Narrative abilities of bilingual children with Autism Spectrum Disorder, Developmental Language Disorder and Typical Development

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

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Abstract

This thesis examined the narrative abilities of English L2 learners with Autism Spectrum Disorder (ASD), Developmental Language Disorder (DLD) and Typical Development (TD). Producing an effective story requires the interplay of linguistic and pragmatic abilities; narrative samples are useful in analyzing the linguistic abilities of children, including those from clinical populations. Narratives can be analyzed for macrostructure and microstructure components, as well as for components requiring perspective-taking abilities such as the use of terms reflecting story characters' internal states. Compared to the monolingual research, there have been fewer studies examining narratives in clinical bilingual groups, especially bilinguals with ASD, and no study so far has compared bilinguals with ASD to bilinguals with DLD. However, studies with bilinguals are essential from both a theoretical and clinical perspective, especially in multilingual and multicultural societies such as Canada.

This thesis addresses gaps in the existing research on bilingualism, ASD and DLD by looking at older school-age bilinguals, examining narratives rather than lexical development or developmental milestones in ASD, and by focusing on the input and language environments of different bilingual populations. The following theoretical questions were examined: (1) Is macrostructure an area of weakness in DLD? (2) Do children with ASD experience difficulties with structural language, i.e., morphology and syntax? (3) Are narrative skills requiring perspective-taking abilities equally vulnerable in ASD and DLD? (4) Do bilinguals with ASD and DLD use the second language input they receive to the same as bilinguals with TD?

To answer the above questions, three studies were carried out with bilingual children from immigrant and newcomer families. Narratives were elicited using a story-generation task and demographic and linguistic input information were collected using parental questionnaires. In

Paper 1, the narrative abilities of bilinguals with DLD were compared to those of bilinguals with TD. The participants were matched on age and length of exposure to L2 (mean=24 months). Both macrostructure and microstructure components were examined. In Papers 2 and 3, a 3-way comparison was conducted with bilinguals with ASD, DLD and TD matched on age, receptive vocabulary, and non-verbal cognitive scores, but crucially not matched on exposure to L2 English. Paper 2 focused on macrostructure measured in terms of global story grammar scores and individual story grammar components, as well as microstructure components such as MLU or the use of complex syntax. Paper 3 focused on the production of internal state terms.

Taken together, the results revealed several important findings. First, macrostructure differentiated between the bilinguals with DLD and the bilinguals with TD (Paper 1). Second, the ASD and DLD groups patterned similarly for narrative macrostructure when global scores were examined, with only the bilingual ASD group differing significantly from the bilingual TD group (Paper 2). Third, both clinical groups patterned similarly for microstructure components and differed from TD (Paper 2). Fourth, bilinguals with ASD produced fewer narrative components requiring perspective-taking abilities such as the use of internal state terms (Paper 3) and unambiguous character introductions (Paper 2) than both the bilinguals with DLD and TD. In fact, the bilinguals with DLD did not differ from the bilinguals with TD on any component requiring perspective-taking abilities. Finally, exposure to L2 input or richer L2 environments did not predict performance in the ASD or DLD group.

Going back to the larger theoretical questions, the findings from this thesis suggest that (1) macrostructure is an area of weakness in DLD when groups that have lower levels of L2 exposure are compared, but not necessarily when groups with more exposure are compared. Next, the findings for narrative microstructure indicate that (2) at least some children with ASD experience

difficulties with structural language and overlap with DLD. They indicate that (3) narrative components requiring perspective-taking skills represent an area of weakness in ASD, but an area of strength in DLD when language-matched groups are compared. Finally (4), narrative deficits are well-entrenched in both clinical groups and cannot be attributed to differences in L2 exposure. The findings of this thesis have both theoretical and clinical relevance by helping identify targets for intervention.

Preface

This thesis is an original work by Krithika Govindarajan. The research projects contained within this thesis received research ethics approval from the University of Alberta Research Ethics Board, Project Name "Expressive language abilities in bilingual children with Autism Spectrum Disorder", No. Pro00086791. The studies were carried out with the assistance of my supervisor Prof. Johanne Paradis. For Chapter 2, I was responsible for the study design, data analysis and manuscript composition. Johanne was the supervisory author, contributing to concept formation and manuscript edits. For Chapters 3 and 4, I was involved in data collection and was responsible for the study design, data analysis and manuscript composition. Johanne was the supervisory author, contributing to concept formation and manuscript edits. Chapter 2 has been published in The Journal of Communication Disorders (2019), vol. 77, pp.1-16.

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1. Introduction

Oral narratives have been examined in different languages and across different cultures (e.g., Berman & Slobin, 1994). Stories, especially oral stories, are a central part of human life, but to a language acquisitionist, oral stories are also important as a rich source of linguistic data for analysis. In this thesis, I have examined narrative abilities in three groups of bilingual children: bilinguals with Autism Spectrum Disorder (ASD), a second clinical group – bilinguals with Developmental Language Disorder (DLD- defined below), and bilinguals with Typical Development (TD). Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder that is characterized by deficits in social communication, along with the presence of restricted and repetitive patterns of behaviour (American Psychiatric Association (APA), 2013). Although language is not part of the diagnostic criteria for autism, many children are initially referred because of delays in language acquisition, or deficits in communication (Dahlgren & Gillberg, 1989; de Giacomo & Fombonne, 1989; Tager-Flusberg, Paul & Lord, 2005). In this thesis, the terms 'autism', 'Autism Spectrum Disorder' and 'ASD' have been used interchangeably. Children with DLD – the other clinical group in this thesis – have below average language development although they score within the normal range on tests of non-verbal intelligence, have normal hearing and social/emotional development and no frank neurological deficits (Leonard, 2014). Telling an effective story requires the integration of linguistic, pragmatic, and sociocultural aspects of language: hence, producing narratives is a challenging task for both children with ASD and children with DLD.

While collecting data for my thesis, I had the opportunity to interact with several children with ASD, as well as with their families. I was told at the onset that when you interact with a child

with ASD, you truly only learn about *one child* with ASD. As a spectrum disorder, children with ASD show enormous variation. There is variation in both the core symptoms of autism (i.e., social communication and repetitive behaviours), as well as in language and intelligence. Some individuals have profound intellectual disability, while others show superior levels of intelligence. Similarly, while some individuals with ASD have seemingly relatively intact structural language skills, others never acquire functional language (Tager-Flusberg, 2004; Tager-Flusberg *et al*., 2005). As much as 25% to 30% of the population with ASD remains minimally verbal, even after years of receiving intervention (Tager-Flusberg *et al*., 2005; Tager-Flusberg, 2013). As Kasari, Brady, Lord and Tager-Flusberg (2013) note, children who are minimally verbal have a small repertoire of spoken words and phrases to use communicatively. This group is also rarely the focus of language acquisition research.

Most of the research on autism and language has been conducted with monolingual children (e.g., Capps, Losh & Thurber, 2000; Norbury & Bishop, 2014). Children with ASD experience difficulties with social communication and interaction, and as a group, struggle with pragmatic skills (e.g., Capps, Kehres & Sigman, 1998). The monolingual research offers valuable insights into the nature of ASD, as well as raises questions about the linguistic domains affected in ASD, as will be discussed later. However, looking at only monolinguals, as has been the case for much of the existing research, offers an incomplete picture about language and ASD.

It is important to look beyond monolinguals as bilinguals do not represent a marginal population. In Canada, 21.8% of the population speaks a language other than the official languages of English or French at home (Statistics Canada, 2016). This is a statistic from *a single country*. Learning two languages instead of one could reveal unique paths and mechanisms in language development in children with ASD. The existing research on bilingualism and ASD is

characterized by several limitations, such as a focus on comparisons with monolinguals with ASD in order to determine whether children with ASD possess the capacity to become bilingual in the preschool years (e.g., Hambly & Fombonne, 2012; 2014; Ohashi *et al*., 2012; Petersen,Marinova-Todd & Mirenda, 2012; Reetzke *et al*., 2015; Valicenti-Mc Dermott *et al*., 2013). Few studies have included bilinguals with Typical Development (TD) as a comparison group (e.g., Baldimsti *et al*., 2016) and few have looked at older school-age bilingual children with ASD, or at narrative samples (Baldimsti *et al*., 2016; Hoang *et al.,* 2018). Finally, to date, no cross-disorder comparison has been conducted with bilinguals with ASD, and bilinguals with Developmental Language Disorder or DLD. Cross-disorder comparisons between children with ASD and children with DLD have been shown to highlight syndrome-specific characteristics in monolinguals (e.g., Norbury & Bishop, 2014) that might not be revealed by comparisons with TD children.

Coming to the research on bilingualism and DLD, unlike the bilingual ASD research, there is a large – and growing – body of research on the second language acquisition of bilinguals with DLD, including on the narratives produced by this population (e.g., Blom & Paradis, 2013; 2015; Boerma *et al*., 2016; Paradis, Jia & Arppe, 2017; Tsimpli, Persiteri & Andreou, 2016). Children with DLD characteristically struggle with structural aspects of language, like verb morphology (e.g., Blom & Paradis, 2015). However, while DLD has traditionally been defined as *specifically* affecting language, there is evidence indicating that children with DLD also experience difficulties with their processing skills (e.g., Kohnert, Windsor & Danahy Ebert, 2009; Leonard, 2014; Schwartz, 2009). While there are several studies on the narratives produced by bilinguals with DLD (e.g., Altman, Armon-Lotem, Fichman & Walters, 2016), the research provides contradictory results for the specific narrative components affected, and does not fully explain how children with DLD make use of their linguistic experiences and whether they benefit from their linguistic

experiences to the same extent as children with TD. Therefore, additional research on narratives in bilinguals with DLD is warranted in addition to comparisons with bilingual children with ASD.

As this introductory section suggests, there are several limitations to the existing research on narratives, bilingual development and ASD, as well as larger theoretical questions that remain unanswered. The rest of this chapter reviews the extant research on autism and bilingualism, as well as on narrative production across populations in more detail. The limitations of the existing research are highlighted to motivate the research undertaken in this thesis, and the larger proposed theoretical contributions of this thesis are underscored.

This chapter is structured around the following topics:

1. Eliciting narratives and narrative analysis
2. Language abilities in autism: background information, narrative abilities in ASD, and comparisons to children with DLD
3. Research on bilinguals with ASD: limitations of the existing research, comparisons to bilinguals with TD and the existing research on narratives
4. Narratives in DLD: limitations of the existing research
5. The role of language input and environment
6. Aims of this thesis

1.1 Narratives: eliciting narratives and narrative analysis

1.1.1 Eliciting narratives

The term *narrative* refers to a type of connected discourse in which utterances are produced in a temporal order about an event or an experience (e.g., Boudreau, 2008). The ability to produce structured narratives continues to develop over time, continuing into adolescence and later in life (Berman & Slobin 1994, Westerveld & Moran 2013). Narrative abilities have also been linked to later academic outcomes (e.g., Beals, 2001; Dickinson & McCabe, 2001). Analyzing a story produced by a child gives us a rich overview of that child's linguistic abilities; furthermore, narratives allow us to gather linguistic samples in a relatively naturalistic setting. Language sampling is a sensitive and clinically useful method of assessing expressive language (Costanza-Smith, 2010).

Language samples elicited by narratives have been extensively analyzed in both monolingual and bilingual children with TD (Fiestas & Peña, 2004; Gagarina, 2016; Gutiérrez-Clellen, 2002; Pearson, 2002; Rojas *et al*., 2016; Uccelli & Paéz, 2007) as well as in clinical populations, such as children with DLD (e.g., Schneider, Hayward & Dubé, 2006), and monolingual children with ASD (e.g., Norbury & Bishop, 2003). Narratives are probably most commonly elicited through retell tasks (in which a child repeats a story they have heard, with or without visual support) or through story generation tasks (in which a child produces a story while looking at a wordless picture book). Normed and standardized instruments, such as the Edmonton Narrative Norms Instrument (ENNI, Schneider, Dubé & Hayward, 2005) or the Multilingual Assessment Instrument for Narratives (MAIN, Gagarina *et al*., 2012) are often used to elicit narratives in both generation and retell tasks. The ENNI was the narrative instrument used in all studies included in this thesis. Less frequently, narratives may be elicited using personal narratives, in which case, participants are asked to relate something they have experienced. What elicitation method is the most effective in eliciting narratives is a nuanced question: there is some evidence

that children with ASD may find narratives using picture books easier than personal narratives (Losh & Capps, 2003).

There is evidence that the elicitation method – story generation or retell –may affect the narrative produced. Story generation tasks may be more difficult for children than story retell tasks. For example, Schneider (1996) and Schneider and Dubé (1997, 2003) found the quality of stories retold by children to depend on how the stories were presented to them. Children with language disorders produced more story components when they retold stories than when they had to produce stories using picture support (without hearing the story first). Similar results have also been reported with children with TD (Schneider & Dubé, 2005).

1.1.2 Narrative analysis

Narratives are generally analyzed at two different levels, namely macrostructure and microstructure.

The term macrostructure refers to the overall content and organization of the story. The story grammar model (Stein & Glenn, 1979) has been used extensively to study narrative macrostructure, however, other approaches such as looking at information units (e.g., Norbury *et al*., 2014) may also be adopted to analyze narrative macrostructure. Macrostructure analyses typically focus on children's inclusion of story grammar components, the number of story episodes included and the complexity of episode structures.

In the story grammar model, narratives consist of six categories of information or story grammar components. However, not all narratives conform entirely to this model. According to this model, a story has (1) a *Setting* that introduces the time, place and characters in the story, (2) an *Initiating Event* that sets up the problem or dilemma in the story, (3) an *Internal Response* or

the protagonist's response to the Initiating Event, (4) an *Attempt* or an action of the protagonist to solve the problem, (5) the *Consequence* or the result of the previous action and (6) an *Ending* or *Response* of the protagonist to the consequence (Iluz-Cohen & Walters, 2012).

In contrast to macrostructure, the term microstructure refers to a local level of analysis in which the linguistic structures used to produce stories are analyzed. It includes measures of productivity and measures of complexity (e.g., Baixauli, Colomer, Roselló & Miranda, 2016; Justice *et al*., 2006). The term *productivity* refers to the amount of material produced in a narrative. This may be measured by looking at the total number of words produced (TNW), the number of different words produced (NDW), or by calculating clausal level elements such as Communication units or C-units (Justice *et al*., 2006; Mäkinen *et al*., 2014; Mäkinen, 2016). Looking at the mean length of C-units (MLCU), examining complex syntax, looking at morphological errors such as errors in tense and number marking are some ways of examining *complexity* or grammatical functioning (Altman, Armon-Lotem, Fichman & Walters, 2016; Baixauli *et al*., 2016; Justice *et al*., 2006; Mäkinen *et al*., 2014; Mäkinen, 2014). As Altman *et al*. (2016) note, microstructure components cover a wide range of linguistic features.

Mäkinen (2014) indicates two other terms relevant to narrative analysis: *coherence* which refers to the "global organisation of the story of the story in an interrelated and meaningful way, so that the story hangs together" (p.24), and *cohesion* which refers to coherence at a local or micro-level, such as the use of appropriate referring expressions. Telling a story requires not only linguistic skills, but also pragmatic skills as it requires keeping the listener's perspective in mind and distinguishing between new and given information. As Mäkinen (2016) points out, while referencing is established and maintained through linguistic devices (such as through the use of indefinite and definite articles in English), it also requires understanding the listener's perspective

and therefore, an interplay between pragmatic and linguistic aspects. Another aspect that has been extensively examined in the narratives of children with ASD is the use of *internal state terms*, or terms referring to characters' internal states (e.g., emotional or cognitive states) such as *happy* or *think*.

While the explanatory theories of ASD are not the focus of this thesis, referring to two cognitive explanations, the Theory of Mind (ToM) deficit (Baron-Cohen, Leslie & Frith, 1985; Baron-Cohen, 2000) and the Weak Central Coherence (WCC) account (Happé & Frith, 2006) nevertheless help clarify why children with ASD would be expected to have difficulties with narrative tasks, as well as later, in interpreting the results reported. According to the ToM deficit account, individuals with ASD experience difficulties in attributing mental states to themselves and to others (Baron-Cohen *et al.*, 1985). As Baixauli *et al*. (2016) note, it is therefore logical to expect individuals with ASD to experience difficulties with aspects of narration such as the use of internal state terms as these terms require understanding characters' internal states. According to the WCC account, individuals with ASD have a bias towards processing information at a local level, focusing on details, rather than at the global or big picture level (Happé & Frith, 2006). As effective stories have a coherent overall structure, it is possible to assume that individuals with ASD would have difficulties at the macrostructural level (Baixauli *et al*., 2016; Mäkinen, 2016).

Coming to children with DLD, these children would, by definition, be expected to struggle with microstructure components and the literature supports this; however, as reported below, when it comes to narrative macrostructure, the picture is less clear. (see Chapter 2 for more details on narratives in children with DLD).

1.2 Language abilities in autism: background information, narrative abilities in ASD, and comparisons to children with DLD

1.2.1 Background information

As noted above in the introduction, autism is a highly heterogenous condition. By definition, individuals with autism struggle with social communication (APA, 2013). Differences have also been reported for prosodic patterns (Shriberg *et al*., 2001) and language in children with ASD may also be characterized by unusual features such as the use of jargon and echolalia, which is the immediate or delayed echoing of language produced by others (Tager-Flusberg & Calkins, 1990).

When it comes to morpho-syntax, the findings are somewhat conflicting. While some individuals with ASD have clinically normal morpho-syntactic abilities, a substantial sub-group differs significantly from their neuro-typical peers in their morpho-syntactic abilities, and another substantial sub-group has little or no language (Boucher, 2012). Furthermore, developmental patterns and individual profiles vary tremendously (Boucher, 2012). Children with autism may also show more morpho-syntactic deficits relative to normative data in spontaneous speech than in standardized tests, a possible result of the difficulties with pragmatics and social reciprocity that characterize autism (Condouris *et al*., 2003).

Some studies have reported intact use of syntax in children with ASD (e.g., Diehl, Bennetto & Carter Young, 2006; Shulman & Guberman, 2007). For example, in Shulman and Guberman (2007), 5-year-old children with ASD were able to use syntactic information to learn novel verbs in Hebrew to the same extent as TD controls. Similarly, in Diehl *et al*. (2006) 6 to 14-year-old children with ASD produced equally complex sentences as controls with TD on a

narrative task. In contrast to syntax, morphology is more likely to be affected in ASD (Boucher, 2012). Difficulties have been attested for third person and tense morphology in English, as well as for pronominal clitics in French (e.g., Eigsti *et al*., 2007; Tager-Flusberg & Joseph, 2004; Durrleman & Delage, 2016; Meir & Novogrodsky, 2019; Wittke *et al*., 2017). Wittke *et al*. (2017) performed a within-group comparison of language abilities in 5-year-old children with ASD using spontaneous language samples and noted the existence of a sub-group experiencing marked difficulties with grammatical morphology, with relatively intact vocabulary.

