (<i>p</i> -value)
# of Morphological Errors	.638	.117
Story Grammar Score	.051	< .001*
Search Theme Score	.254	.003*
# of Evaluative Devices	.037*	< .001*
# of Cognitive Inferences	.759	< .001*
# of Social Engagement Devices	.089	.006*

* $p < .05$

A significant group effect was observed for the total number of evaluative devices only. The group effect for story grammar score and number of social engagement devices approached significance. Again, these results were fairly consistent with the results of the independent and paired t-tests. The ANCOVAs for the chronological age-matched comparison also revealed that

the number of propositions in a narrative had a significant effect on all of the variables except for one (number of morphological errors). This finding validates the decision to analyze the variables that were not scored using an established scale as a proportion of the total number of propositions.

Morphological Errors

No significant differences were observed between the Dup7 group and either of the Williams syndrome groups for frequency of morphological errors. However, this variable did approach significance in both the independent-t test ($p = .06$) and the paired t-test ($p = .059$) run for the language age-matched comparison, with the Dup7 group committing a higher mean frequency of morphological errors than the Williams syndrome group. This result could be a function of morphology improving with age. The mean age of the participants with Williams syndrome ($M=10.34$ years) was greater than the mean age of the participants with Dup7 ($M=9.79$ years), and it has been documented that language skills and command of morphology tend to improve with age, even if a language delay or disorder is present (Reilly et al., 2004).

However, these participants were matched by language-age based on expressive vocabulary scores. This means that for one of the groups, there is a possible mismatch between vocabulary level and morphological development. Either the children with Williams syndrome have a better command of morphology than their vocabulary levels would predict, or the children with Dup7 have a worse command of morphology than their vocabulary levels would predict (or both). The standard deviation of the Dup7 group ($SD = 0.23$) was larger than the standard deviation of the Williams syndrome group ($SD = 0.08$), indicating greater variability in the frequency of morphological errors committed among participants in the Dup7 group.

In the chronological age-matched comparison, the mean expressive vocabulary score for the Dup7 group ($M = 164$) was higher than the mean expressive vocabulary score for the Williams syndrome group ($M = 154$). Despite having a higher mean vocabulary score, the Dup7 group did not differ significantly from the Williams syndrome group in terms of frequency of morphological errors. Thus, the between-group differences in language ability are not the same for all aspects of language.

To investigate relationships among age and these two aspects of language in more detail, further post-hoc correlations were run. Expressive vocabulary scores were positively correlated with age among the participants with Dup7 ($r = .84$) and among the participants with Williams syndrome ($r = .61$). Therefore, expressive vocabulary appears to improve with age in both populations. Frequency of morphological errors was negatively correlated with age among participants with Dup7 ($r = -.71$), suggesting that children with Dup7 might make fewer morphological errors as they get older. The same relationship was not observed among the participants with Williams syndrome ($r = -.13$). Expressive vocabulary may improve with age in both populations; however, morphology only appeared to improve with age in the participants with Dup7. The results from the post hoc correlations indicate that children with Dup7 and children with Williams syndrome likely develop language differently as they age.

Losh et al. (2001) and Reilly et al. (2004) report delayed morphosyntactic development in children with Williams syndrome, so it is possible that both the participants with Williams syndrome and the participants with Dup7 involved in this study are at least somewhat delayed in terms of morphological development. Even if delays in morphological development are present in both populations, the relationships among expressive vocabulary development, morphological

development, and age are different in individuals with Williams syndrome versus individuals with Dup7.

Measures of Narrative Comprehension: Story Grammar & Search Theme

In both the language age comparison and the chronological age comparison, significant differences in story grammar score were observed between the Dup7 and Williams syndrome groups as a whole, as well as between the individually matched pairs. In existing studies on narrative language, narrative comprehension (measured by story grammar score) was used as an indication of a participant's cognitive abilities (Reilly et al., 1998; Reilly et al., 2004). On average, the participants with Dup7 received higher story grammar scores than the participants with Williams syndrome. This is consistent with the finding that language delay or disorder is a more marked feature of Dup7 than cognitive deficits, especially when compared to the Williams syndrome phenotype (Velleman & Mervis, 2011). This result is also consistent with Reilly et al.'s (2004) study, in which children with Williams syndrome performed consistently worse on measures of story grammar compared to both children with significant language impairments and typically developing children.

As a whole, the Dup7 group did not differ significantly from either of the Williams syndrome groups in terms of average search theme score. However, the difference in mean search theme score between the Dup7 group and the Williams syndrome group matched by chronological age did approach significance. Additionally, significant differences were observed in search theme scores between matched pairs in both the language age-matched and chronological age-matched comparisons. On average, the participants with Dup7 received higher search theme scores than their peers with Williams syndrome.

The search theme score represents a participant's ability to establish and maintain the theme of the story, which is closely linked to cognitive abilities (Losh et al., 2001; Reilly et al., 2004), an area in which children with Dup7 are expected to outperform their peers with Williams syndrome. An earlier study by Haas & Reiss (2012) suggested that children with Williams syndrome are likely to demonstrate difficulty making connections between events in a story, which would therefore lead to lower story grammar and search theme scores than individuals with less severe cognitive deficits, as was observed in the current study.

Evaluative Language

In both the language age-matched comparison and the chronological age-matched comparison, significant differences were observed in the overall frequency of use of evaluative language. Significant differences were observed between the Dup7 and Williams syndrome groups as a whole, as well as between matched pairs. This finding is unsurprising due to the social nature and strong expressive language skills typical of individuals with Williams syndrome. Since children with Williams syndrome are generally more socially inclined than children with Dup7, it is possible that they are more likely to use evaluative language in an effort to connect with their audiences. Existing studies support this speculation and report that children with Williams syndrome tend to excel in the use of evaluative language in narrative story telling (Losh et al., 2001; Reilly et al., 2004).

There were two types of evaluative devices that were of particular interest in the language age-matched comparison: cognitive inferences and social engagement devices. On average, the children with Dup7 made cognitive inferences more frequently than their peers with Williams syndrome. This means that the children with Dup7 were more likely to provide insight into characters' mental states, indicate motivation behind character actions, and infer causality of

events. The literature supports this finding, indicating that children with Williams syndrome struggle with higher order cognitive functions involving perspective taking and the ability to attribute mental states to others (Haas & Reiss, 2012). Since the children were matched by language-age, this result suggests that expressive language skills are not necessarily a good indicator of these cognitive abilities in children with Williams syndrome. A child with Williams syndrome might produce a lengthy narrative that demonstrates a strong command of expressive language, but fail to make important connections between the events in the story.

The same group effect for frequency of cognitive inferences was not observed in the chronological age-matched comparison. This is likely because chronological age is not an accurate indicator of cognitive abilities in populations with developmental disorders. A child with Dup7 might have an IQ very similar to or very different from a child with Williams syndrome who is their same age. Because intellectual abilities can vary considerably between age-matched pairs, it makes sense that there was not a significant difference observed in the frequency of cognitive inferences made in the chronological age-matched comparison.

The other evaluative device of particular interest in this study was the frequency of social engagement devices. In the language age-matched comparison, the children with Williams syndrome included social engagement devices significantly more frequently than the children with Dup7. This difference was observed between the Dup7 and Williams syndrome groups as a whole, as well as between matched pairs. For the groups matched by chronological age, the difference in the frequency of use of social engagement devices approached significance.