Unlike the results for structural language, the results for pragmatics are uniform. Discourse-pragmatics are acknowledged to be the domain in which deficits are most observed in ASD (Eigsti *et al*. 2007). Such deficits are persistent and may also be observed in children with optimal outcomes. For example, in Kelley, Paul, Fein and Naigles (2006), 5 to 9-year-old children with prior diagnoses on the spectrum, with IQs in the normal range, in age-appropriate mainstream classes and considered to be functioning at the level of their neurotypical peers at the time of testing by teachers showed significant differences in discourse and pragmatic abilities but not in structural language.

1.2.2 Narrative abilities in ASD

Going by the very definition of ASD as well as the cognitive explanations proposed for ASD (see 1.1.1), children with ASD would be expected to experience difficulties with some aspects of narrative discourse. There is a growing body of literature that supports the above statement (e.g., Banney, Harper-Hill & Arnott, 2015; Capps, Losh & Thurber, 2000; Losh & Capps, 2003; Mäkinen *et al*., 2014; Mäkinen, 2014; Norbury & Bishop, 2003; Norbury *et al*., 2014). Qualitative differences have been found in the narratives produced, as well as differences

in story components requiring perspective-taking abilities and macrostructure and microstructure components.

1.2.2.1. Qualitative differences and differences in components requiring perspective-taking skills. Telling a story requires both linguistic and pragmatic skills. Not surprisingly, the differences in the narratives produced by individuals with ASD when compared to their neurotypical peers go beyond macrostructure and microstructure components. For example, these differences may be evident to naïve listeners, such as in de Marchena and Eigsti (2010), in which the narratives produced by adolescents with ASD were considered to be less clear and engaging than those produced by their neurotypical peers. Furthermore, difficulties with narration are persistent and remain present even in adults with ASD who do not differ from their neurotypical peers on standardized measures of language (Barnes & Baron-Cohen, 2012; Colle, Baron-Cohen, Wheelwright & van der Lely, 2008). For example, in Barnes and Baron-Cohen (2012), differences were found between the *kind* of information provided by adults with ASD and the *kind* of information produced by neurotypical adults when producing stories from video clips. While the participants with ASD provided details about story components, such as by describing furniture for the setting, the neurotypical participants were more likely to situate these components within the story as a whole, such as by identifying specific locations for the setting. These results were considered consistent with the WCC theory. Similarly, in Colle *et al*. (2008), adults with autism produced fewer temporal and referential expressions than neurotypical controls during a story generation task. These results were considered consistent with the ToM deficit theory as producing temporal and referential expressions requires keeping the listener's needs in mind. The narratives produced by children with ASD may also be characterized by the presence of irrelevant information (Capps *et al*., 2000; Loveland, McEvoy, Tunali & Kelley, 1990; Mäkinen *et al*., 2014;

Norbury *et al*., 2014). For example, in Norbury *et al*. (2014), children with ASD were significantly more likely to make pragmatic errors, including erroneous information and irrelevant details. Children with ASD may also use idiosyncratic language, such as overly formal, scripted language or neologisms in their stories (Suh *et al*., 2014).

Children with autism experience difficulties in perspective-taking and hence, a natural corollary of the ToM account would be the reduced use of internal state terms (Bang, Burns & Nadig, 2013). While some studies indicate that children with autism use fewer internal state terms than controls with TD (e.g., Baron-Cohen, Leslie and Frith, 1986; Brown, Morris, Nida & Baker-Ward, 2012; Rumpf, Kamp-Becker, Becker & Kauschke,2012; Siller, Swanson, Serlin & Teachworth, 2014), other studies have not found differences for the production of internal terms (e.g., Bang *et al*., 2013; Norbury & Bishop, 2003; Mäkinen *et al*., 2014). However, even when differences have not been found for the number of internal state terms produced, children with ASD may struggle with telling stories within a causal framework and explaining *why* story characters experience the internal states they do (Tager-Flusberg & Sullivan, 1995; Capps *et al*., 2000; Losh & Capps, 2003; Diehl *et al*., 2006). A recent meta-analysis by Baixauli, Colomer, Roselló and Miranda (2016) indicates that the production of internal state terms is an area of weakness for children with ASD. According to this meta-analysis, children with autism include fewer internal state terms than children with TD, with a medium effect size.

1.2.2.2 Narrative abilities in ASD: macrostructure and microstructure. For macrostructure and microstructure in narrative produced by children with ASD, the results seem to be inconclusive, especially at first. Studies have found divergent, and sometimes contradictory results for both narrative macrostructure (e.g., Norbury & Bishop, 2003 vs. Norbury *et al*., 2014) as well

as for aspects of narrative microstructure such as the use of complex syntax (e.g., Rumpf, Kamp-Becker, Becker & Kauschke, 2014 vs. Norbury *et al*., 2014).

Coming to narrative macrostructure – the conceptual organisation of stories – there is some evidence that children with ASD produce stories with informative content similar to those produced by TD children (Norbury & Bishop, 2003; Young, Diehl, Morris, Hyman & Bennetto, 2005). Other studies have, however, found significant differences for either story components taken together, or for particular story components, especially story resolutions (e.g., Banney *et al*., 2015; Losh & Capps, 2003; Mäkinen *et al*., 2014; Norbury *et al*., 2014; Rumpf *et al*., 2012; Suh *et al*., 2014; Tager-Flusberg, 1995). For example, in Mäkinen *et al*. (2014) the narratives produced by 5-10-year-old children with ASD (N=16) were compared to those produced by age-matched children with TD. A story generation task was used in this study and a list of information units was created before analysis. Overall, the children with ASD produced fewer information units than the children with TD, resulting in less coherent stories. Similar results have been found in other languages (e.g., Rumpf *et al*., 2012), as well as in story retell tasks (Diehl *et al*., 2006; Smith Gabig, 2008). While contradictory results have been reported (Norbury & Bishop, 2003; Young *et al*., 2005), the meta-analysis by Baixauli and colleagues indicates narrative macrostructure as an area of weakness in ASD when compared to TD. Significant group differences were reported, with a large effect size (Baixauli *et al*., 2016).

Next, moving on to microstructure components, looking at these components is particularly interesting as there is debate in the field, as to whether morphosyntax is an area of relative strength for children with ASD (Naigles, Kelty, Jaffery & Fein, 2011), or whether children with ASD show atypical morphosyntactic trajectories when compared to the neurotypical population (Eigsti, Bennetto & Dadlani, 2007; also see Section 1.2.1). As with the literature on narrative

macrostructure, the findings for microstructure are also characterized by seemingly inconsistent and contradictory results, both for measures of productivity (e.g., Norbury *et al*., 2014 vs. Young *et al*.,2005) as well as for measures of complexity (e.g., Norbury *et al*., 2014 vs. Rumpf *et al*., 2014).

Narrative productivity is often analyzed in different ways, such as by examining the total number of words produced (e.g., Banney *et al*., 2015), the number of utterances produced (e..g, Novogrodsky, 2013), the number of clauses produced (e.g, Losh & Capps, 2003; Sah & Torng, 2015) or by examining the number of different words produced (e.g, Suh *et al*.,2014). While some studies have reported differences for narrative productivity (Norbury *et al*., 2014; Rumpf *et al*., 2014; Siller *et al*., 2014; Smith Gabig, 2008), several studies have not (Banney *et al*., 2015; Mäkinen *et al*., 2014; Kauschke, van der Beek & Kamp-Becker, 2016; Novogrodsky, 2013; Sah & Torng, 2015; Suh *et al*., 2014; Young *et al*.,2005). However, the meta-analysis by Baixauli *et al*. (2016) indicates productivity to be an area of weakness for children with ASD, with a moderate effect size. Furthermore, narrative productivity does not necessarily indicate good story content as some studies that have not found differences on measures of narrative productivity have nevertheless found differences on measures of story structure/macrostructure (e.g., Banney *et al*., 2015, Mäkinen *et al*., 2014; Suh *et al*., 2014).

Complexity has generally been examined by looking at syntactic complexity (e.g., Norbury & Bishop, 2003; Diehl *et al*.,2006) and the mean length of utterances (e.g., Kauschke *et al*., 2015; Rumpf *et al*.,2014). Children with ASD have been reported to produce shorter utterances (Mäkinen *et al*., 2014; Norbury *et al*.,2014; Smith Gabig, 2008; Tager-Flusberg, 1995) and use less complex syntax than their TD peers (Capps *et al*., 2000; Banney *et al*.,2015; Mäkinen *et al*., 2014; Norbury & Bishop, 2004), but similar patterns of performance for both groups have been reported for both

the length of utterances (Kauschke *et al*., 2016; Rumpf *et al*.,2014; Suh *et al*.,2014) as well as for syntactic complexity (Diehl *et al*., 2006; Losh & Capps; Norbury & Bishop, 2003; Norbury *et al*, 2014; Novogrodsky, 2013; Rumpf *et al*., 2014). While it is difficult to generalize from these studies, Baixauli *et al*. (2016) report in their meta-analysis that measures of complexity differentiate between children with ASD and children with TD, with a moderate effect size.

To conclude, narratives show promise as assessment tools for children with ASD, with moderate to large effect sizes for internal state terms, macrostructure, and microstructure components (Baixauli *et al*., 2016). Furthermore, narrative measures differentiate between children with ASD and TD controls who do not differ on standardized language assessments (Banney *et al*., 2015; Norbury *et al*., 2014). However, inconsistent results have been reported in the literature. Matching strategies, task-effects as well as the heterogeneity of symptoms in ASD may partly underlie these divergent results.

1.2.3 Comparisons to children with DLD

Comparisons between children with ASD and children with DLD are valuable as they help identify both similarities and differences between the linguistic profiles of these two clinical groups. They are important as the boundaries between ASD and DLD have been discussed (e.g., Bishop, 2010; Norbury *et al*., 2014; Tager-Flusberg & Joseph, 2004), with the suggestion that a sub-group of children with ASD may also have a co-morbid language disorder (e.g., Tager-Flusberg & Joseph, 2004; Wittke *et al*., 2017; Tomblin, 2011). While it is universally acknowledged that children with ASD struggle with pragmatics, as noted earlier in section 1.21.1, children with ASD may also struggle tense and person morphology in English and clitics in French, both of which are considered clinical markers of DLD in their respective languages (e.g., Eigsti *et*

al., 2007; Tager-Flusberg & Joseph, 2004; Durrleman & Delage, 2016; Wittke *et al*., 2017). Cross-disorder comparisons with these two clinical populations can highlight syndrome-specific difficulties and strengths, which in turn, could inform theories on the nature of the disorders as well as help identify targets for intervention.

To date, only a few studies have compared the narratives produced by children with ASD to those produced by children with DLD (Colozzo *et al*., 2015; Engberg-Pedersen & Christensen, 2017; Mäkinen, 2014; Manolitsi & Botting, 2011; Norbury & Bishop, 2003; Norbury *et al*., 2014). Taken together, these studies indicate largely similar microstructure profiles between ASD and DLD (Colozzo *et al*., 2015; Norbury & Bishop, 2003; Norbury *et al*.,2014). For macrostructure, ASD and DLD have patterned similarly in some studies (Norbury & Bishop, 2003; Norbury *et al*., 2014) but there is some evidence suggesting that macrostructure may be an area of vulnerability for children with ASD when compared to children with DLD (Colozzo *et al*., 2015; Manolitsi & Botting, 2008). For example, in Colozzo *et al*. (2015), the narratives produced by 6 to 10-year-old age-matched children with ASD, TD and DLD were examined. Two story generation tasks were used. While significant differences were found for story grammar scores between the children with ASD and the children with TD, the children with DLD occupied an intermediate position and did not differ significantly from either group. The ASD group also produced more irrelevant content than the DLD group. Further differences were reported between children with ASD and children with DLD in Goldman (2008) on two specific macrostructure components- persons and resolutions. When it comes to internal state terms, looking at internal state terms has rarely been the focus of DLD research. Some studies have found no differences in the production of internal state terms when comparing children with ASD, DLD and TD (e.g., Norbury & Bishop, 2003). However, other studies have found children with DLD to produce more internal state terms

compared to children with ASD (e.g., Colozzo *et al*., 2015), and yet others have found children with ASD to produce more internal state terms than children with DLD (e.g., Norbury *et al*., 2014; Mäkinen, 2014). For example, in Norbury and Bishop (2014), a three-way comparison was conducted between by 6 ½ to 15-year-old children with ASD, DLD and TD who were matched on age and non-verbal abilities. Crucially, the participants with ASD did not differ from TD controls on measures of structural language as measured on standardized tests, and the children with DLD did not show any pragmatic deficits but differed from TD controls on structural language measures. The children with DLD produced fewer internal state terms than both the participants with ASD and the participants with TD who did not differ in their production of internal terms. Norbury and Bishop noted that to produce internal state terms, it is necessary to have the vocabulary to do so. Both Norbury *et al*. (2014) and Mäkinen (2014) proposed linguistic deficits, rather than difficulties with ToM abilities, for the reduced use of internal state language by children with DLD.

To conclude, the existing research comparing the narratives produced by children with ASD and children with DLD indicates possible similarities and differences between these two groups, but also leaves some questions unanswered. First, microstructure abilities are largely similar in ASD and DLD with both groups differing from TD. Comparisons with bilinguals can further elucidate whether structural language difficulties also characterize ASD in the context of dual language learning, and, in their second language. In other words, the question of whether structural language difficulties represent a stable characteristic of ASD across diverse language experiences can be elucidated by examining bilingual groups. Second whether macrostructure represents an area of consistent vulnerability in ASD, as compared to DLD, remains to be seen in monolingual and bilinguals. Third, the question of whether certain story grammar components, such as resolutions or story outcomes, are particularly affected, needs to be further investigated.

Finally, it is important to compare ASD and DLD groups matched on language abilities to see whether narrative components requiring perspective-taking skills represent an area of weakness in ASD, but possibly an area of relative strength in DLD. Matching on language skills is particularly important for bilingual populations who show greater heterogeneity in language abilities than their monolingual counterparts due the complexity of their language experiences (Paradis, 2019; Paradis, Genesee & Crago, 2011; see also 1.5).

1.3 Research on bilinguals with ASD: limitations of the existing research, comparisons to bilinguals with TD and the existing research on narratives

1.3.1 Limitations of the existing bilingual research

The existing research on bilingualism and ASD has largely focused on whether children with ASD have the capacity to become bilingual (e.g., Hambly & Fombonne, 2012; Ohashi *et al*., 2012; Petersen, Marinova-Todd & Mirenda, 2012; Reetzke, Zhou, Sheng & Katsos, 2015; Valicenti-Mc Dermott *et al*., 2013). This body of research is motivated by both theoretical as well as clinical interests as assessment, intervention and providing advice about language use to parents are more complex when two languages need to be considered (Kay Raining-Bird, Trudeau & Sutton, 2016). Concerns about bilingualism and ASD are similar to those that have been voiced for children with DLD. Both children with ASD and children with DLD have deficits in their language learning mechanisms – in processing for children with DLD (Leonard, 2014) and in social interaction for ASD (APA, 2013). As bilingual children with autism and bilingual children with DLD need to also deal with learning an additional language, along with their syndrome specific deficits, research has therefore focused on whether bilinguals from these two populations face any additional challenges in language acquisition when compared to their monolingual peers.

In the case of children with DLD, the claim that bilingual children with DLD would experience additional difficulties compared to their monolingual peers is known as the Cumulative Effects Hypothesis or CEH (e.g., Orgassa, 2009; Orgassa & Weerman 2008; Paradis, 2010a, Verhoeven, Steenge and van Balkom, 2011a; Verhoeven, Steenge, van Weerdenburg and Van Balkom, 2011b). While a few studies have found evidence in support of the CEH (Orgassa & Weerman 2008; Verhoeven, Steenge and van Balkom, 2011a; Verhoeven, Steenge, van Weerdenburg and Van Balkom, 2011b), others have not (e.g., Gutiérrez-Clellen, Simon-Cereijido & Wagner, 2008; Morgan, Restrepo and Auza, 2013; Paradis *et al*., 2000; 2003; Paradis, Jia & Arppe, 2017; Rothweiler, Chilla & Clahsen, 2012). Paradis *et al*. (2017) note that while there is mixed empirical evidence in favour of the CEH, most studies on the CEH focus on the early years of acquisition, and differences found between monolinguals and bilinguals with could be attributed to limited second language (L2) exposure.

For bilinguals with ASD though, the existing results are incontrovertible: there are no detrimental effects of bilingualism on children with ASD (e.g., Baldimsti *et al*.,2016 ; Gonzalez-Barrero & Nadig, 2017; Hambly & Fombonne, 2012; Lam, 2015; Ohashi *et al*.,2012; Petersen *et al*.,2012; Reetzke *et al*.,2015; Valicenti-McDermott *et al*.,2013). This line of research is important because parents and caregivers frequently express concerns about bilingualism and mention receiving advice from professionals to use only one language with their child (e.g., Ijalba, 2016; Kremer-Sadlik, 2004; Yu, 2013; 2016). They may feel pressured to switch to English even when they are less proficient speakers of English (Yu, 2013).

The research comparing bilinguals with ASD to monolinguals with ASD has found both groups to be comparable on different developmental measures, such as the age of first words and phrases, vocabulary size and performance on standardized language tests (Hambly & Fombonne,

2012; Ohashi *et al*., 2012; Petersen *et al*., 2012; Reetzke *et al*., 2015; Valicenti-McDermott *et al*., 2013). Nevertheless, this research is also characterized by several limitations. The focus has largely been on early development and milestones, have mainly used parent questionnaires (and hence, limited direct testing) and have not included comparisons to bilinguals with TD who would have similar linguistic environments and would receive similar input in the L2 (e.g., Ohashi et al., 2012; Valicenti-Mc Dermott *et al*., 2013) To date, only a handful of studies have included a bilingual TD control group (discussed below in 1.3.2). One way for bilingual research on ASD to advance is through an increased focus on comparisons to bilinguals with TD and studies with older bilinguals with ASD that examine connected discourse. In so doing, such research would build on the exiting base to increase our understanding of whether bilingualism poses any additional disadvantages for the language development of children with ASD.

1.3.2 Comparisons to bilinguals with TD and the existing research on narratives

Only a few studies have included a bilingual TD comparison group when studying bilinguals with ASD (e.g., Baldimsti *et al*.,2016; Gonzalez-Barrero & Nadig, 2017; Hoang, Gonzalez-Barrero & Nadig; 2018; Yang, 2011) and out of these, only three have looked at narratives (Baldimsti *et al*.,2016; Hoang, Gonzalez-Barrero & Nadig; 2018; Yang, 2011). More studies on narratives with TD bilingual participants are required as the existing research is quite limited, and its results are inconclusive. For example, Baldimsti *et al*. (2016) did not find differences for macrostructure or microstructure components between TD and ASD, while Hoang *et al*. (2018) found children with ASD to produce less coherent stories on a picture-sequencing task than children with TD. More research is required on the narrative skills of bilingual children as microstructure components such as lexical diversity or story components such as internal state terms have not been examined in detail with bilinguals with ASD. Furthermore, there have been no cross-disorder comparisons of bilinguals with ASD and with DLD.