These findings are consistent with the extremely social nature of individuals with Williams syndrome. Children with Williams syndrome tend to be very talkative and expressive, whereas children with Dup7 tend to be shy and more conservative in their use of language

(Mervis & Velleman, 2011; Osbourne & Mervis, 2010; Velleman & Mervis, 2011). Therefore, children with Williams syndrome would be expected to use social engagement devices more frequently than children with Dup7. In general, the narratives from the participants with Williams syndrome tended to be dialogue-heavy and include a variety of sound effects. Three out of the 30 participants with Williams syndrome included so many instances of dialogue and sound effects in their narratives that their frequency of use of social engagement devices exceeded 100%. Each sound effect was coded as a social engagement device; however, sound effects in isolation did not necessarily fulfill the requirements of a proposition. Therefore, a narrative could contain a greater number of social engagement devices than number of propositions, resulting in a frequency of use of social engagement devices greater than 100%.

There were, however, some Dup7 participants who produced dialogue-heavy narratives that seemed more characteristic of what would typically be expected of a child with Williams syndrome. And although on average the Dup7 participants made cognitive inferences more frequently, there were some participants with Williams syndrome who provided excellent examples of cognitive inferences. Table 7 provides examples of cognitive inferences from participants with Dup7 and from participants with Williams syndrome.

Table 7

Examples of Cognitive Inferences from Participant Narratives

Dx	Cognitive Inference
Dup7	“And then the dog’s trying to get up there so the bees don’t get him.”
Dup7	“He suddenly realized his frog Douglas was married and had babies. Now he knows why he ran off.”
Dup7	“They thought they heard something behind the log.”
WS	“And the owl thinks that that [the deer’s antlers] is a branch.”
WS	“And he was telling the dog to be quiet so he could hear where the frog was.”
WS	“The dog is running because the bee is chasing him.”

These examples, along with the heavy use of dialogue observed in the narratives of some of the Dup7 participants, speak to the range of intellectual and social abilities that are present in both the Dup7 population and the Williams syndrome population. Some degree of variability in all areas of development is expected in children, particularly those with diagnosed disorders. The fact that two children have the same neurodevelopmental diagnosis does not necessarily mean that their cognitive abilities and social skills are identical. This point helps to illustrate the importance of viewing each child as an individual with unique strengths.

Implications for Clinical Practice

The majority of children diagnosed with Dup7 or Williams syndrome will likely benefit from some form of speech-language therapy. The unique strengths and weaknesses observed not only between the Dup7 and Williams syndrome groups, but also among participants in each group, can serve as guidelines when developing treatment plans for children affected by these syndromes. The participants with Dup7 used evaluative language less frequently in their narratives than the participants with Williams syndrome. Children with Dup7 might therefore benefit from speech-language therapy focused on expressive elaboration, or using language to go beyond simply transmitting information. Children with Dup7 may need help expanding their language skills to learn how to communicate things like emotion, humor, uncertainty, imagination, etc.

The participants with Williams syndrome showed strengths in their use of evaluative language; however, they were less successful in linking the events of the story and communicating how the characters' actions contributed to the overall theme. The participants with Williams syndrome also made fewer cognitive inferences in their narratives than the participants with Dup7. Therefore, children with Williams syndrome would likely benefit from

speech-language therapy that is more focused on Theory of Mind training and pragmatic language development. Children with Williams syndrome might need help with perspective taking and learning how to recognize and respond appropriately to social cues.

Although a child's diagnosis is a good starting point to help guide intervention, individual differences must also be considered because no two children are the same. The most effective forms of therapy involve helping children to embrace their unique strengths to meet their own challenges.

Limitations

A possible limitation of this study relates to the participant sample, mainly the small number of participants with Dup7. This is in part due to the rare nature of Dup7. The first case was only identified about ten years ago, and since researchers are still working to identify a comprehensive phenotype for the disorder, many cases still go undiagnosed. Overall, a larger, more diverse sample would help make the results of the study more generalizable to the Dup7 and Williams syndrome populations.