Focusing on three-way comparisons with bilinguals with ASD, TD and DLD would clarify two larger theoretical questions: the presence of structural language deficits in ASD and the overlap between ASD and DLD. As noted earlier in 1.2.1, the extent of structural language difficulties in children with ASD is being debated. Comparisons between bilinguals with ASD and bilinguals with TD would contribute uniquely to this debate which has hitherto been carried out in the context of monolingual acquisition. If differences were found on microstructure components between bilinguals with ASD and bilinguals with TD, who are both in the process of acquiring their second language, this would point to the existence of stable structural language deficits in ASD and strengthen the conclusions of the monolingual research. Next, if bilinguals with ASD and bilinguals with DLD were to pattern similarly for narrative microstructure measures, this would provide additional support to the idea that some children with ASD may have a language disorder, again with a unique population of language learners. Finally, such cross-disorder comparisons would also have practical relevance by determining targets for intervention with bilingual speakers with ADD and DLD.

1.3 Narratives in DLD: limitations of the existing research

There is an extensive body of research comparing the narrative abilities of children with DLD to those of children with TD. Unsurprisingly, significant differences have been reported for measures of productivity and complexity (e.g., Fey *et al*., 2004; Norbury & Bishop, 2003; Norbury *et al*.,2014; Reilly *et al*., 2004; Schneider *et al*.,2006). However, when it comes to macrostructure, the results are less consistent. While some studies have found lower macrostructure scores for children with DLD (e.g., Bishop & Donlan, 2005; Reilly *et al*.,2004; Norbury *et al*.,2014), other studies have not found macrostructure to distinguish between these two groups (e.g., Norbury & Bishop, 2003).

The results from the growing body of research on the narratives produced by bilinguals with DLD parallel the findings from the monolingual literature (e.g., Boerma *et al*., 2016; Rezzonico *et al*.,2015; Squires *et al*., 2014; Tsimpli, Persiteri & Andreou, 2016). Overall, bilinguals with DLD are less-skilled narrators than bilinguals with TD. The results are consistent for microstructure components, with bilinguals with TD outperforming bilinguals with DLD (e.g., Altman *et al*., 2016; Iluz-Cohen & Walters, 2012; Rezzonico *et al*., 2015; Squires *et al*., 2014; Tsimpli *et al*., 2016). Like for monolinguals, the results are inconsistent for narrative macrostructure with bilinguals with DLD producing fewer story elements in some studies (Boerma *et al*., 2016; Rezzonico *et al*., 2015), but not in others (e.g., Altman *et al*., 2016; Iluz-Cohen & Waters, 2012). Further discussion of some reasons for these conflicting findings are in Chapter 2.

More research is therefore required to determine whether story structure represents an area of weakness in bilinguals with DLD, and especially how bilingual children with DLD pattern relative to children with ASD. As noted earlier, internal state terms have rarely been the focus of the research on DLD. Whether internal state terms represent an area of relative strength in bilinguals with DLD and with ASD when groups matched on language abilities are compared remains to be seen.

1.4 The role of language input and environment

Variation in input affects language acquisition, both for monolinguals and for bilinguals. When it comes to bilinguals, there are even more sources of input variation to consider, as bilinguals encounter the variation arising from learning two different languages, in addition to the variation that monolinguals also face (Grüter & Paradis, 2014; Paradis & Jia, 2016). Factors influencing L2 acquisition, such as the length of L2 exposure and quality of L2 input have been examined in

bilinguals with TD (e.g., Golberg, Paradis & Crago, 2008; Unsworth, 2013, 2016; Paradis, 2011). For example, bilingual children with a longer overall exposure to English as a L2 are more accurate with L2 morphosyntax and vocabulary (e.g., Paradis, 2011). Similarly, bilingual children who spend more time doing activities associated with high quality input such as reading books in the L2, i.e., children who have richer language environments, show better L2 outcomes in areas such as vocabulary size and verb morphology, when compared to children with less rich L2 environments (e.g., Jia & Fuse, 2007; Paradis, 2011; Paradis, Rusk, Sorenson Duncan & Govindarajan, 2017).

In contrast to the extensive literature examining sources of individual differences in bilingual children with TD, there have only been a few studies that have looked at how variation in input affects bilingual children with DLD (Blom & Paradis, 2015; Squires *et al.*, 2014). These studies indicate differential effects for bilinguals with TD and bilinguals with DLD, as bilinguals with DLD do not seem to make use of the input they receive to the same extent as bilinguals with TD. For example, in Blom and Paradis (2015), bilingual children with TD performed better on a tense inflection task when they had more exposure to English. However, the children with DLD did not show greater accuracy on the same task with more exposure to English. These differential effects were explained by referring to the processing limitations that characterize DLD (Blom & Paradis, 2015) .The relationship between amount of input and language abilities may not be the same for children with DLD, as it is for children with TD, as children with DLD exhibit deficits in cognitive systems implicated in language learning such as verbal memory and information processing speed (e.g., Kohnert, Windsor & Danahy Ebert, 2009; Leonard, 2014; Schwartz, 2009), which could make uptake from the input more difficult than for unaffected children

As Bang and Nadig (2015) note, relatively little is known about the linguistic environment that is available to children with ASD, and the extent to which children with autism make use of their linguistic environments. Children with ASD experience difficulties with social communication and engaging with others and therefore, may not make use of the input they receive to the same extent as children with TD (Paradis & Govindarajan, 2018). Studies with monolingual children with ASD indicate positive relationships between input and later language (Bang & Nadig, 2015; Swensen, 2007; Warren *et al*., 2010). For example. in Bang and Nadig (2015), input MLU was seen to positively contribute to monolingual children's later spoken vocabulary, for both children with TD and the children with ASD. Not surprisingly, these results indicate that children with ASD make some use of the input that is available to them. However, further investigation, is required to determine the extent to which they do so. For bilinguals with ASD, the relationship between input and language outcomes has hardly been examined (Hambly & Fombonne, 2014; Reetzke, Zou, Sheng & Katsos, 2015). While Hambly and Fombonne found amount of current exposure to the L2 to account for 69% of the variance in L2 expressive vocabulary size, Reeztke *et al*. (2015) found no significant correlations between bilingual children's overall amount of exposure to their two languages and their communication skills.

To summarize, the relationship between quantity and quality of input and language abilities remains to be further explored for both monolingual and bilingual children with ASD. The question of whether bilingual children with ASD make use of their language environments to the same extent as children with TD is particularly important given the greater variation in the linguistic environments of bilinguals.

1.6 Aims of this thesis

The purpose of this dissertation was to examine narrative abilities in bilinguals with ASD, DLD and TD. As reviewed in this chapter, the existing findings from the literature are often conflicting; there are also gaps in knowledge about narrative development in bilinguals with language and communication disorders, and larger theoretical questions remain unanswered. In this section, the broad research questions and objectives of this thesis are discussed.

While there has been more research examining narratives in bilinguals with DLD compared to bilinguals with ASD, as outlined in section 1.4, the question of whether macrostructure is an area of weakness in DLD remains to be answered. This broad research question was addressed in the study reported in Chapter 2.

Next, as indicated in section 1.3, the existing research on autism and bilingualism is characterized by several limitations, such as limited studies on narratives and no comparisons to bilinguals with DLD. The studies reported in Chapters 3 and 4 addressed these limitations by conducting a 3-way comparison of the narrative abilities of bilinguals with ASD, DLD and TD. As outlined in section 1.2.1, the question of whether autism is also characterized by difficulties with structural language needs to be answered. This broad research question was addressed in the study reported in Chapter 3 in which narrative components were examined, along with narrative macrostructure components.

The next research question addressed was the question of whether narrative components requiring perspective-taking abilities represent an area of relative strength in DLD, but an area of weakness in ASD when groups matched on language was compared. This question was briefly

addressed in the study reported in Chapter 3 in which individual story grammar components were examined; it was examined in detail in Chapter 4 which focused on the production of internal state terms. Finally, given the social communication difficulties in ASD and the processing limitations in DLD, both clinical groups would be expected to use the L2 input they receive less efficiently than bilinguals with DLD. This question of whether bilinguals with DLD and bilinguals make less efficient use of L2 input was examined across all three studies.

Accordingly, the specific objectives of the three studies that constitute this thesis were as follows:

1 In Chapter 2, bilinguals with DLD were compared to bilinguals with DLD. Both macrostructure and microstructure components were examined. The specific objectives of this study were to examine the narrative abilities in bilingual children with TD and DLD in order to determine whether macrostructure is an area of weakness or strength in DLD, and to examine the extent to which children with DLD make use of the input they receive.

2 In Chapter 3, the narrative abilities of bilinguals with ASD, DLD and TD were examined. Both macrostructure and microstructure components were analyzed. The specific objectives of this study were to identify whether macrostructure is particularly vulnerable in ASD compared to DLD; to see whether children with ASD and DLD have similar microstructure abilities and differ from children with TD and to identify whether structural language difficulties characterize ASD.

3 In Chapter 4, the internal state terms produced by bilinguals with ASD, DLD and TD were examined. The specific objective of this study was to examine whether narrative components requiring perspective-taking abilities represent an area of relative weakness in ASD, but an area of relative strength in DLD when groups that are matched on language abilities are compared.

2. Narrative abilities of bilingual children with and without Developmental Language Disorder (SLI): Differentiation and the role of age and input factors (Krithika Govindarajan & Johanne Paradis)

Abstract

Purpose: The narrative abilities of bilinguals with TD and with DLD/SLI in their English L2 were examined in order to 1) identify the narrative components that differentiate these two groups and 2) determine the role of age and input factors in predicting L2 narrative abilities in each group.

Method: Participants were 24 English L2 children with DLD and 63 English L2 children with TD, matched on age (mean = 5;8) and length of exposure to the L2 (mean = 24 months). Narrative samples were elicited using a story generation task and a parent questionnaire provided age and input variables.

Results: Bilinguals with DLD had significantly lower scores for story grammar than their TD peers but showed similar scores for narrative microstructure components. Length of L2 exposure in school and richness of the L2 environment predicted better narrative abilities for the group with TD but not with DLD. Older age predicted better narrative abilities for the group with DLD but not with TD. Quantity of L2 input/output at home did not predict story grammar or microstructure abilities in either group.

Conclusion: Story grammar might differentiate between children with TD and DLD better than microstructure among bilinguals with less exposure to the L2 and when a story generation task is used. Bilinguals with TD make more efficient use of L2 input than bilinguals with DLD.

Keywords: Developmental Language Disorder, child bilingualism, narratives, Specific Language Impairment, second language acquisition, individual difference factor

2.1 Introduction

Societies are becoming increasingly multilingual, with many people speaking a language other than the majority language at home. In the Canadian context, 21.8 % of the population speaks a language other than the official languages of English or French at home (Statistics Canada, 2016). The growing number of minority language-speaking children in both Europe and North America has revealed a need for a greater understanding of bilingual development as it pertains to clinical practice (e.g., Kay-Raining Bird, Genesee & Verhoeven, 2016; Paradis & Govindarajan, 2017). The bulk of research on bilingual children with Developmental Language Disorder (DLD; synonymous with specific language impairment, SLI)[1] has been focused on how to discriminate bilingual children with typical development (TD) from their peers with DLD in order to improve accuracy in assessment. The present study follows this line of research by examining how different components of narrative production distinguish children with DLD from those with TD among bilinguals from immigrant and refugee families in Canada who were still in the process of learning their second language (L2). Furthermore, much recent research has shown that, for bilingual children with TD, factors such as age and quantity and quality of language input have a great deal of impact on individual children's development in each language (e.g., Grüter & Paradis, 2014). However, very little research on bilinguals with DLD has focused on what predicts individual differences in their dual language development. Our understanding of the mechanisms underlying bilingual development in children with DLD would be enhanced by examining the role of these factors (Blom & Paradis, 2015; Paradis, 2016). Therefore, in addition to comparing the narrative

[1]Following Bishop, Snowling, Thompson, Greenhalgh & CATALISE-2 consortium (2017), we use the term 'Developmental Language Disorder (DLD)' in lieu of 'Specific Language Impairment (SLI)' throughout.

skills of bilingual children with and without DLD, the present study examines the role of age and input factors in predicting individual differences in children's narrative skills.

2.1.1 Narrative abilities in monolingual children with and without DLD

Narratives provide rich information about a child's linguistic abilities. Examining oral narratives allows clinicians and researchers to look at multiple aspects of a child's language such as morphology, phonology, syntax, and discourse-pragmatic abilities. Narratives have been studied extensively in different languages and in different cultures (e.g., Berman & Slobin, 1994). Narrative samples are commonly elicited by using story generation or story retell tasks. In story generation tasks, children are asked to produce stories, often with the support of wordless picture books such as Mercer Mayer's *Frog, where are you*? (Mayer, 1969). In story retell tasks on the other hand, children are asked to retell a story that has been read out to them.

Producing a story requires both linguistic and conceptual knowledge. It requires the ability to organize and structure the narrative (i.e. macrostructure) to produce a coherent story, as well as the ability to use the linguistic devices required to produce a cohesive story (i.e. microstructure). For analyses of children's narratives, both narrative macrostructure and narrative microstructure are typically examined. The term macrostructure means the conceptual organization of the story and often refers to the story grammar model (Stein & Glenn, 1979). In this model, a story consists of different episodes which may be divided into different story grammar units. The different story grammar units include the setting (that provides information about the characters in the story as well as the location of the story in time and place), an initiating event (an event that triggers some response from the characters), an internal response (how characters respond to the initiating event), an internal plan (how characters plan to respond to the initiating event), an attempt (the different

actions performed by characters to reach their goals), an outcome or the consequence of the previous attempt and a reaction (how characters respond to the consequence) (e.g. Stein & Glenn, 1979). The story grammar model has been used extensively to study narrative macrostructure and formed the basis for the standardized narrative instrument, the Edmonton Narrative Norms Instrument (ENNI; Schneider, Dube, & Hayward, 2005), used in the present study. Other narrative instruments measure narrative macrostructure in somewhat different ways. For example, the Multilingual Assessment Instrument for Narratives, the MAIN (Gagarina, Klop, Kunnari, Tantele, Välimaa, Balciuniene, Bohnacker & Walters, 2012) consists of three measures of narrative macrostructure: (1) the number of story structure elements such as goals, attempts and outcomes (2) the number of internal state terms used and (3) structural complexity, which measures completeness of story episodes.

The term microstructure, on the other hand, refers to a variety of linguistic devices to promote cohesion, such as referring expressions in first mentions of characters or use of connectives. For example, choosing between a definite or indefinite noun phrase as a referring expression to introduce a new character is a component of microstructure. The term microstructure is also often used to refer to the lexical and morphosyntactic components of the story, e.g., mean length of utterance, lexical diversity or use of complex syntax. Whereas macrostructure/story grammar is at the interface of cognitive and linguistic abilities, microstructure elements require more specifically linguistic knowledge of the target language.

There is an extensive body of research on the narratives produced by monolingual children with TD as well as with DLD (e.g., Berman & Slobin, 1994; Fey, Catts, Proctor-Williams, Tomblin, & Zhang, 2004; Reilly, Losh, Bellugi & Wulfeck, 2004). Studies that have examined the narrative abilities of monolingual children with TD and with DLD have focused on the

identification of the narrative components that differentiate between these two populations. When it comes to narrative microstructure, the findings have been largely consistent: children with TD outperform children with DLD. For example, children with DLD tend to produce narratives with more grammatical errors, reduced lexical diversity, fewer complex sentences and have difficulties introducing referents (e.g., Fey *et al*., 2004; Norbury & Bishop, 2003; Schneider & Hayward, 2010). However, results have been less consistent for story grammar as not all studies have found narrative macrostructure to discriminate between children with TD and children with DLD (e.g., Blom & Boerma, 2016; Norbury & Bishop, 2003).

2.1.2 Narrative abilities in bilingual children with TD and DLD

In addition to studies with monolingual children, there is now a growing body of research that has examined the narrative abilities of bilingual children. Studies with TD bilingual children have included comparisons with TD monolinguals and have also examined narrative abilities in both languages (e.g., Fiestas & Peña, 2004; Gagarina, 2016; Gutiérrez-Clellen, 2002; Pearson, 2002; Rojas *et al*., 2016; Uccelli & Paéz, 2007). Studies with bilingual children with DLD have compared the narrative abilities of bilingual children with DLD to those of monolingual children with DLD (e.g., Boerma, Leseman, Timmermeister, Wijnen & Blom, 2016; Cleave, Girolametto, Chen & Johnson 2010; Rezzonico *et al*., 2015) and of bilingual children with TD in order to better differentiate between these populations (e.g., Boerma *et al*., 2016; Paradis, Schneider & Sorenson Duncan, 2013; Rezzonico *et al*.,2015; Squires *et al*., 2014; Tsimpli, Persiteri & Andreou, 2016). Narratives have also been used with bilingual populations to elicit language samples whose microstructure is analyzed for clinical markers of DLD, such as morphological use and accuracy, with the goal of understanding if clinical markers are similar for monolinguals and bilinguals with DLD (Gutiérrez-Clellen, Simon-Cereijido & Wagner, 2008). Narratives have also been used with

bilingual populations to elicit language samples that have been analyzed to identify phenomena such as the emergence of tense marking (Gusewski & Rojas, 2017).

Overall, bilingual children with DLD are less skilled narrators than bilingual children with TD. Like the findings for monolingual children with and without DLD, not all studies have found narrative macrostructure to effectively discriminate between bilingual children with DLD from those with TD. Some studies have found comparable story grammar abilities in both groups of bilingual children (e.g., Iluz-Cohen & Walters, 2012; Altman Armon-Lotem, Fichman & Walters; 2016; Tsimpli *et al*., 2016) whereas others have found story grammar components to differentiate between bilinguals with and without DLD (Boerma *et al*., 2016; Paradis *et al*., 2013; Rezzonico *et al*., 2015). When it comes to narrative microstructure, the results are more consistent. Bilingual children with TD tend to outperform bilingual children with DLD on various microstructure components (e.g., Altman *et al*., 2016; Iluz-Cohen & Walters, 2012; Rezzonico *et al*., 2015; Squires *et al*., 2014; Tsimpli *et al*., 2016).

In Iluz-Cohen and Walters (2012), five- and six-year-old English-Hebrew bilingual children with and without DLD produced narratives when shown picture books depicting familiar stories. Participants in this study spoke English at home, had been exposed to Hebrew as a second language (L2) when they started preschool and, at the time of testing, had more than two years of exposure to Hebrew. Both groups of children had similar story grammar scores but differed on lexical and morphosyntactic measures such as the use of different word types and complex syntax (Iluz-Cohen & Walters, 2012). Parallel results were also reported in Altman *et al.* (2016) in which English-Hebrew bilingual preschoolers with TD and with DLD who had at least of two years of exposure to their L2, Hebrew, took part in a narrative retell task. Both groups of participants had similar narrative macrostructure abilities but differed on microstructure components such as lexical

diversity (Altman *et al*., 2016). Finally, Tsimpli *et al*. (2016) administered a narrative retell test to nine-year-old bilingual children with TD and with DLD who had several years of exposure to Greek as their L2. Both groups of participants had similar scores for story structure, as measured by calculating the number and structure of episodes in each story: however, the bilinguals with TD outperformed the bilinguals with DLD on microstructure components such as lexical diversity and the use of subordinate clauses.

In contrast to the above studies, others have found narrative macrostructure to discriminate between bilinguals with TD and bilinguals with DLD, (Boerma *et al.*, 2016; Paradis *et al*., 2015; Rezzonico *et al*., 2015). For example, in Boerma *et al*. (2016), five and six-year-old bilingual children with and without DLD heard a model story in their Dutch L2 after which they were asked to produce a story with the support of pictures. The children had, on average, more than three years of exposure to Dutch. In addition to differences on narrative microstructure, the two groups also differed on narrative macrostructure with the bilingual children with DLD producing fewer story structure components as well as fewer internal state terms than the bilingual children with TD. In Paradis *et al* (2013), English L2 children with TD and with DLD from diverse first language backgrounds with an average of two years' exposure to English took part in a story generation test. Story grammar scores were significantly lower for the DLD than the TD group. Narrative microstructure was not examined in this study. Differences in the narrative macrostructure abilities of bilingual children with TD and bilingual children with DLD were also observed in Rezzonico *et al*. (2015) in which bilingual preschoolers in Canada told a story at two different time points. The participants in this study heard and spoke predominantly English at home and only English at preschool. The bilingual children with TD included more story elements than the bilingual children

with DLD and also differed on microstructure measures such as sentence length, lexical diversity and first mentions.

The conflicting findings for the discriminatory potential of narrative macrostructure may arise out of differences in the bilingual proficiency of the children studied, how story grammar abilities were analysed and whether children were given a story generation or re-tell task. Nevertheless, the bilingual research is consistent with the monolingual research in that narrative microstructure components differentiate children with DLD from their TD peers more reliably than narrative macrostructure.

2.1.3 Age and Input Factors in Bilingual Development

Individual differences in bilingual development can be influenced by factors like age of acquisition and the quality and quantity of the input the child receives. Sources of individual differences like age of acquisition and input factors have been studied a great deal in bilingual children with TD, but very few studies have looked at age and input factors in bilingual children with DLD. Consequently, we know little about the mechanisms underlying individual variation in bilingual development in children with DLD.

Bilingual children may be simultaneous bilinguals or may start learning their L2 at different ages. An older age of L2 acquisition is often considered to be less advantageous than a younger age of L2 acquisition when the entire life span is considered (e.g., Abrahamsson & Hyltenstam, 2009); however, older child L2 learners are more cognitively as well as linguistically mature than younger child L2 learners which may result in faster L2 development (e.g., Blom & Bosma, 2016; Golberg, Paradis & Crago, 2008; Paradis, 2011). The relationship between age of acquisition and L2 outcomes is not a straightforward one when comparing children with different ages of

acquisition within early childhood. While some studies have reported positive effects for a later age of acquisition within childhood (e.g., Blom & Bosma, 2016; Golberg *et al*., 2008; Paradis, 2011; Paradis & Jia, 2016; Snedeker, Geren & Shafto, 2007; 2012) other studies have reported negative effects for a later age of L2 acquisition (e.g., Unsworth 2013; Unsworth *et al*., 2014). For example, an older age of acquisition is predictive of faster L2 vocabulary acquisition (Golberg *et al*., 2008; Paradis, 2011; Snedeker *et al*., 2007). Blom and Bosma (2016) note that while positive effects are generally found for an older age of acquisition on L2 vocabulary development, such effects are not always consistent for morphosyntax. For example, in Unsworth *et al.* (2014), English-Dutch and English-Greek bilingual children's accuracy with grammatical gender was examined. While age of acquisition effects were not found for Dutch (when cumulative exposure was controlled for), possible age effects were observed for Greek. Simultaneous bilinguals were more accurate on masculine and feminine nouns in Greek than early successive bilinguals who in turn, were more accurate than later successive bilinguals. However, age was not a significant predictor in the regression analysis (Unsworth *et al.,* 2014). By contrast, Paradis & Jia (2017) found that English L2 learners aged 8-10 showed superior abilities in a sentence repetition tasks when they were foreign born as opposed to Canadian-born and thus started to learn English at an older age. Paradis (2011) also found that older age was associated with greater accuracy when length of exposure to the L2 was controlled.

In addition to when they started learning their L2, bilingual children, at a given age, might vary in the amount of current and cumulative exposure that they have had to their L2. There is robust evidence that L2 proficiency increases with longer L2 exposure (e.g., Blom & Paradis, 2015; Jia & Fuse, 2007; Paradis, 2011; Unsworth, 2013). Individual differences in relative current exposure to the L2 also predict outcomes (e.g., Bedore*,* Peña, Griffin & Hixon, 2016; Unsworth,

2016). For example, in Unsworth (2016) more current exposure to Dutch was significantly related to English-Dutch bilingual children's scores for verb morphology, verb placement and vocabulary in Dutch. However, some studies have found that amount of current L2 exposure at home did not predict L2 outcomes (e.g., Chondrogianni & Marinis, 2011; Golberg *et al*., 2008; Paradis, 2011). This discrepancy is likely related to the quality of the L2 input at home since parents are often non-proficient speakers of the L2. In addition to cumulative and current input quantity, researchers have found that the quality of L2 input predicts individual differences in L2 outcomes (Jia & Fuse, 2007; Hoff, Welsh, Place & Ribot, 2014; Paradis, 2011; Paradis, Rusk, Sorenson Duncan & Govindarajan, 2017). Quality of input may be measured by looking at the frequency of activities such as, reading books or interacting with native-speaker peers, that are associated with high quality L2 input, so-called 'richness of the L2 environment' (e.g., Jia & Fuse, 2007; Paradis, 2011). Bilingual children who engage more often in rich activities outside school show better L2 outcomes such as a larger vocabulary size, more accuracy with verb morphology or increased use of complex sentences (e.g., Jia & Fuse, 2007; Paradis, 2011; Paradis *et al*., 2017).

In comparison, to the studies with bilingual children with TD, there have been fewer studies exploring sources of individual differences in bilinguals with DLD (Altman *et al*., 2016; Blom & Paradis, 2015; Squires *et al*., 2014). In Blom and Paradis (2015), a tense morphology probe was administered to bilinguals with TD and with DLD; groups were matched for mean age and cumulative L2 exposure, but there was variation in age and L2 exposure among individuals in each group. While both groups of participants showed an advantage for an older age of acquisition, the bilinguals with TD were more accurate with tense morphemes with increased exposure to English and were better able to transfer knowledge from their L1 to their L2. The group with DLD did not show clear increases in morphological accuracy with increased exposure to English. Blom &

Paradis (2015) suggested that the children with DLD might not have been able to make effective use of their input because of the verbal memory and processing limitations that most children with DLD have. Similarly, Altman *et al*. (2016) noted that their bilingual participants with TD produced longer utterances with more exposure to English, but a correlation between exposure and length of utterances was not found for the participants with DLD. Finally, in a longitudinal study on narrative development, Spanish-English bilingual children with TD showed larger improvements over time in both narrative macrostructure and narrative microstructure than bilingual children with DLD (Squires *et al.*, 2014). Specifically, bilingual children with DLD did not show improvements in microstructure and only showed limited improvements in their macrostructure abilities over the same period of time. The mechanism underlying the different trajectories for the TD and DLD groups could have been differential abilities to process and make effective use of the input.

2.2 Research questions and predictions

This study examined narrative abilities in five- and six-year-old bilingual children with and without DLD learning English as their L2. The following research questions were formulated.

1) What narrative components differentiate between bilinguals with TD and bilinguals with DLD?

The existing research on the narratives produced by bilinguals with TD and DLD indicates that bilinguals with TD score consistently higher than bilinguals with DLD on measures of narrative microstructure but that only some studies have found narrative macrostructure to differentiate between children with DLD from their TD peers. It is noteworthy that the majority of prior studies have included retell tasks or tasks with familiar books or a model story training phase.

Children, both with TD and with DLD, include fewer story grammar elements in story generation versus retell tasks (Schneider, 1996; Schneider & Dubé, 2005), suggesting that story generation tasks are more challenging and thus, story grammar measured through a story generation tasks might have better discriminatory potential. We used a story generation task in the present study, and therefore, we predicted that both macrostructure and microstructure components might differentiate between bilinguals with TD and with DLD.

2) How do age and input factors (age, length of L2 exposure, richness of the L2 environment , quantity of L2 input at home) influence narrative performance, and do they do so differently for learners with TD and learners with DLD?

Consistent with previous literature, we predicted that bilingual children with DLD would make less efficient use of a longer exposure to English or a richer English language environment than bilingual children with TD (Altman *et al*., 2016; Blom & Paradis, 2015; Squires *et al*., 2014); therefore, input factors would have a greater impact on the narrative abilities of TD bilinguals than on the narrative abilities of bilinguals with DLD. Given that the age range of the children in this study is narrow, we expected older children in the group with DLD to perform better with narratives (cf. Blom & Paradis, 2015), but that age would have a smaller impact on the narrative abilities of the children with TD. Age and input factors, rather than factors such as language typology, were used as predictors because of the diversity of first language backgrounds (see below) which would have made it difficult to group participants based on any typological criteria.

2.3. Method

2.3.1 Participants

Data from 24 English L2 learners with DLD and 63 English L2 learners with TD from diverse L1 backgrounds (such as Assyrian, Mandarin, Somali, Pashto, Spanish and Arabic) were analyzed for this study. The majority of the children had no or very little exposure to English before they were about four years of age, so they are a sample of sequential rather than simultaneous bilinguals. The children in this study started learning English when they entered an English-speaking preschool programme. Children were residing in either Edmonton or Toronto, Canada and came from first generation immigrant and refugee families where both parents were foreign-born and L2 speakers of English. Participants were chosen from an existing corpus of over 200 English L2 learners used in previous studies (e.g., Blom & Paradis 2015, 2013; Paradis *et al.*, 2013), but the sample in this study was not identical to the sample in any previous study. Ethics approval for data collection was granted by a Research Ethics Board (REB 2) at the University of Alberta.

Children in the TD group were recruited through schools as well as through agencies offering assistance to newcomers. The children with DLD were referred to our research team by registered speech-language pathologists who were working with these children in a school setting (kindergarten to grade one). Since children were referred from several school programs and two school boards, the speech-language pathologists did not rely on a single assessment measure, but instead, assessments were based on a variety of standardized assessment instruments, but all would have been approved by the health district for use in the diagnosis of DLD. The speech-language pathologists only referred children for our project without any exclusionary criteria (e.g., hearing loss or difficulties only with articulation).

As noted above, the participants in the TD and DLD groups were selected from a larger sample of children. The 24 children with DLD and 63 children with TD were selected from the

larger sample on the basis of criteria that permitted the two groups to be matched. Therefore, children from the larger sample were eliminated until the group-wise matching criteria for age and input factors were met. Participants without complete narrative samples were also excluded from this study. The information required for group-wise matching was obtained from a parental questionnaire, the Alberta Language Environment Questionnaire (Paradis, 2011– see next section). We used an alpha level of 0.05 for all statistical tests. Using Welch's t-tests, we determined that there were no significant differences between the groups for age at testing (t=1.41(48.57), p=0.16), age of English acquisition (t=1.47(30.83), p=0.15) or the length of exposure to English (t=-0.73(27.95), p=0.47). Participants in both groups also did not differ in the amount of time they spent with native speaker friends or using media in English and therefore, had similar scores for English language richness (t= 0.85*(*36.16*)*, p=0.4). Finally, participants did not differ in terms of the amount of English input/output they received at home (t=*-1.77*(36.18), p=0.08). The non-verbal cognitive abilities of the two groups, measured by using the Columbia Mental Maturity Scales (Burgemeister, Blum & Lorge, 1972), showed the DLD group to have significantly lower scores (t=3.19(44), p<0.01); a common finding in studies comparing children with DLD to TD age peers (Leonard, 2014). Significant differences between the groups were also reported on a parental report of first language development, the Alberta Language Development Environment Questionnaire- the ALDeQ (Paradis, Emmerzael & Sorenson Duncan, 2010 – see next section). The ALDeQ is a parent report instrument with questions about timing of early developmental milestones, current L1 abilities, behaviour patterns and interests as well as family history of DLD. As would be expected, the group with DLD had significantly lower ALDeQ total scores (t= 9.86(36.42).

Table 2.1

Participant characteristics

Characteristic	Group	*M*	*SD*	Cohen's *d*
Age at testing	TD	69.37	6.85	0.33
	DLD	67.29	5.83	
Age of acquisition	TD	45.71	8.30	0.38
	DLD	41.63	12.66	
Exposure	TD	23.49	8.40	0.19
	DLD	25.67	13.67	
Richness	TD	0.63	0.13	0.21
	DLD	0.60	0.15	
Home language	TD	0.38	0.23	0.43
	DLD	0.49	0.28	
CMMS	TD	104.5	12.18	0.75
	DLD	95.83	10.76	
ALDeQ	TD	0.80	0.11	2.54
	DLD	0.48	0.14	

Notes. TD=Typical Development; DLD=Developmental Language Disorder; Age at testing= Age at testing (in months); Age of acquisition= Age of acquisition (in months); Exposure=Exposure to English in months; Richness= English Language Richness Scores, higher scores reflect a richer English language environment, Home language= English input/out at home, higher scores reflect more English use; CMMS=Columbia Mental Maturity Scales, test of non-verbal intelligence with a mean standard score of 100; ALDeQ=Alberta Language Development Questionnaire, scores closer to 1 are more characteristic of children with TD; Cohen's d= measure of effect size. Effect was considered small if d= 0.2, medium if d=0.5 and large if d>≥0.8.

2.3.2 Materials and Procedure

Children were tested at home or in schools where they completed the narrative task and a non-verbal IQ task. At home, parents were given questionnaires about the child's language learning history in L1 and L2 and their current language environment.

The Edmonton Narrative Norms Instrument (ENNI; Schneider, Dubé & Hayward, 2005) was used to elicit narratives. The ENNI is a normed and standardized narrative instrument that consists of two sets of stories of increasing complexity. There are a total of 6 stories. The ENNI can also be scored for a range of story grammar and linguistic measures and can discriminate between children with TD and children with DLD (Schneider, Hayward & Dubé 2006; Schneider & Hayward, 2010). Scores from the ENNI were used as dependent variables in this study.

The ENNI is a story generation task in which children are shown picture books of increasing story complexity and asked to tell the stories while the experimenter cannot see the pictures. The stories produced by the children are then recorded, transcribed using the CHAT system (MacWhinney, 2000) and scored for a range of story grammar and microstructure components. 10% of the corpus was re-transcribed and re-scored for reliability by different research assistants. Reliability of words transcribed and scoring ranged from 90% to 98%. For the ENNI narrative components, the standard mean is 10, with the normal range being 7-13. The standard score and *z* score are based on monolingual norms. The following narrative components were examined.

Story grammar. Stories are coded for the information they contain. A higher story grammar score reflects the presence of more story grammar units and more complete episodes. Core components such as initiating events, attempts and outcomes are scored higher than other components such as internal responses and internal plans. The ENNI has story grammar scoring rubrics for two stories, a simple story, and a complex story. Story grammar scores for the more complex story containing more episodes were used in this study.

Mean Length of Communicative Unit (MLCU). This refers to the utterance length across all stories and is calculated automatically by CLAN (MacWhinney, 2000). This score is calculated

based on words and not morphemes. All utterances produced by the child with the exception of false starts, irrelevant utterances and story-enders are included. A higher MLCU score indicates longer utterances.

Referring expressions in first mentions. This refers to how a child introduces a referent. First mentions scores are attributed depending on how successfully the child introduces characters and objects that are central to the stories. The ENNI contains scoring rubrics for first mentions and first mentions are scored on a scale of 0 to 3 depending on how adequately a referent is introduced. For example, referents introduced with an indefinite article, such as in (1) would be scored as 3, whereas a character or object introduced with a definite article, such as in (2), would be scored as 2, as the use of definite articles assumes shared knowledge. Introductions with pronouns such as in (3) would be scored as 1. Omitted characters/objects would receive a score of 0.

(1) there (i)s **a** boy bunny want to play with **a** girl.
(child 145, TD, Cantonese, 5;07, 31 Months of Exposure to English)

(2) **the** giraffe and **the** elephant putting balls in here.
(child 63, Mandarin, TD, 5;07, 24 Months of Exposure to English)

(3) **they** (a)re putting the balls in the ocean.
(child74, Arabic, DLD, 5;01, 14 Months of Exposure to English)

Lexical Diversity or number of different words. The number of unique word types used across all stories was calculated in CLAN and used as a measure of lexical diversity.

Alberta Language Environment Questionnaire *(ALEQ*, Paradis, 2011). The ALEQ is a parent questionnaire on language input factors, age and family demographics that was given to parents, with the assistance of an interpreter or cultural broker. The ALEQ contains questions about the following topics: age of arrival in Canada, parents' self-rated proficiency in English, parent

education, current language use by family members in the house (parents, other adults, siblings and the target child), age at which the child started learning English in school, exposure to English measured in months (age of acquisition subtracted from the age at testing) as well as the richness of the English language environment. Information on language use was gathered by asking questions about the language that different family members used with the child and the language that the child used with different members of their family. Answers were on a five-point scale ranging from 0 (English never/mother tongue always) to 4 (English almost always/mother tongue almost never). The proportion of English used by family members with the child (input), by the child with their family members (output) and the proportion of L2 use at home (output/input) were calculated from these scales. English language richness scores were calculated by looking at the number of English language activities (book reading, playing with English-speaking friends, watching TV or using devices in English and singing/reciting in English) the child was engaged in as well as the frequency of these activities in a week. A proportional score from 0-1 was calculated, with scores closer to 1 indicating a richer English language environment. Age at testing, length of exposure, English language richness and home language (overall English use at home, a combination of input and output) were the predictor variables in this study. Note that while proficiency was not a separate variable, the existing literature provides robust evidence that L2 proficiency increases with greater L2 exposure (see 1.3 above).

The Alberta Language Development Questionnaire (ALDeQ; Paradis *et al*., 2010). The ALDeQ is a parent questionnaire with four different sections that focus on (a) early milestones, (b) current abilities in the first language, (c) activity and behaviour patterns shown by the child and (d) family history of DLD. The ALDeQ yields a total proportion score with a range from 0-1 and lower scores on the ALDeQ are more typical of children with DLD.

The Columbia Mental Maturity Scales (CMMS; Burgemeister al., 1972). The CMMS is a test of non-verbal intelligence in which children are shown patterns of increasing complexity and asked to identify the pattern that does not logically belong in a given sequence. Children who have a standard score greater than 80 score within the normal range on this test.

2.4 Results

2. 4.1 What narrative components differentiate between bilinguals with TD and bilinguals with DLD?

The first research question concerned the narrative components that differentiate between TD bilinguals and DLD bilinguals. We approached addressing this question in two ways: comparison of each bilingual group to monolingual norms and direct comparison of scores between the TD and DLD bilingual groups. Descriptive statistics for both groups as well as the percentage of children who scored below monolingual age-based norms in each group have been listed in Table 2.2. As a group, the participants with TD had mean scores within the normal range for all components. However, there were still some individual children with TD who had scores below the normal range for the different narrative components. While 22% of the TD group scored below the normal range for story grammar, the percentage of children scoring below the normal range was higher for referring expressions in first mentions (38.42%). Participants with DLD had mean scores below the normal range for all narrative components except for the number of different words used. Over 40% of the participants with DLD scored below the normal range for all narrative sub-skills, with half of the children scoring below the normal range for MLCU scores. Thus, in terms of benchmarking to monolingual norms, the children with DLD showed consistently poor performance for each narrative component except referring expressions than the children with TD.