Another possible limitation of this study lies in the coding of narrative transcripts. The research assistant was trained by the principal investigator, which could have influenced her coding for inter-rater reliability. Although concise operational definitions and structured coding schemes were taken from reputable studies and used as guidelines for coding, there is still a possibility of individual coding differences. The principal investigator had more in-depth background knowledge of the project, more experience coding participant transcripts than the research assistant, as well as knowledge of the research questions and research literature, which could have potentially led to some coding differences. However, the 20% of DVDs that were re-coded by the research assistant for reliability purposes did reach at least 90% agreement with the

original coded transcripts, with an overall agreement level of 93%, so any coding differences observed were minor and did not affect the overall reliability of the study.

Conclusion & Directions for Future Research

This study is unique in that it compared the narrative language of children with Dup7 to that of children with Williams syndrome, matched by both language age and chronological age. The participants with Williams syndrome differed from the participants with Dup7 with respect to some, but not all of the narrative measures examined. The participants with Dup7 tended to excel in narrative measures related to cognitive functioning, such as making cognitive inferences, linking the events in the story, and effectively communicating the search theme. The participants with Williams syndrome showed strengths in their use of evaluative language, particularly social engagement devices. Results also indicated that the relationships between morphological development and expressive vocabulary development appeared to differ between the two groups, with the two aspects of language developing more in parallel with each other among children with Dup7 than among children with Williams syndrome. Overall, the difference observed among participants reflect the cognitive and social profiles unique to each disorder and provide important insight into what types of speech-language therapies might be appropriate for children with Williams syndrome and children with Dup7. Additionally, differences observed among participants with the same diagnosis speak to the importance of viewing each child as an individual with unique strengths and challenges.

Future Research

The findings from this study contribute to a growing body of research on Williams syndrome and Dup7; however, further research on the two disorders is needed. The more researchers know about Williams syndrome and Dup7, the more clinicians can do to help

individuals affected by these disorders. One suggestion for future research would be to take a closer look at the relationships among age, vocabulary development, and morphological development among children with Williams syndrome and children with Dup7. Taking a closer look at how participants' Expressive Vocabulary Test scores, or scores on other tests of language and intelligence, relate to narrative language skills could also be beneficial. The methodology for this particular study was a compilation of established research methods commonly used in reputable studies examining narrative language, so the framework is set for additional research. This study could also be replicated with a larger sample size, or perhaps a more diverse sample that involves comparing narratives of participants from different cultural backgrounds.

Appendix A

SALT Transcriptions Conventions

1. Transcript Format. Each entry begins with one of the following symbols. If an entry is longer than one line, continue it on the next line.

- \$** Identifies the speakers in the transcript. Example: \$ Child, Examiner
- C** Child/Client utterance.
- E** Examiner utterance.
- +** Typically used for identifying information such as sex and age.
- Time marker. Example of two-minute marker: -2:00
- :** Pause between utterances of different speakers. Example of 5 second pause: ::05
- ;** Pause between utterances of same speaker. Example of 3 second pause: ::03
- =** Comment line. This information is not analyzed in any way.

2. End of Utterance Punctuation. Every utterance must end with one of these six punctuation symbols.

- | | |
|---|--|
| <ul style="list-style-type: none"> . Statement ! Surprise, exclamation. ? Question. | <ul style="list-style-type: none"> ~ Intonation prompt. Ex: And then you~ ^ Interrupted utterance. > Abandoned utterance. |
|---|--|

3. {} Comments Within an Utterance. Example: C Lookit {C points to box}.
Nonverbal utterances of communicative intent are placed in braces. Example: C {nods}.

4. Unintelligible Segments.

- X** Used to mark unintelligible words or sections of an utterance.
- XX** Used to mark an unintelligible utterance of unspecified length.
Example: C He XX today.
- XXX** Used to mark an unintelligible utterance.
Example: C XXX

5. Bound Morphemes. Words which contain a slash “/” indicate that the word is contracted, conjugated, inflected, or pluralized in a regular manner. The root word is entered in conventional spelling followed by a slash “/” and then the bound morpheme.

- /S** Plural. Words that end in “s” but represent one entity are not slashed. Ex: cat/s
- /Z** Possessive inflection. Ex: dad/z. Do not mark possessive pronouns.
- /S/Z** Plural and possessive. Ex: baby/s/z
- /ED** Past tense. Ex: love/ed
- /3S** 3rd person singular verb form. Irregular forms are not slashed. Ex: go/3s
- /ING** Verb inflection. Ex: go/ing
- /N'T, /'T** Negative contractions. Irregular forms are not slashed. Ex: can/'t, does/'nt
- /'LL, /'M, /'D, /'RE, /'S, /'VE** Contractible verb forms. Ex: I/'ll, I/'m, he/'s, we/'ve

6. Mazes. Filled pauses, false starts, repetitions, reformulations, and interjections.

- () Surrounds the words/part-words that fall into these categories.
Example: C And (then um) then (he) he left.

7. Omissions. Partial words, omitted words, and omitted bound morphemes are denoted by an asterisk (*).

- * Following one or more letters this indicates that a word was started but left unfinished. Example: C I (w* w*) want it.
- * Preceding a word indicates that an obligatory word was omitted. Example: C Give it *to me.
- /* Following a slash the * is then followed by the bound morpheme which was omitted, indicating the omission of an obligatory bound morpheme.
Example: C The car go/*3s fast.

8. Overlapping speech. When both speakers are speaking at the same time, the words or silences that occur at the same time are surrounded by angle brackets <>.

- Example: C I want you to do it <> for me.
E <Ok>.

9. Linked Words. The underscore “_” is used to link multiple words so they are treated as a single word. Examples include titles of movies and books, compound words, proper names, and words or phrases repeated multiple times.

10. Root Identification. The vertical bar “|” is used to identify the root word.

- Example: C He goed|go
Example: C Hissel|f himself
Example: C He was sad cuz|because

11. Sound Effects and Idiosyncratic Forms %. The percent sign is used to identify sound effects which are essential to the meaning or structure of the utterance. Non-essential sound effects are entered as comments. Strong of the same sound are linked together.

- Example: C The dog went %woof_ woof. vs. C The dog barked {woof woof}

The % sign is also used to identify idiosyncratic forms: non-adult productions of very young children which are consistent in reference to an object, person, or situation.

- Example: C See %vroom {car}.

12. Spelling Conventions

- Filled pause words: AH, EH, ER, HM, UH, UM
- Yes words: OK, AHA, MHM, UHHUH, YEAH, YEP, YES
- No words: NO, AHAH, MHMH, UHUH, NAH, NOPE
- Numbers: 21 or TWENTYONE
- Concatenatives: GONNA, GOTTA, HAFTA, LIKETA, OUGHTA, SPOSTA, TRYNTA, WANNA, WHATCHA

13. [] Codes. Codes are used to mark words or utterances. Codes are placed in brackets [] and cannot contain blank spaces. Codes used to mark words are inserted at the end of a word with no intervening spaces between the code and the word.

[EO:_] marks overgeneralization errors

Example: C He falled|fall[EO:fell]

[EW:_] marks other word-level errors

Example: C He were[EW:was] go/ing.

[EU] marks utterance-level errors

Example: C And they came to stop/ed [EU].

[FP] marks non-standard filled pauses

Example: C The dog (um like [FP]) fell down.

*Taken from Systematic Analysis of Language Transcripts (SALT) Software Transcription Guide. (Miller, J., 2013).

Appendix B

Narrative Measures Used for Coding Participant Transcripts

(1) Length of the Narrative: number of propositions (a proposition = a verb and its arguments, representing a single event)

- ex) “The boy was happy” = 1 proposition
- “The boy was angry with his friend for taking his toy” = 2 propositions
- “The boy was happy to see his friend” – 1 proposition

(2) Number of Morphological (word grammar) Errors Made

Taken from: (Losh, Bellugi, & Anderson, 2001)

Errors of omission (represented by ‘*’ below) and of use of the incorrect form were counted for each of the following grammatical categories and added up to yield the total number of morphological errors. The total number of morphological errors was divided by the total number of propositions for each individual.