In order to determine whether the group with DLD had significantly lower scores for narrative components than the TD group, a series of linear regression models were fitted using the lm function in R (R Core Team, 2013),with group (TD or DLD) as the independent variable or predictor and narrative component scores as the dependent variables. Standard scores were used, rather than raw scores, in order to control for age differences. Group was a significant predictor for story grammar scores but not for referring expressions in first mentions or number of different words used (Table 2.3). A trend towards significance was however observed for MLCU scores (Table 2.4). Group also explained a significant proportion of variance for story grammar scores ($R^2 = 0.06$, $F(1,85) = 6.09$, $p = 0.02$)

Table 2.2

Descriptive statistics for narrative components

ENNI Component	Group	Mean(SD)	*z* score	Cohen's *d*	Percentage below normal range
SG	TD	8.79(4.04)	-0.37(1.29)	0.53	22.2
	DLD	6.46(4.66)	-1.1(1.47)		45.83
MLCU	TD	7.67(3.79)	-0.79(1.28)	0.44	30.16
	DLD	6.08(3.41)	-1.31(1.14)		50
RE	TD	7.19(3.92)	-0.99(1.38)	0.24	38.42

	DLD	6.29(3.69)	-1.38(1.53)		41.67
NDW	TD	8.52(3.64)	-0.48(1.22)	0.42	23.8
	DLD	7.21(2.41)	-0.92(0.78)		41.67

Notes. Mean (Standard Deviation); ENNI=Edmonton Narrative Norms Instrument; TD=Typical Development; DLD=Developmental Language Disorder; SG= Story Grammar; MLCU= Mean length of Communicative Unit; RE= Referring Expressions in First Mentions; NDW= Number of Different Words. Standard scores for each ENNI sub-skill have a mean of 10 and a 1 SD range of 7-13. Percentage below normal range is the percentage of children with a score >-1 Standard Deviation below the mean; Cohen's d= measure of effect size. Effect was considered small if d= 0.2, medium if d=0.5 and large if d>≥0.8.

Table 2.3

Group (TD or DLD) predicted SG scores, but not MLCU scores

	Predictor	ß	SE	t	p
SG	Intercept	11.31	1.36	8.33	<.001***
	Group (TD/DLD)	-2.45	0.99	-2.47	0.02*
	Predictor	ß	SE	t	p
MLCU	Intercept	9.23	1.19	7.74	<.001 ***
	Group (TD/DLD)	-1.56	0.87	-1.78	0.08.

Note: Group=Bilinguals with TD or with DLD; SG= Story Grammar; MLCU= Mean Length of Communicative Units, *= significance code when p<0.05, ***= significance code when p<.001,.=R code when p<0.1

2.4.2. How do age and input factors influence narrative performance, and do they do so differently for learners with TD and learners with DLD?

Our second research question examined how individual difference factors (age of acquisition, age at testing, richness of the L2 English language environment, exposure to English, home

language) influenced narrative performance for both groups of participants. Linear regression models were used to estimate the role of individual difference factors on each narrative component, also using the lm function in R Studio. Correlations between the predictor variables were first calculated before running the models to see if any of the predictors were moderately to strongly correlated (.5-1.00). There were moderate to strong negative correlations between age of exposure and exposure to English for both groups of participants (r=-0.6 for the TD bilinguals and r= -0.9 for the bilinguals with DLD). Therefore, in line with previous studies (Paradis, 2011; Armon-Lotem, Joffe, Abutbul-Oz, Altman & Walters, 2014), only age at testing (and not age of English acquisition) was included in our models to control for collinearity effects. Models were then created with backward elimination with the first model containing all the predictor (fixed effect) variables. Non-significant predictors were then eliminated until a model with significant fixed effects was obtained that was a significantly better fit than a reduced model with fewer fixed effects. All model tables have been included in the appendix.

Story grammar. The optimal model for the bilinguals with TD included both length of exposure to English(β= -0.13, t(.06) = 2.3, p =0.03) and English language richness(β = 8.4, t(3.79) = 2.22, p =0.03), but not age or home language use (Table 2.4 and Figure 2.1). There was a collective significant effect between exposure to English, English language richness and story grammar scores (R^2 =0 .18, F(2,60) = 6.58, p <0.01). Figure 2.1 indicates that the TD bilinguals had higher story grammar scores with (a) more exposure to English and (b) a richer English language environment. However, for the bilinguals with DLD, no factors entered in the models predicted their story grammar scores.

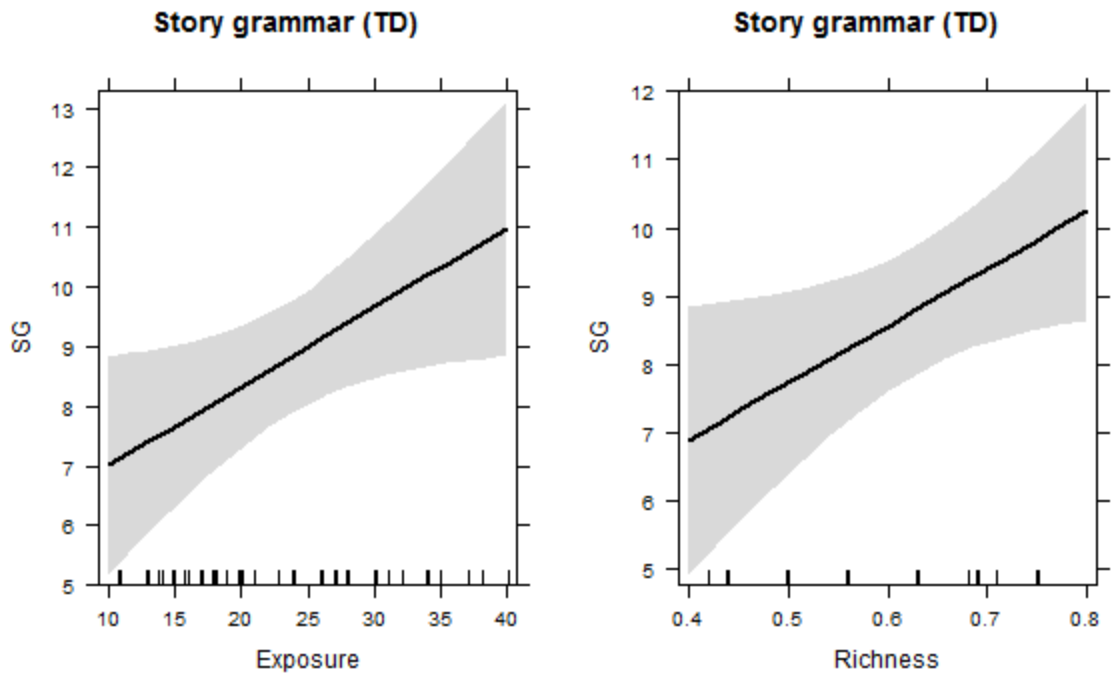

Figure 2.1. Exposure and English Language Richness scores predict story grammar scores for TD bilinguals

Mean Length of Communicative Unit. The optimal model for TD bilinguals included both length of exposure to English (β = 0.13, t(0.06) = 2.35, p =0.02) and English language richness(β = 8.01, t(3.54) = 2.27, p =0.03), but not age and home language use (Table 2.5, Figure 2.2). These predictors also explained a significant proportion of variance in mean length of communicative unit scores (R^2 = 0.19, F(2,60) = 6.87, p <0.01). Bilinguals with TD therefore produced longer utterances with more exposure to English and when they were exposed to a richer English language environment.

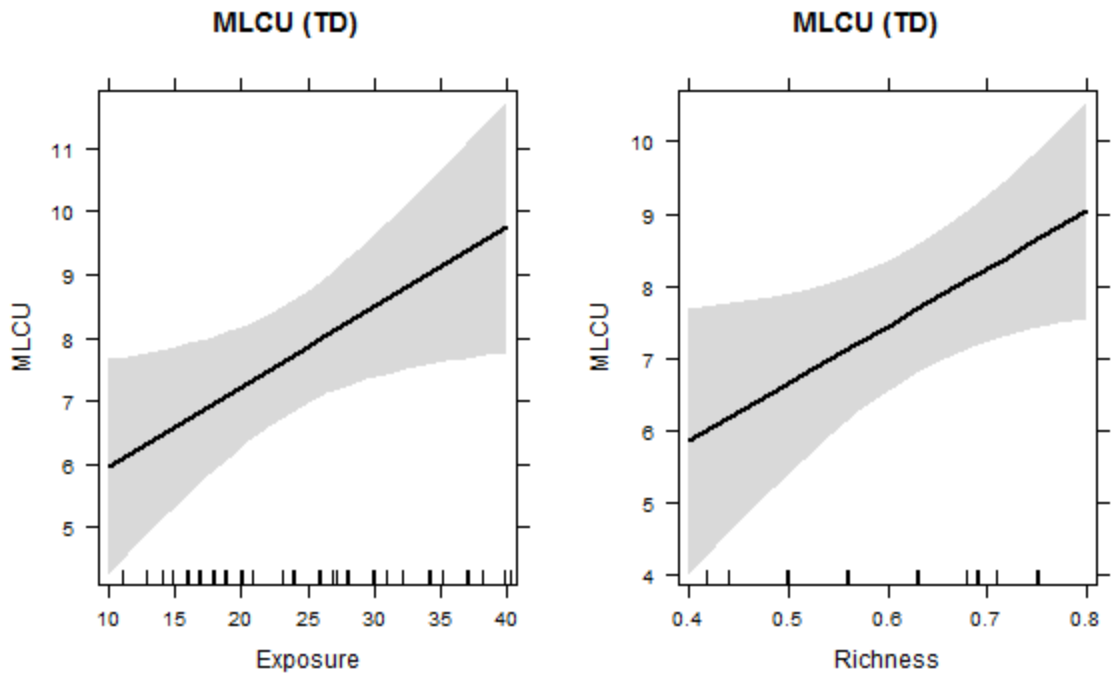

Figure 2.2. Exposure and English Language Richness scores predict Mean Length of Communicative Unit scores for TD bilinguals

For bilinguals with DLD, exposure, richness and home language use were non-significant predictors. The optimal model included only age (Table 2.6, Figure 2.3). Age was a significant predictor for bilinguals with DLD ($\beta = 0.31$, $t(0.11) = 2.98$, $p < 0.01$) and explained a significant proportion of variance in mean length of communicative unit scores ($R^2 = 0.29$, $F(1,22) = 8.9$, $p < 0.01$).

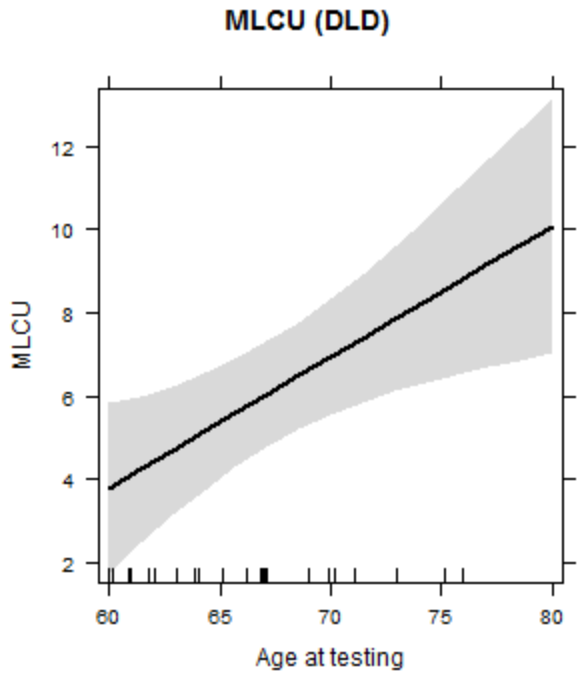

Figure 2.3. Older bilinguals with DLD produced longer utterances than younger bilinguals with DLD.

Referring Expressions in First Mentions. Only the richness of the English language environment was a significant predictor for TD bilinguals ($\beta = 10.51$, $t(3.68) = 2.85$, $p < 0.01$; Table 2.7, Figure 2.4). English language richness scores also explained a significant proportion of variance ($R^2 = 0.11$, $F(1,61) = 8.14$, $p<0.01$) in scores for referring expressions. TD bilinguals were more successful at adequately introducing referents when they were exposed to a richer English language environment. No factors predicted how successfully bilinguals with DLD introduced referents. However, there was a trend towards significance for age (Table 2.8).

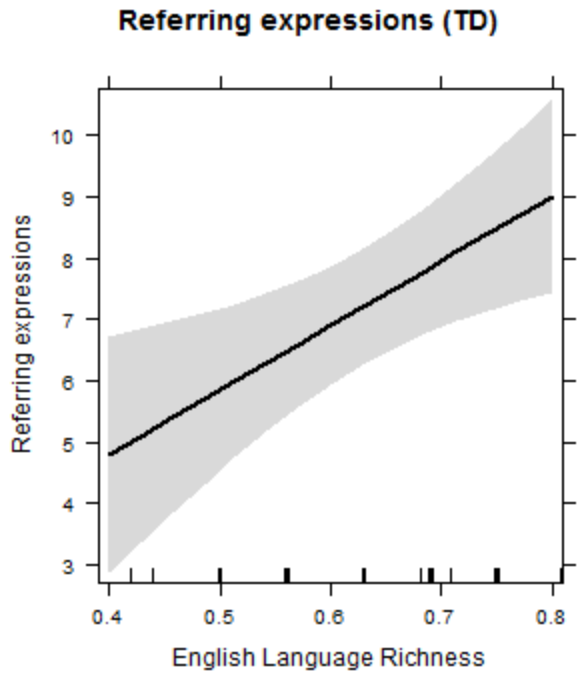

Figure 2.4. English Language Richness scores predict how successfully TD bilinguals introduce referents

Number of Different Words. The optimal model for TD bilinguals included only richness of the English language environment (β = 8.24, t(3.48) = 2.37, p =0.02; Table 2.9, Figure 2.5). English language richness scores also explained a significant proportion of variance (R^2 = 0.08, F(1,61) = 5.6, p =0.02). TD bilinguals therefore used a more diverse vocabulary when they were exposed to a richer English language environment.

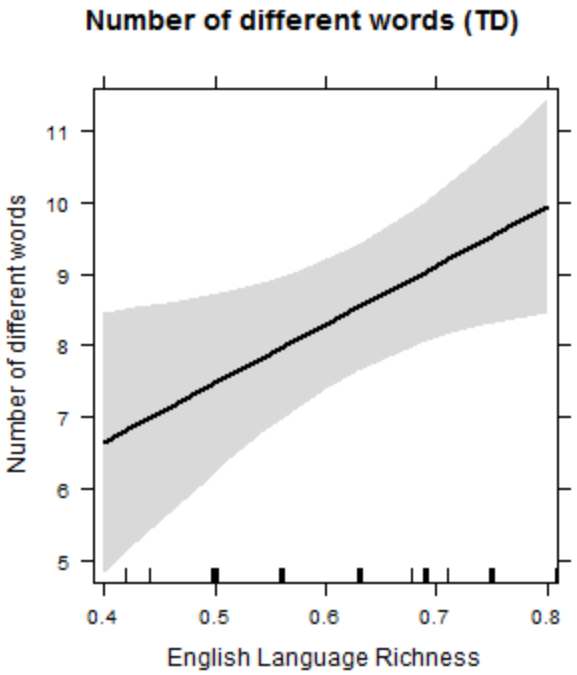

Figure 2.5. English Language Richness scores predict the number of different words used by TD bilinguals.

For bilinguals with DLD, exposure, richness and home language use were non-significant predictors. The optimal model included only age (β = 0.19, t(0.08) = 2.4, p =0.03; Table 2.10, Figure 2.6).Age also explained a significant proportion of variance (R^2 = 0.21, F(1,22) = 5.78, p =0.03). Older bilinguals with DLD used a more diverse vocabulary than younger bilinguals with DLD. These results have been listed in Table 2.10 and plotted in Figure 2.6.

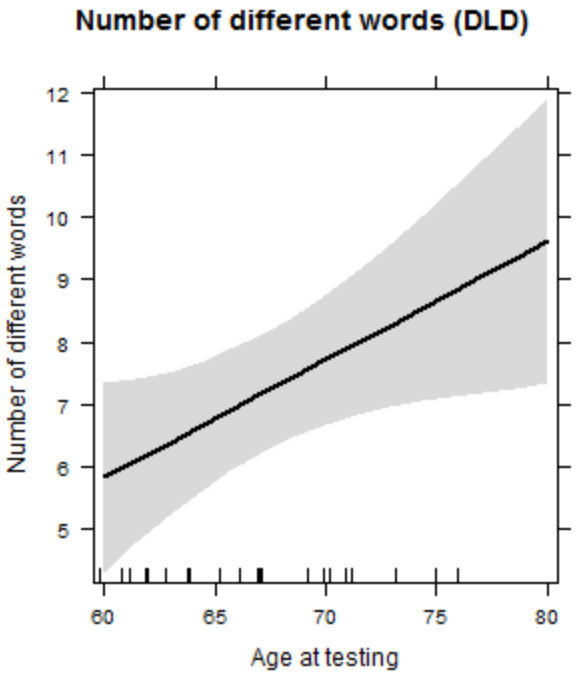

Figure 2.6. Older children with DLD used a greater number of different words than younger children with DLD.

2.5. Discussion

The aims of this study were to identify the narrative components that differentiate between bilinguals with TD and bilinguals with DLD and to understand how age and input factors impact narrative performance for these two groups.

2.5.1 What narrative components differentiate between bilinguals with TD and bilinguals with DLD?

For our first research question, we predicted significant differences for narrative macrostructure and microstructure components. These predictions were only partially supported by the data. When bilingual children were assessed in terms of meeting monolingual norms, it was clear that more of the bilingual children with DLD than the bilinguals with TD fell below the

normal range for each narrative component except for referring expressions. This indicates that there is some difference between these groups in terms of how they compare to monolingual age expectations for each narrative component. However, because a substantial proportion of the bilingual TD sample fell below monolingual norms, this result has clinical implications regarding the utility of benchmarking bilinguals' performance on that of monolinguals. Specifically, this finding underscores the need for understanding how bilinguals with DLD compare to their peers with TD in order to achieve effective discrimination of the clinical population among bilinguals (cf. Paradis *et al*., 2013). Accordingly, in another approach to addressing this first research question, we conducted direct comparisons between the bilinguals with TD and DLD for each narrative component score. We found significant differences for story grammar, consistent with some previous studies on narratives (e.g. Boerma *et al*., 2016; Paradis *et al*.,2013; Rezzonico *et al*., 2015). However, significant differences were not found for microstructure components, although there was a trend towards significance for MLCU. These results for microstructure are not consistent with most prior research (Altman *et al*., 2016; Iluz-Cohen & Walters, 2012; Rezzonico *et al*., 2015; Squires *et al*., 2014; Tsimpli *et al*., 2016).