Categories of Morphological Errors:
<ol style="list-style-type: none"> 1. Pronouns (<i>her</i> saw it’) 2. Auxiliaries (helping verbs) (‘she * running’ or ‘they <i>was</i> running’) 3. Determiners (e.g., “the” or “a”) – (‘* girl likes to run’) 4. Noun plurals – (‘She reads lots of book*’) 5. Verb tenses – (‘She <i>run</i> yesterday’ or ‘She <i>runned</i> yesterday’) 6. Number markings – (‘She <i>have</i> a dog’ or ‘They <i>is</i> happy’) 7. Prepositions – (‘She look <i>in</i> the rock’ or ‘She look * the house’)

(3) Use of Story Grammar Components

Taken from: (Reilly, Bates, & Marchman, 1998, p. 347)

Participants earned an overall score ranging from 0-8 points based on the inclusion of the following story grammar components:
<ol style="list-style-type: none"> a) Setting & Instantiation <ol style="list-style-type: none"> i. frog escapes – <i>1 point</i> ii. boy goes looking for him – <i>1 point</i> b) 5 Search Episodes (1 point for each episode mentioned; total of <i>5 points possible</i>) <ol style="list-style-type: none"> i. interaction with bees ii. interaction with gopher iii. interaction with owl iv. interaction with deer v. falling in the pond c) Resolution <ol style="list-style-type: none"> i. boy finds the frog – <i>1 point</i>

(4) Comprehension of Search Theme

Taken from: (Reilley, Bates, & Marchman, 1998, p.347)

Participants earned an overall score ranging from 0-4 based on their understanding of “the motivation for the boy’s behavior and the general theme of the story” (Reilley, Bates & Marchman, 1998, p.347).

- a) communicate that frog is missing – *1 point*
- b) communicate that boy goes looking for him – *1 point*
- c) one or two additional mentions of search theme – *1 point*
- d) three or more additional mentions of search theme – *1 point*

(5) use of evaluative language

Taken from: (Losh, Bellugi, & Anderson, 2001)

Frequency of evaluative language was calculated separately for each of the five evaluative devices by dividing the number of times a particular evaluative device was observed by the total number of propositions in the narrative.

Evaluative Language Devices
<p>1. Cognitive Inferences – “inferences of character motivation, causality, and mental states” (Losh, Bellugi, & Anderson, 2001, p. 273) ex) “The girl <i>accidentally</i> dropped her ice cream cone.” “The boy <i>thinks</i> the dog wants to play.” “The boy is <i>trying</i> to find his lost book.”</p> <p>2. Social Engagement Devices</p> <ul style="list-style-type: none"> a. sound effects b. character speech <ul style="list-style-type: none"> i. direct (“The girl yells, ‘<i>come here</i>’ to her friend”) ii. indirect (“The boy calls to his friend” or “The cat meows”) c. audience hookers (“Look at the cat.”) <p>3. References to Affective States or Behaviors – conveying an understanding of the characters’ feelings, emotions, and wellbeing</p> <ul style="list-style-type: none"> a. primary & secondary emotional states (happy, sad, annoyed, scared) b. emotion verbs (“He was crying”) c. physical pain, or lack thereof, (“The boy was hurt” or “He was not hurt”/“He was okay”) <p>4. Intensifiers</p> <ul style="list-style-type: none"> c. repetitions (“The boy <i>looked and looked</i> for his toy.”) d. emphatic markers (<i>very, really, deeply</i>, etc.) <p>5. Hedges – indicating a level of uncertainty (<i>maybe, might, probably</i>, etc.)</p>

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