What could be the reason for this discrepancy with previous research? Recall that we used a story generation instead of a retell task because it is arguably a more challenging task with respect to production of story grammar components. The significant differences between the TD and DLD groups for story grammar might have been the result of task selection. Another reason for the discrepancy with prior research could be rooted in the bilingual proficiency of our sample. The majority of studies reviewed in section 1.3 included bilingual participants with more than two years of exposure to their L2 and/or were dominant in the L2, and thus, participants in other research might have been more proficient in the L2. Bilingual children show overlap with

monolinguals with DLD during the early stages of L2 acquisition and, thus, risk being over-identified as having DLD (e.g. Bedore & Pena, 2010; Paradis, 2005; Paradis, Rice, Crago & Marquis, 2008). This is one of the reasons why much prior research has focused on how to differentiate TD and DLD groups among bilingual children. However, bilingual children with TD also show *profile effects* (Oller, Pearson & Cobo-Lewis, 2007) and score closer to age-expected norms on some sub-skills of language than on others. For example, in Oller *et al*; (2007), bilingual children scored closer to monolingual age-expected norms on pre-literacy skills which could be transferred/shared between languages than on receptive vocabulary which would be more language specific. When it comes to narratives, research by Paradis and colleagues has found that bilingual children converge on monolingual age-based norms faster for story grammar than for microstructure components that draw upon specific L2 knowledge (Paradis, Genesee & Crago, 2011; Paradis & Kirova, 2014). Paradis & Kirova (2014) argued that the reason for these profile effects could be that story grammar skills can potentially be shared between the two languages of bilinguals because they are at the cognitive-linguistic interface, while microstructure components, which draw on particular linguistic properties of the L2 would have less potential for sharing across languages. Furthermore, bilingual children with TD can transfer narrative skills from their L1 to their L2 better than bilingual children with DLD (Squires *et al*., 2014). Thus, the presence of profile effects suggests that macrostructure components like story grammar might differentiate bilingual children with TD from those with DLD better than microstructure components at the early stages of L2 learning when both groups of participants are learning their L2. Much research has shown comparability in narrative macrostructure abilities across the two languages of bilingual children (e.g. Fiestas & Pe**ñ**a 2004; Gagarina, 2016; Iluz-Cohen & Walters, 2012; Kunnari, Välimaa, & Laukkanen-Nevala., 2016; Pearson, 2002; Squires *et al*., 2014; Ucceli & Paéz, 2007), and in so

doing, supports the presence of this mechanism underlying profile effects. Finally, we would like to signal the heterogeneity of these populations: while more children with DLD scored below monolingual norms compared to the bilinguals with TD, there were nevertheless, some children with DLD who scored at or above monolingual norms. Similarly, while as a group, the children with TD scored within the normal range for all narrative components, there were still some individual children who scored below the normal range.

2.5.2 How do age and input factors influence narrative performance, and do they do so differently for learners with TD and learners with DLD?

We predicted language input factors to impact the narrative performance of TD bilinguals more than that of bilinguals with DLD. This prediction was supported by the data. Cumulative length of L2 Exposure and richness of English language environment, measuring input quantity and quality, predicted the narrative performance of bilinguals with TD across narrative components, but not that of bilinguals with DLD. TD participants who had more exposure to English and a richer English language environment produced stories with more story grammar units, longer utterances, more different words and introduced referents more adequately than participants with TD who had a less rich language environment and less exposure to English. The finding that Richness and exposure did not predict the narrative performance of participants with DLD is consistent with previous research. Taken together with prior studies, this study adds to growing evidence for the view that bilinguals with DLD do not make the same use of their L2 input as their bilingual peers with TD (e.g. Altman *et al.,* 2016; Blom & Paradis, 2015; Squires *et al*., 2014). Finally, the relative use of English at home among family members did not predict narrative performance for either group. This finding is consistent with some previous research (e.g.

Chondrogianni & Marinis, 2011), and is likely rooted in issues with the input quality of non-fluent speakers like the foreign-born parents of these children.

We also predicted an advantage for older age for the bilinguals with DLD. This prediction was supported by the data. Older children with DLD used longer utterances than younger children with DLD and also used a more diverse vocabulary when producing stories. There was also a trend towards significance for age in predicting more adequate use of referring expressions in first mentions. Recall that, in this dataset, age of English acquisition was moderately correlated with length of L2 exposure, but age at testing was not; therefore, the predictors age at testing and length of L2 exposure were specifying mostly different sources of variance. Taken together, these results suggest an advantage for older age for bilingual children with DLD, consistent with previous studies which suggest that maturation may bring improvements to the language processing deficits in SLI (Blom & Paradis, 2015; Paradis, Jia & Arppe, 2017). It is worth noting that the children in this study were five- and six-year-olds, therefore, their age range was relatively narrow. Our findings point to the possibility that important changes could be evident in the language learning mechanisms of children with DLD within this age range. One point to note is that the values of R^2 are generally low. This is generally expected in linear regressions studying human behaviour, and for heterogenous populations such as bilingual children and children with DLD in particular. A worthwhile direction for future research would be to further probe the sources of individual differences in these bilingual groups.

2.6. Conclusions and Limitations

This study contributes to the existing literature on narratives, individual difference factors and bilinguals with DLD. First, the results from this study show that macrostructure/story

grammar may distinguish between bilinguals with TD and bilinguals with DLD with lower levels of L2 exposure better than microstructure when a story generation task is used. This outcome could be informative to clinicians working with bilingual children who are still in the process of learning their L2 for deciding on what kinds of measures would be most useful for assessment with this population. This study also contributes to our understanding of the mechanisms underlying bilingual development in children with DLD. The results suggest that bilinguals with DLD make less efficient use of the input they receive, in terms of both quantity and quality, when compared to TD bilinguals. These findings are consistent with the idea that children with DLD have limitations in language processing (e.g., Leonard, 2014). However, older children with DLD outperformed younger children with DLD on certain microstructure components. Maturation possibly brings improvements to the language processing deficits in DLD, which in turn, permitted the older children to have increased proficiency in their L2 lexicon and morphosyntax, and thus, enabled them to produce superior narratives.

We would also like to acknowledge certain limitations to this study. While bilinguals with TD had higher story grammar scores than bilinguals with DLD, this study does not indicate which story grammar units differentiate between these two groups. Future research could address this question by performing a category by category analysis to find out which story grammar units are actually produced by these two groups of bilinguals. While age and input factors were examined in this study, future research could also examine whether narrative components such as referring expressions in first mentions are subject to cross-linguistic influence by taking participants' L1 backgrounds into account.

Appendix

TABLE 2.4. *Optimal model for story grammar scores for bilinguals with TD*

Predictor	ß	SE	t	p
Intercept	0.41	2.45	0.17	0.87
Exposure	0.13	0.06	2.30	0.03*
Richness	8.40	3.79	2.22	0.03*

Note: Exposure=length of exposure to English measured in months; Richness= richness of the English language environment; *= significance code when p<0.05

TABLE 2.5. *Optimal model for MLCU scores for bilinguals with TD*

Predictor	ß	SE	t	p
Intercept	-0.33	2.33	0.14	0.89
Exposure	0.13	0.05	2.35	0.02*
Richness	8.01	3.54	2.27	0.03*

Note: Exposure=length of exposure to English measured in months; Richness= richness of the English language environment;*= significance code when p<0.05

TABLE 2.6. *Optimal model for MLCU for bilinguals with DLD*

Predictor	ß	SE	t	p
Intercept	-15.06	7.11	-2.12	0.05.
Age	0.31	0.11	2.98	0.007**

Note: Age=age at testing;**= significance code when p<0.01; .= R code when p<0.1

TABLE 2.7. *Optimal model for Referring Expressions in First Mentions for bilinguals with TD*

Predictor	ß	SE	t	p
Intercept	0.6	2.36	0.26	0.8
Richness	10.51	3.68	2.85	0.006**

Note: Richness= richness of the English language environment, **= significance code when p<0.01,

TABLE 2.8. *Trend towards significance for age for bilinguals with DLD (Referring expressions in First Mentions)*

Predictor	ß	SE	t	p
Intercept	-9.73	8.45	-1.15	0.26
Age	0.24	0.13	1.9	0.07.

Note: Age=Age at testing.; .= R code when p<0.1

TABLE 2.9. *Optimal model for Number of Different Words for bilinguals with TD*

Predictor	ß	SE	t	p
Intercept	3.36	2.23	1.51	0.14
Richness	8.24	3.48	2.37	0.02*

Note: Richness= richness of the English language environment; *= significance code when p<0.05

TABLE 2.10. *Optimal model for Number of Different Words for bilinguals with DLD*

Predictor	ß	SE	t	p
Intercept	-5.5	5.31	-1.04	0.31
Age	0.19	0.08	2.40	0.03*

Note: Age=Age at testing; *= significance code when $p<0.05$

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3. Narrative abilities of bilingual children with ASD: Comparisons to bilinguals with TD and with DLD reveal structural language difficulties in ASD (Krithika Govindarajan & Johanne Paradis)

Abstract

Purpose: We investigated the narrative abilities of English L2 learners with ASD, DLD and Typical Development (TD), including looking specifically at the narrative components that differentiate L2 learners with ASD from L2 learners with TD and DLD. Narratives can be scored for a range of macro- and micro/linguistic features, thus clarifying the extent to which structural language difficulties characterize ASD. Comparisons involving school-age bilingual populations are particularly relevant because bilinguals with TD are also acquiring their L2.

Method: A standardized narrative test was administered to 29 L2 children with ASD (L2-ASD), DLD (L2-DLD) and TD (L2-TD). Participants were matched for age (mean=6;8), non-verbal intelligence and receptive vocabulary. Narratives were coded for the following components: 1) macrostructure: story grammar (SG) and number of individual SG components 2) microstructure: syntactic complexity, MLU, lexical diversity and story length.

Results: L2-TD included more SG units and produced longer and more complex sentences than L2-ASD. No differences emerged between L2-ASD and L2-DLD for SG scores or microstructure components. For SG components requiring perspective-taking abilities, L2-ASD had lower performance than both L2-TD and L2-DLD.

Conclusion: ASD is characterized by difficulties with structural language. Our findings parallel those from the monolingual literature. The only three-way differences found were for character

introductions, a component requiring both linguistic and pragmatic skills. Such components are particularly vulnerable in ASD.

3.1 Introduction

Narratives have been studied extensively to assess language development across different cultures (e.g., Berman & Slobin, 1994). Telling a story requires manipulating both linguistic and conceptual knowledge (Tsimpli, Peristeri & Andreou, 2016). Furthermore, perspective-taking abilities are essential to producing effective narratives, as narrators must keep their listeners' requirements in mind, and accordingly, adapt their stories. Narratives therefore represent a valuable tool for examining the language and communication abilities of individuals with autism or Autism Spectrum Disorder (ASD), who, by definition, have deficits in social communication, (American Psychiatric Association (APA), 2013), and therefore, could be expected to struggle with telling engaging stories to others

Nearly all the extant research on the narrative skills of children with ASD has been conducted with monolinguals, and thus there is limited information on how bilingual children with ASD tell stories in their second language. Most research to date on children with ASD who are exposed to two languages has focused on whether these children have the capacity for bilingual development, has been conducted mainly with young, preschool age children, and has compared bilinguals to monolinguals with ASD (e.g., Ohashi *et al*, 2012). A fuller understanding of the linguistic profiles of bilingual children with ASD requires not only studies with school-age children but also studies with typically developing (TD) bilinguals as a comparison group. Comparisons between bilinguals with TD and ASD are crucial, as bilingual children with ASD are more likely to be similar to bilinguals with TD, rather than to monolinguals with ASD, in terms of their overall language environments and the input they receive in the L2 (Paradis, 2016). Furthermore, while some studies on monolinguals with autism have included comparisons to monolinguals with Developmental Language Disorder or DLD (e.g., Engberg-Pedersen &

Christensen, 2017; Norbury, Gemmel & Paul, 2014), no such cross-disorder analysis has yet been undertaken with bilingual populations. Cross-disorder comparisons are valuable, as the boundaries between ASD and DLD have been debated in terms of linguistic profiles (Norbury *et al*., 2014), and, in particular, each group would be predicted to have different profiles of strengths and weaknesses in narratives (e.g., Goldman, 2008)

Comparing bilingual populations with ASD, DLD, and TD is important from both a theoretical and a clinical perspective. From a theoretical perspective, examining bilingual populations would clarify two interrelated questions: (1) whether children with ASD exhibit deficits with structural language (e.g., Eigsti, Bennetto & Dadlani, 2007) and (2) whether some children with ASD present profiles similar to children with DLD in terms of structural language abilities (e.g., Meir & Novogrodsky, 2019). As the literature attests, bilingual children with TD may show similarities to monolingual children with DLD, especially during the early stages of L2 acquisition, and may be incorrectly identified as having DLD, when tests normed on monolingual samples are used (e.g., Bedore & Peña, 2008; Paradis, 2005; 2008). If differences were to be found for structural language measures between bilinguals with ASD, and bilinguals with TD, who are both in the process of acquiring their L2, this would provide compelling evidence for the presence of structural language deficits in some individuals with ASD. Next, if bilinguals with ASD and bilinguals with DLD were to cluster similarly for narrative microstructure measures, this would provide additional evidence that a sub-group of children with ASD may have a language disorder. From a clinical perspective, a fuller understanding of the linguistic profiles of bilingual children with ASD, with similarities and differences to their peers with TD and with DLD, would also be relevant for accuracy in identification of language disorder in bilinguals and determining targets for intervention, and moreover, is especially needed in diverse societies such as Canada and the

United States (e.g., Kay-Raining Bird, Genesee & Verhoeven, 2016; Paradis & Govindarajan, 2018).

This study aimed to address the gaps in knowledge by comparing the narrative skills in the English L2 of bilingual children with ASD, TD and DLD. We sought to identify which narrative components differentiate the children with ASD from the other groups. In so doing, this study will contribute to our understanding of the linguistic profiles of children with ASD and DLD in their L2.

3.1.1 Narrative abilities in monolingual children with ASD: comparisons to monolinguals with TD

Narratives are generally analyzed at two levels, namely macrostructure and microstructure. The term macrostructure refers to the overall content and organization of the story. The story grammar model (Stein & Glenn, 1979) has been used extensively to study narrative macrostructure, however, other approaches such as looking at information units (e.g., Norbury *et al*., 2014) have also been adopted. In contrast to macrostructure, the term microstructure refers to a local level of analysis in which the linguistic structures used to produce stories are analyzed. A distinction can be made between measures of productivity, such as story length, and measures of complexity, such as utterance length or the use of complex syntax.

Narrative macrostructure. Studies have overwhelmingly found significant differences between children with ASD and TD controls for either global macrostructure scores or for individual narrative macrostructure components (e.g., Banney *et al*., 2015; Diehl *et al*., 2006; Losh & Capps, 2003; Smith Gabig, 2008). Mäkinen *et al*., 2014; Norbury *et al*., 2014; Rumpf *et al*., 2012; Suh *et al*., 2014; Tager-Flusberg, 1995). For example, in Tager-Flusberg (1995), children

with ASD were less likely to include resolutions in their stories than children with TD. Similarly, Mäkinen *et al*. (2014) found that 5-10-year-old children with ASD produced fewer information units than the children with TD, resulting in less coherent stories. Participants were matched on age. A recent meta-analysis by Baixauli and colleagues found that macrostructure measures differentiated children with ASD from TD controls, with a large effect size (Baixauli *et al*., 2016). However, conflicting findings have also been reported (Norbury & Bishop, 2003; Young *et al*., 2005). In Norbury and Bishop (2003), stories produced by 6-10-year old children with ASD were compared to those produced by age-matched children with TD. No group differences emerged for macrostructure scores or for any component examined. The authors suggested that the relatively young age of the participants might explain this null finding, as there are developmental trends in the production of story elements (Berman & Slobin, 1994).

Narrative microstructure. There is debate in the field, as to whether morphosyntax is an area of relative strength for children with ASD (Naigles, Kelty, Jaffery & Fein, 2011), or whether children with ASD show atypical morphosyntactic trajectories when compared to the neurotypical population (Eigsti, Bennetto & Dadlani, 2007). While the pragmatic difficulties inherent to autism are well-acknowledged, studies have also found that, at least some children with ASD, differ from TD controls in their accuracy with specific morphosyntactic structures, such as the production of tense and person morphemes in English (Roberts *et al*., 2004), complex syntax in English (Eigsti *et al*., 2007) and pronominal clitics in French (Durrleman & Delage, 2016). Looking at microstructure skills, especially at measures of complexity, can inform this debate.

Regarding productivity, while some studies have found children with ASD to produce shorter stories than TD controls (e.g., Tager-Flusberg, 1995; Norbury *et al*., 2014; Rumpf *et al*., 2014), others have not found significant differences for length (e.g., Banney *et al*., 2015; Mäkinen

et al., 2014). Conflicting findings have also emerged for complexity. Children with ASD have been reported to produce shorter utterances (Mäkinen *et al*., 2014; Norbury *et al*., 2014; Smith Gabig, 2008; Tager-Flusberg, 1995) and use less complex syntax than their TD peers (e.g., Capps *et al*., 2000; Banney *et al*., 2015; Mäkinen *et al*., 2014), but similar patterns of performance for both groups have been reported for utterance length (e.g., Kauschke *et al*., 2016; Rumpf *et al*., 2014) as well as for syntactic complexity (e.g., Diehl *et al*., 2006; Rumpf *et al*., 2014). While it may appear difficult to generalize from these studies, Baixauli *et al*. (2016) reported in their meta-analysis that measures of productivity and complexity functioned to differentiate between children with ASD and children with TD, with a moderate effect size.

3.1.2. Narratives abilities in monolingual ASD: comparisons to monolingual children with DLD

Studies comparing both children with ASD and children with DLD are valuable, as the boundaries between ASD and DLD have been debated (e.g., Bishop, 2010; Norbury *et al*., 2014; Tager-Flusberg & Joseph, 2003), with the suggestion that some children with ASD exhibit language profiles similar to those characteristic of DLD (e.g., Wittke *et al*., 2017; Meir & Novogrodsky, 2019; Tomblin, 2011). Difficulties with aspects of morphosyntax considered to be clinical markers of DLD, such as person and tense morphology in English, and clitics in French, have also been documented in ASD (e.g., Eigsti *et al*., 2007; Tager-Flusberg & Joseph, 2004; Durrleman & Delage, 2016; Wittke *et al*., 2017). Cross-disorder comparisons help identify the profiles of strengths and weaknesses in these two clinical populations (Norbury *et al*., 2014).

So far, only a handful of studies have compared the narratives produced by children with ASD to those produced by children with DLD (Colozzo, Morris & Mirenda, 2015; Goldman, 2008; Manolitsi & Botting, 2011; Norbury & Bishop, 2003, Norbury *et al*., 2014). For example, in

Norbury and Bishop (2003), narratives produced by 6-10-year old children with ASD were compared to those produced by age-matched children with DLD and with TD. No group differences were found between the clinical groups for either macrostructure or microstructure. Both clinical groups used less complex syntax and tense morphology and produced more ambiguous pronouns than the TD group. Norbury *et al*. (2014) also examined narratives produced by 6-15-year old children with ASD, DLD and TD. Although the ASD group had no structural language deficits on standardized assessments, both clinical groups patterned similarly and worse than the TD group for macrostructure and microstructure measures such as, inclusion of story components, the use of complex syntax, utterance length, story length and lexical diversity. In contrast, other studies have found significant differences in macrostructure abilities between ASD and DLD. For example, in Colozzo *et al*. (2015), only children with ASD had significantly lower story grammar scores than children with TD, with the children with DLD occupying an intermediate position, and not differing significantly from either group. Similarly, in Manolitsi and Botting (2011), children with ASD group performed worse than children with DLD on a measure of story content and included characters' goals and actions less frequently than the DLD group. Further differences were found between children with ASD and children with DLD in Goldman (2008) on two specific macrostructure measures- persons and resolutions. Taken together, these cross-disorder studies indicate that children with ASD and children with DLD can show largely similar narrative profiles but with differences for macrostructure.

Compared to studies including both children with DLD and ASD, there has been an extensive body of research comparing the narrative skills of children with DLD to those of children with TD (e.g., Fey, Catts, Proctor-Williams, Tomblin, & Zhang, 2004; Reilly, Losh, Bellugi & Wulfeck, 2004; Schneider, Hayward & Dubé, 2006). Not surprisingly, given the nature of DLD,

significant differences have been found for measures of productivity and complexity (e.g., Fey *et al*., 2004; Norbury & Bishop, 2003; Norbury *et al*., 2014; Reilly *et al*., 2004; Schneider *et al*., 2006). When it comes to macrostructure, the results have been less consistent: while some studies have found children with TD to obtain higher story grammar scores or include more narrative content (e.g., Bishop & Donlan, 2005; Reilly *et al*., 2004; Norbury *et al*.,2014), other studies have not found macrostructure to distinguish between these two groups (e.g., Norbury & Bishop, 2003). More research is therefore required to clarify whether macrostructure represents an area of weakness in DLD, and especially how children with DLD pattern relative to children with ASD in this regard.

3.1.3 Narratives abilities in bilingual ASD and DLD: comparisons to bilingual children with TD

While there is a growing body of research comparing the narrative skills of bilinguals with DLD to those of bilinguals with TD (e.g., Altman, Armon-Lotem, Fichman & Walters, 2016; Blom & Paradis, 2015; Govindarajan & Paradis, 2019; Paradis, Schneider & Sorenson Duncan, 2013; Boerma, Leseman, Timmermeister, Wijnen & Blom, 2016), to date, only three studies have examined the narrative skills of bilinguals with ASD (Baldimsti *et al*., 2016; Hoang, Gonzalez-Barrero and Nadig, 2018; Yang, 2011), and no study has yet compared bilinguals with ASD to bilinguals with DLD.

Parallel to the monolingual literature, bilingual children with DLD are less skilled narrators than their bilingual age peers with TD. While the results have been consistent for microstructure (e.g., Altman *et al*., 2016; Iluz-Cohen & Walters, 2012), they have been less so for macrostructure (Boerma *et al*., 2016, Govindarajan & Paradis, 2019 vs. Altman *et al*., 2016). Altman *et al*. (2016) examined narratives retold by bilingual English-Hebrew preschoolers with TD and with DLD in

both languages. Both groups patterned similarly for macrostructure but differed on microstructure measures such as utterance length and lexical diversity. Similar results were also reported in Iluz-Cohen and Walters (2012) in which the narratives produced by English-Hebrew bilingual children with and without DLD were examined. Again, while both groups patterned similarly for macrostructure, significant differences were reported for microstructure measures such as the use of complex syntax. In contrast, other studies have found significant group differences for narrative macrostructure. In Boerma *et al*. (2016), five and six-year-old bilingual children with and without DLD heard a model story in L2 Dutch and then produced a story with the support of pictures. The children with DLD produced fewer story grammar components than the children with DLD. Similarly, in Govindarajan and Paradis (2019), narratives produced in L2 English by bilinguals with and without DLD (mean age= 5;8) were examined. The bilinguals with DLD obtained significantly lower story grammar scores than the bilinguals with TD. These conflicting findings indicate that further research is required to clarify the extent to which macrostructure represents an area of weakness in DLD.

In Baldimsti *et al*. (2016), narratives produced by 7-11-year-old bilingual children with ASD were compared to those produced by age-matched bilinguals with TD. Narratives were elicited in L2 Greek and the participants had diverse L1 backgrounds. No significant differences were found between the ASD and TD bilingual groups for macrostructure, which was assessed by looking at the number and complexity of story episodes. Group differences were also not found for complex syntax or lexical diversity. In contrast, Yang (2011) found narrative skills in L2 English to differentiate between Mandarin-English bilinguals with ASD and with TD. Significant group differences were found for story structure scores. While both groups produced settings and initiating events, the TD bilinguals produced more outcomes than the ASD group. The TD group

also used more complex syntax than the ASD group. Similarly, in Hoang *et al*. (2018), bilingual children with ASD produced less coherent stories than TD bilinguals in a picture-sequencing task in L2 French. All bilinguals had English, Russian or Spanish as their non-dominant language. However, microstructure measures such as complex syntax and utterance length were not examined. Such limited and conflicting findings indicate that further research on the narrative skills of bilingual children with ASD is needed.

3.2 Research questions and predictions

For the present study, narrative language samples were gathered using a standardized narrative instrument from three groups of age-matched children (mean age = 6;8) who were acquiring English as an L2 with diverse L1 backgrounds: children with TD, ASD and DLD. Our analyses were guided by the following research questions:

1) Do bilinguals with ASD produce fewer story grammar components (i.e., have less coherent stories overall) than bilinguals with TD, and bilinguals with DLD?

Based on the existing research with monolinguals (e.g., Baixauli *et al*., 2016; Norbury *et al*., 2014; Suh *et al*., 2014), and with bilinguals (Hoang *et al*., 2018; Yang, 2011), bilingual children with ASD were expected to include fewer story grammar components than the bilinguals with TD, and to pattern similarly to the bilinguals with DLD (Norbury *et al*., 2014).

2) Which individual story grammar components differentiate the narratives produced by bilinguals with ASD, from those produced by bilinguals with TD and bilinguals with DLD?

This research question was asked because the majority of studies reviewed above have relied on composite story grammar scores. While children with ASD and children with DLD may

have similar story grammar scores overall, they may nevertheless have different profiles of strengths and weaknesses in terms of what components they include. Consistent with prior literature, the bilingual children with ASD were expected to produce fewer story outcomes, a story grammar component, than the bilinguals with TD (e.g., Tager-Flusberg, 1995; Yang, 2011). Group differences were also predicted for story grammar components that require perspective-taking abilities such as character introductions (Goldman, 2008) and internal plans and reactions to story outcomes. Bilinguals with ASD were expected to produce fewer of these components than both the TD and DLD groups.

3) What microstructure components differentiate the narratives produced by bilingual children with ASD from those produced by bilingual children with TD and with DLD?

Overall, bilinguals with ASD were expected to pattern similarly to bilinguals with DLD with respect to narrative microstructure abilities (Norbury *et al*., 2014; Norbury & Bishop, 2003). Both clinical groups were predicted to differ from the bilinguals with TD consistent with prior research (Baixauli *et al*., 2016; Norbury, 2014). More specifically, we expected both clinical groups to produce shorter stories and utterances, use a less diverse vocabulary and show a reduced use of complex syntax in comparison to the bilingual TD group.

3.3 Method

3.3.1 Participants

Nine English L2 learners with ASD, 10 L2 learners with TD and 10 L2 learners with DLD participated in this study (mean age = 6;8, range 5;4 to 9;1). Children's L1 backgrounds are given in Table 3.1. While children had diverse L1s, Table 3.1 shows that each group included children

with Chinese, South Asian, Arabic and Spanish L1s; therefore, the groups were fairly balanced in terms of L1 types. The children with TD and with DLD were chosen from participants from previous studies (Paradis, Schneider & Sorenson Duncan, 2013; Paradis, 2011) according to matching criteria with the ASD group (see below), but the sample in this study was not identical to that in any previous study. All children in this study came from first generation immigrant and refugee families where both parents were foreign-born and L2 speakers of English. The Research Ethics Board at the [removed for review] granted approval for this study.

Table 3.1

L1 backgrounds of participants in each group

Group	L1	Number of speakers
ASD	Mandarin	4
	Spanish	3
	Cantonese	1
	Arabic	1
DLD	Cantonese	3
	Vietnamese	1
	Spanish	4
	Urdu	1
	Arabic	1
TD	Arabic	4
	Farsi	1
	Cantonese	1
	Mandarin	1

Spanish	1
Urdu	1
Punjabi	1

Children with TD were recruited through schools as well as through agencies offering settlement assistance to newcomers. The children with DLD were referred to us by speech-language pathologists who were working with them in a school setting. Only children who met standard exclusionary criteria (e.g., no hearing loss, autism, or intellectual disabilities) were included in the DLD group (see Paradis *et al*., 2013 for more details). Children with ASD were also recruited through schools and from agencies offering assistance to newcomers. All the children referred to us had a clinical diagnosis of ASD established through an assessment protocol from a multidisciplinary team at one of the two centres in the district certified to provide an ASD diagnosis. A diagnosis from this centre is necessary in our district in order for families to access intervention services. Children with ASD in this study had all received intervention services, and 4 were currently receiving them at the time of the study

Our testing time with each child did not permit the inclusion of diagnostic measures specific to DLD or ASD, nor did we have access to health records for these children. Therefore, we included a parent questionnaire, ALDeQ (Paradis, Emmerzael & Sorenson Duncan, 2010 – see below) as an additional source of information about children's early and current L1 development.

As mentioned above, the 10 children with TD and the 10 children with DLD were selected from a larger sample on the basis of criteria that allowed the three groups to be matched. The non-parametric Kruskal-Wallis test was used to determine that there were no significant group differences for age at testing ($\chi^2(2)=2.89$, $p= 0.24$), for non-verbal cognitive abilities ($\chi^2(2)=3.4$,

p= 0.18; measured by using the Columbia Mental Maturity Scales, CMMS; Burgemeister, Blum & Lorge, 1972), for receptive vocabulary ($\chi^2(2)$=1.32, p= 0.52; measured using the Peabody Picture Vocabulary Test, PPVT-III; Dunn & Dunn, 1997). Also, participant groups did not differ in the amount of time children spent with native speaker friends or using media in English, and therefore, had similar scores for the richness of their English L2 environment ($\chi^2(2)$= 3.68, p= 0.16). Thus, participants in this study were matched group-wise on age, non-verbal intelligence, L2 receptive vocabulary and richness of the L2 environment.

On average, the children with TD and the children with DLD had little or no exposure to English before they were about four years of age, which coincided with their entry into an English-speaking preschool programme. However, the participants with ASD had exposure to English before they were three years old, as they started receiving early intervention in English at this time. Therefore, length of exposure to English and age of L2 acquisition was not equivalent across groups ($\chi^2(2)$=7.71, p= 0.02; $\chi^2(2)$= 6.17, p=0.05). Differences between the TD group on one hand and the DLD and ASD groups on the other, were also found on a parent report measure on early and current L1 development, ($\chi^2(2)$= 20.2, p<.001) (ALDeQ; Paradis *et al*., 2010 – see next section). As would be expected, the group with ASD and with DLD had lower scores than the group with TD. Participant characteristics have been summarized in Table 3.2.

Table 3.2

Characteristics of L2 participants

Characteristic	Group	Mean	SD
Age at testing	ASD	85.22	16.08

	TD	79.1	6.81
	DLD	77.3	15.7
Length of L2 exposure	ASD	55	15.83
	TD	30.3	10.11
	DLD	38	17.93
Age of L2 Acquisition in months	ASD	30.22	11.29
	TD	48.8	13.08
	DLD	39.3	21.81
Non-verbal intelligence (CMMS)	ASD	100.75	24.68
	TD	107.5	10.5
	DLD	97.7	11.41
Receptive vocabulary (PPVT)	ASD	84	12.12
	TD	90.2	20.65
	DLD	88.2	18.56
Parent report on L1 development (ALDeQ)	ASD	0.6	0.12
	TD	0.82	0.07

	DLD	0.44	0.13
Richness of L2 environment	ASD	0.76	0.13
	TD	0.65	0.14
	DLD	0.64	0.14

Note: CMMS, Columbia Mental Maturity Scales, standard mean=100; ALDeQ, Alberta Language Development Questionnaire, scores from 0-1.0; Richness of L2 environment, scores from 0-1.0; PPVT= Peabody Picture Vocabulary test, standard mean=100.

3.3.2 Materials and Procedure

Children were tested by trained student research assistants at home or in schools, where they completed the narrative assessment, a non-verbal IQ test and a test of receptive vocabulary. At home, parents were given questionnaires about their child's language learning history in L1 and L2 and their current language environment. A cultural broker or interpreter was present if the families desired so.

The Edmonton Narrative Norms Instrument (ENNI; Schneider *et al.*, 2005; http://www.rehabmed.ualberta.ca/spa/enni/about_the_enni.htm) was the instrument used to elicit narratives. The ENNI is a normed and standardized instrument that consists of two sets of three stories of increasing complexity, stories A1-A3 and B1-B3. Children are shown the picture books and asked to tell the stories while the experimenter cannot see the pictures. The stories produced by the children were then recorded, transcribed using the CHAT system (MacWhinney, 2000) and analyzed. The ENNI can be scored for a range of story linguistic measures. All ENNI standard scores have a standard mean of 10, with the normal range being from 7-13. The following macrostructure (story grammar) and microstructure (mean length of communicative unit, syntactic

complexity, number of different words/lexical diversity and total number of words/story length) measures were examined in the children's stories.

Story Grammar (macrostructure). Story grammar scores were calculated using rubrics specifically created for this study. Scoring rubrics were created for two reasons. First, the ENNI manual contains scoring rubrics for only two out of six stories; so, four additional rubrics were created following the principles used for the two existing rubrics. Next, in the ENNI, reactions to story outcomes may include internal state terms such as *happy*, but also actions such as *say thank you*, behavioural manifestations of emotions such as *cry,* or even physical descriptions such as *wet.* As children with ASD have difficulties with perspective taking, it is possible that they may produce fewer reactions, compared to actions that do not require perspective-taking abilities. Hence, in our scoring rubrics we made a distinction between internal state terms produced as reactions, and actions or behavioural manifestations produced as reactions to story outcomes. The scoring rubrics we created were used for scoring all six ENNI stories. The distinction between reactions using internal state terms and actions produced as reactions was consistent with the macrostructure scoring scheme of the Multilingual Assessment Instrument for Narratives (MAIN; Gagarina *et al*., 2012).

Each story was scored for the presence or absence of story grammar components by using the rubrics created for this study. Raw story grammar scores were calculated for each story (research question #1). Next, the number of each story grammar component produced across stories was counted (see research question #2). For example, we examined whether a child provided details about the setting in each story and counted how many settings the child produced across all six stories. Details on story grammar components with examples and instructions for scoring are given in the appendix. Note that for character introductions, we used a stringent scoring

scheme in which only unambiguous introductions were counted. As such, introductions with pronouns were excluded. Because judgment is involved in scoring for story grammar components, 31% of the corpus was re-scored by a separate research assistant. Comparisons of scoring for story grammar and story grammar components across stories yielded reliability of 82% and 85% respectively. Discrepancies were settled through discussion and a final scoring was arrived at by consensus.

Utterance length (microstructure). This refers to the mean utterance length in words across all stories and was calculated automatically by CLAN (MacWhinney, 2000) by looking at the Mean Length of Communicative Units (MLCU). All utterances produced by the child, except for false starts, repetitions and irrelevant utterances were included. Higher scores reflect longer utterances/ greater complexity.

Syntactic complexity (microstructure). An index of syntactic complexity was calculated by dividing the number of independent and dependent clauses produced across all stories by the number of independent clauses produced. Higher scores mean the presence of more complex sentences. 55% of the transcripts produced by the children with ASD were rescored for reliability by a separate research assistant. Comparisons of scoring for syntactic complexity yielded reliability of 87%. Comparisons for scoring for syntactic complexity in the other two bilingual groups yielded reliability of 98%. Any discrepancies were settled through discussion and a final scoring was arrived at by consensus.

Lexical diversity (microstructure). The number of unique word types used across all stories was calculated automatically by CLAN. This was used as a measure of lexical diversity.

Story length (microstructure). The number of word tokens used across all stories was calculated automatically by CLAN. This was used as a measure of story length/productivity.

The Alberta Language Development Questionnaire (ALDeQ; Paradis *et al*., 2010; https://www.ualberta.ca/linguistics/cheslcentre/questionnaires). The ALDeQ is a parent questionnaire with sections that focus on (a) early milestones, (b) current abilities in the first language, (c) activity and behaviour patterns shown by the child and (d) family history of language and or learning disabilities. The ALDeQ yields a total proportion score with a range from 0-1 and lower scores on the ALDeQ are more typical of children with DLD. A modified version of the ALDeQ was used for the children with ASD.

The Alberta Language Environment Questionnaire (ALEQ; Paradis, 2011; https://www.ualberta.ca/linguistics/cheslcentre/questionnaires). The ALEQ is a parent questionnaire with questions on language input factors, age, and family demographics. This questionnaire was administered to parents with the assistance of interpreters or cultural brokers. The ALEQ contains questions about the following topics: age of arrival in Canada, parents' self-rated proficiency in English, parent education, current language use by family members in the house (parents, other adults, siblings and the target child), age at which the child started learning English in school, exposure to English measured in months (age of acquisition subtracted from the age at testing) as well as the richness of the English language environment. Parents were asked questions about the language that different family members used with the child and the language that the child used with others in the family. English language richness scores were calculated by examining the number of L2 enriching activities (book reading, playing with English-speaking friends, watching TV or using devices in English and singing/reciting in English) the child was

engaged in, as well as the frequency of these activities in a week. A proportional score from 0 to 1 was calculated, with scores closer to 1 indicating a richer English language environment.

The Columbia Mental Maturity Scales (CMMS; Burgemeister al., 1972). The CMMS is a test of non-verbal intelligence in which children are shown patterns of increasing complexity and asked to identify the pattern that does not logically belong in a given sequence. Children who have a standard score greater than 80 score within the normal range on this test.

The Peabody Picture Vocabulary Test (PPVT-III; Dunn & Dunn, 1997). The PPVT is a test of receptive vocabulary in which children are shown pictures and asked to identify the picture that corresponds to the word spoken by the experimenter. The PPVT has a standard score of 100, with the normal range being from 85-115.

3.4 Results

3.4.1 Story grammar/macrostructure for each story

To address our first research question, we examined whether there were between-group differences in in children's global story grammar scores for each story. A series of linear regression models were fitted for each story using the lm function in R (R Core Team, 2013), with group (ASD, TD or DLD) as the independent variable or fixed effect, and story grammar scores as the dependent variable. Length of exposure to L2 English was also entered as a fixed effect in the models to specify the variance in scores due to differences in experience with L2 input. Non-significant fixed effects were eliminated until a model with only significant fixed effects was obtained. Significant group differences were found between the bilinguals with ASD and the bilinguals with TD for four of the six stories: A1 (β= 4.32, t=2.60, p= 0.02), A2 (β= 4.98, t=3.74,

p<0.01), A3 (β= 5.24, t=2.60, p= 0.02) and B3 β= 4,23, t=2.57, p= 0.02). The bilinguals with DLD did not differ significantly from the bilinguals with ASD on any story, although a trend towards significance was found for stories A1 (β= 1.65, t=2.09, p= 0.05) and B3 (β= 3.09 t=1.86, p= 0.08). The bilingual DLD group obtained lower story grammar scores than the bilingual TD group for story A2 (β= -3.97, t=-3.7, p= p<0.01) possibly because of a few outliers and a trend towards significance was found for story A3 (β= -3.87, t=-1.93, p= p= 0.06). Finally, while exposure was a significant predictor for story A2 β= 0.08, t=2.43, p= 0.04), no interaction was found between group and L2 exposure. These results have been summarized in Table 3.3 and Figure 3.1.

Table 3.3

Model results for story grammar scores

	Predictor	Estimate	*SE*	*t*	*p*
A1	Intercept	4.56	0.57	7.98	<.001
	Group TD	1.94	0.79	2.47	0.02*
	Group DLD	1.64	0.79	2.09	0.05.
A2	Intercept	3.64	1.88	1.94	0.06
	Group TD	4.98	1.33	3.74	0.001***
	Group DLD	1.00	1.21	0.83	0.42
	L2 Exposure	0.08	0.03	2.42	0.02*
A3	Intercept	11.56	1.46	7.90	<.001
	Group TD	5.24	2.02	2.60	0.02*

	Group DLD	1.84	2.02	0.92	0.37
B3	Intercept	10.11	1.21	8.35	<.001
	Group TD	4.29	1.67	2.57	0.02*
	Group DLD	3.09	1.67	1.86	0.08.

Note: For task, the bilingual ASD group was the reference level. Exposure= length of exposure to English measured in months; *= significance code when p<.05; **= significance code when p<.01;***= significance code when p<.001; .=trend towards significance

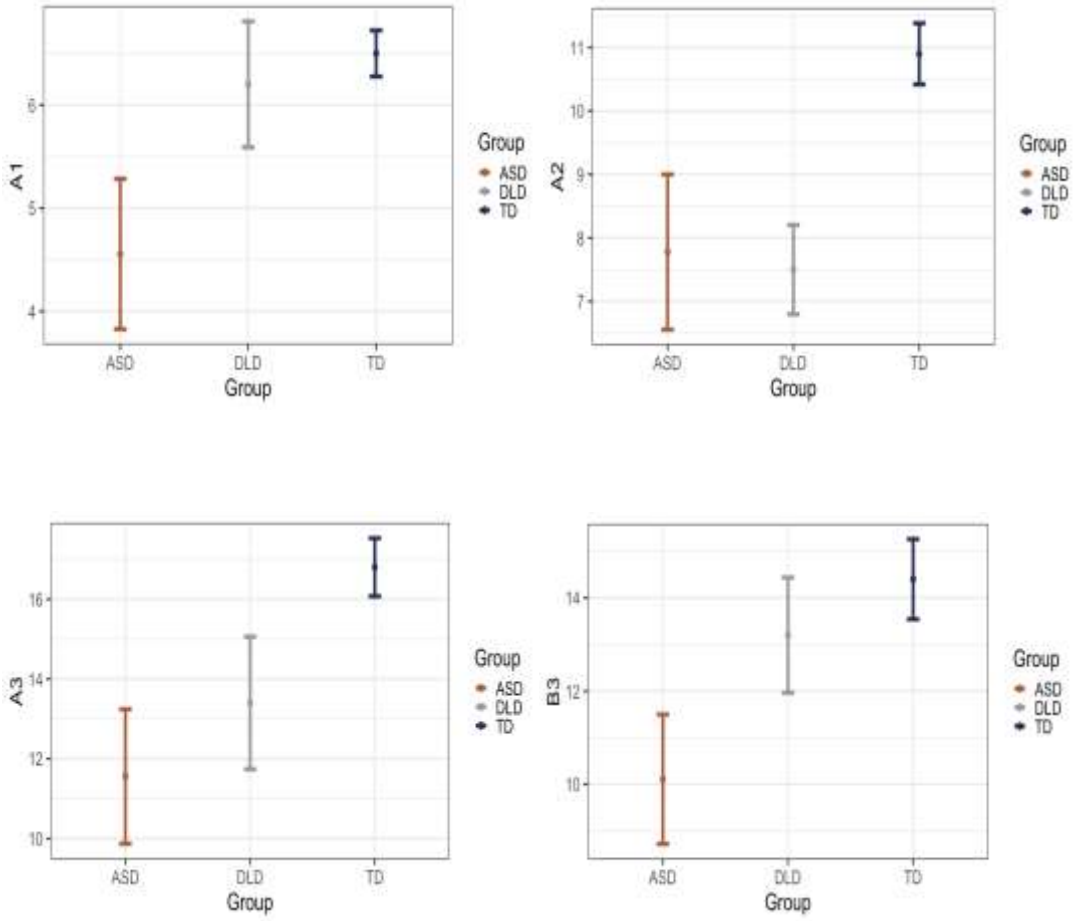


Figure 3.1. Score ranges for story grammar scores. These figures show global story grammar scores obtained by the participants. Significant group differences were found between ASD and TD for stories A1, A2, A3 and B3. The bilinguals with DLD did not differ significantly from the bilinguals with ASD although a trend towards significance was found for stories A1 and B3.

3.4.2 Story grammar/macrostructure components across stories

To address our second research question, we examined individual story grammar components across stories to see if group differences emerged for some components versus others. A series of Poisson regressions were fitted for each component using the glmer function in R (R Core Team, 2013) as count data were analyzed. Group and L2 exposure were entered as fixed effects, and participant was entered as a random effect. Non-significant fixed effects were eliminated until a model with significant fixed effects was obtained. Group emerged as a significant predictor for character introductions, with both the TD (β= 0.37, z=2.71, p= 0.01) and the DLD groups (β= 0.28, z=2.01, p= 0.04) introducing more characters than the ASD group, who were more likely to introduce characters with pronouns. Significant group differences were found for initiating events with both the DLD (β= -0.45, z=-2.52, p= 0.01), and the ASD (β= 0.62, z=2.83, p= 0.005) group being less likely to produce initiating events than the TD group. Similarly, the bilinguals with TD were more likely to include attempts (β= 0.39, z=2.42, p= 0.02), and outcomes (β= 0.47, z=2.50, p= 0.01) in their narratives than the bilingual ASD group. The DLD group produced fewer outcomes than the TD group (β= -0.36, z=-2.33, p= 0.02) and a trend towards significance was found for attempts (β= 0.29, z=-1.89, p= 0.06). The two clinical groups did not differ significantly from each other for any component except for the use of internal state terms as reactions: the bilingual DLD group produced more internal state terms as reactions than the bilingual ASD group (β= 0.69, z=2.28, p= 0.02). Although the bilingual TD group did not differ from the bilingual ASD group for use of internal state terms as reactions, a trend towards significance was noted (β= 0.53, z=1.71, p= 0.09). Finally, no interactions were found between group and L2 exposure, and L2 exposure emerged as a significant predictor only for initiating events (β= 0.19, z=2.06, p= 0.04) and outcomes (β= 0.16, z=2.13, p= 0.03). These results have been summarized in Table 3.4 and Figure 3.2.

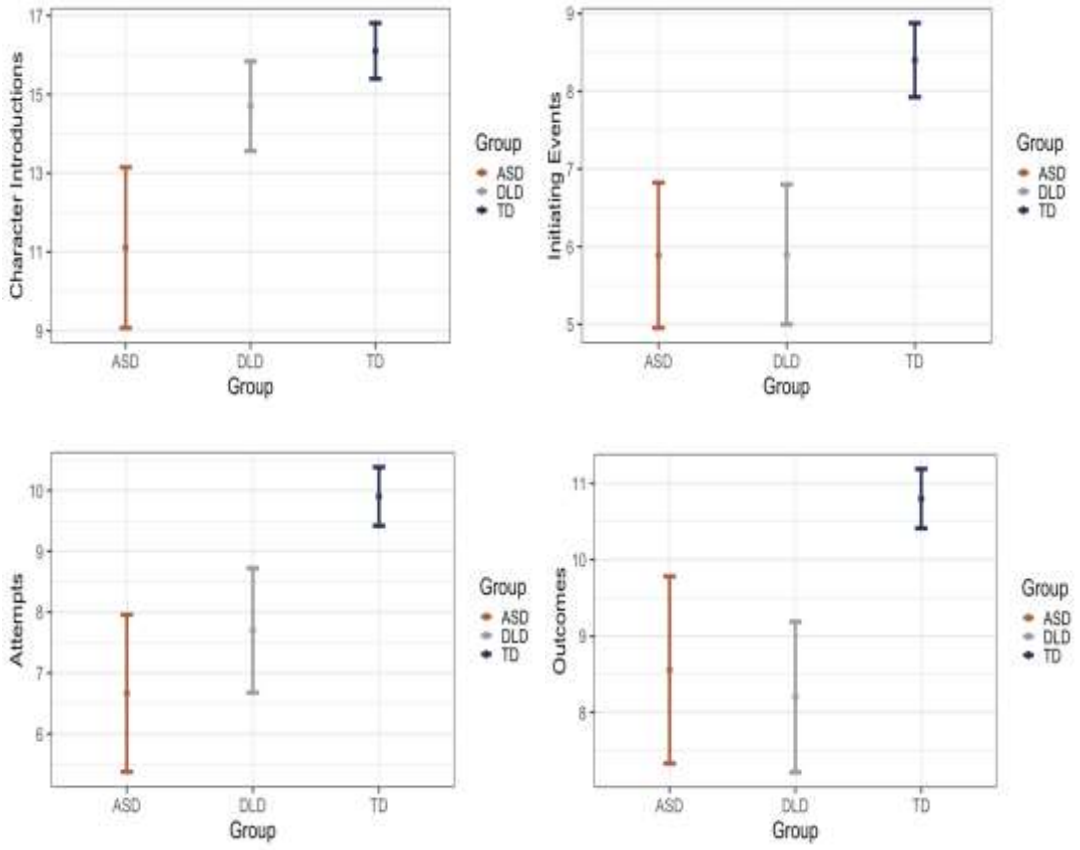
Table 3.4

Model results for story grammar components

	Predictor	Estimate	*SE*	*t*	*p*
Characters	Intercept	2.40	0.11	22.16	<.001***
	Group TD	0.37	0.14	2.71	0.007**
	Group DLD	0.28	0.14	2.01	0.04*
Initiating Events	Intercept	1.61	0.16	9.95	<.001***
	Group TD	0.62	0.22	2.83	0.004**
	Group DLD	0.18	0.21	0.86	0.39
	Exposure	0.19	0.09	2.01	0.04*
Attempts	Intercept	1.89	0.13	14.69	<.001***
	Group TD	0.39	0.16	2.42	0.02*
	Group DLD	0.14	0.17	0.84	0.40
Outcomes	Intercept	2.00	0.13	14.89	<.001***
	Group TD	0.47	0.19	2.50	0.01*
	Group DLD	0.11	0.17	0.65	0.52
	Exposure	0.16	0.08	2.13	0.03*

Internal State Terms as Reactions	Intercept	0.93	0.25	3.78	0.001***
	Group TD	0.53	0.31	1.71	0.08.
	Group DLD	0.69	0.31	2.28	0.02*

Note: For task, the bilingual ASD group was the reference level. Exposure= length of exposure to English measured in months; *= significance code when p<0.05; **= significance code when p<.01;***= significance code when p<.001; .=trend towards significance



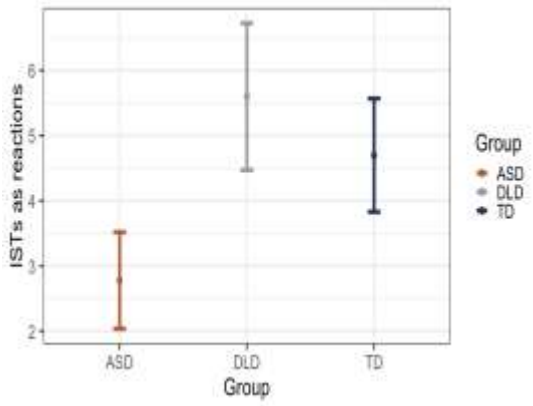


Figure 3.2. Score ranges for story grammar components. These figures show the number of story grammar components produced by participants across stories. ASD produced fewer character introductions, initiating events, attempts and outcomes than TD. ASD produced fewer character introductions and internal state terms as reactions than DLD.

3.4.3 Microstructure components across stories

To address our third research question, we examined microstructure components. A series of linear regression models were fitted using the lm function in R (R Core Team, 2013), with group (ASD, TD or DLD) and L2 exposure as fixed effects and microstructure scores for utterance length, syntactic complexity, lexical diversity and story length as the dependent variables. No significant fixed effects emerged in the models for the number of different words or story length measured in words. Significant group differences emerged for utterance length and syntactic complexity.

The optimal model for utterance length included Group but not L2 exposure. Children with ASD produced shorter utterances than the children with TD (β= 4.42, t=2.48, p= 0.02), but no differences were found with the DLD group. While the children with DLD did not differ significantly from the children with TD, there was still a trend towards significance (β= -3.2, t=-1.18, p= 0.08). Similarly, the ASD group used less complex syntax than the TD group (β= 0.63, t=0.42, p= 0.68), but not the DLD group. Both clinical groups differed significantly from the TD

controls for the use of complex syntax. L2 Exposure was not a significant predictor, nor were any interactions found between group and exposure. These results have been summarized in Table 3.5 and Figure 3.3.

Table 3.5

Model results for microstructure components

	Predictor	Estimate	*SE*	*t*	*p*
Utterance length	Intercept	4.78	1.29	3.69	0.001**
	Group TD	4.42	1.78	2.48	0.02*
	Group DLD	1.22	1.78	0.69	0.49
Syntactic complexity	Intercept	6.67	1.10	6.04	2.22e-06***
	Group TD	4.23	1.52	2.78	0.01*
	Group DLD	0.63	1.52	0.42	0.68

Note: For task, the bilingual ASD group was the reference level. Exposure= length of exposure to English measured in months; *= significance code when p<0.05; **= significance code when p<0.01;***= significance code when p<.001; .=trend towards significance

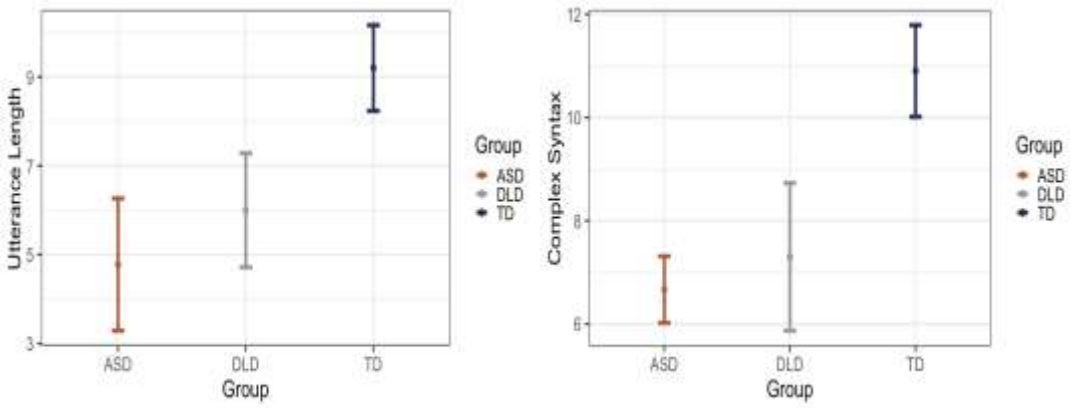


Figure 3.3. Score ranges for microstructure components. These figures show the microstructure scores obtained by the participants. Significant group differences were found between ASD and TD for Utterance Length and the use of Complex Syntax.

3.5 Discussion

The existing research on bilingualism and ASD is characterized by several limitations such as a focus on lexical skills, emphasis on early development and limited research on comparisons with bilinguals with TD. Our study was conducted to address these limitations, as well as to address two larger theoretical questions in the field of ASD and language: (1) the extent to which ASD is characterized by difficulties in structural language and (2) the overlap between ASD and DLD. In this section, we discuss our findings and interpret them with reference to these larger theoretical questions.

3.5.1 Macrostructure abilities in bilingual ASD: story grammar abilities

For our first research question, we examined composite story grammar scores. Consistent with the prevailing literature, we predicted that the bilinguals with ASD would have lower story grammar scores than the bilinguals with TD, but not the bilinguals with DLD (e.g., Baixauli *et al*., 2016; Hoang *et al*., 2018; Norbury *et al*., 2014; Suh *et al*., 2014). Our predictions were partially

supported by the data, as significant group differences were found between the bilinguals with ASD and the bilinguals with TD for four out of six stories. Note that while most studies on monolinguals with and without ASD have found significant differences for story grammar (e.g., Norbury *et al*., 2014), null results have also been reported (e.g., Young *et al*., 2005). It is possible that some picture books may not elicit narratives as well as others, possibly explaining the null findings for two stories. For example, one of the stories for which we did not find significant group differences was story B1 which was a simple six-page story with two characters and consisting of a single episode. It is possible that such stories may not elicit group differences. Notably, we found significant for both stories A3 and B3 which were more complex, with four characters and three-story episodes.

Consistent with our prediction, both clinical groups patterned similarly overall. While the bilingual DLD group did not outperform the bilingual ASD group, trends towards significance still emerged for two stories. Unlike the bilingual ASD group, the bilingual DLD group differed from the bilingual TD group on only two stories. Our findings indicate that, while the children with ASD and children with DLD had largely similar skills, further research is required to determine whether children with DLD possibly occupy an intermediate position between ASD and DLD for macrostructure skills (Colozzo *et al*., 2015).

Taken together, our results dovetail with those from the monolingual literature (Baixauli *et al*., 2016) and indicate that: (1) producing a well-structured narrative is a challenge for children with ASD, with children with ASD producing less informative stories than children with TD and (2) that DLD and ASD pattern similarly for macrostructure when global scores are examined. Being bilingual does not change this profile. However, looking at only composite story grammar scores may mask important differences between the narratives produced by groups, as certain story

grammar components may be particularly challenging for children with ASD. Hence, we formulated our second research question focusing on individual story grammar components.

3.5.2 Macrostructure abilities in bilingual ASD: story grammar components

For our second research question, we examined how individual story grammar components differentiated the groups. Such a fine-grained analysis is rare in both the monolingual and the bilingual literature on autism and narratives. For this question, we counted the number of story grammar components produced by children across all six stories. Following existing studies, we predicted significant group differences between the bilingual ASD group and the other two bilingual groups for narrative components relying on perspective-taking abilities (unambiguous character introductions, internal plans, internal responses and reactions to story outcomes) (Goldman, 2008). As for the core narrative components, consistent with prior literature, the bilingual ASD group was expected to produce fewer story outcomes than the bilingual TD group (e.g., Tager-Flusberg, 1995; Yang, 2011).

Consistent with our prediction, the bilinguals with ASD included fewer story outcomes than the bilinguals with TD. When it came to the core narrative components- initiating events, attempts and story outcomes- both clinical groups patterned similarly. Both the bilinguals with ASD, and the bilinguals with DLD produced fewer initiating events, attempts (trend for DLD) and story outcomes than the bilingual TD group. As such, both clinical groups included fewer story episodes than the bilingual TD group and produced stories with less informative content. Consistent with our predictions, no group differences were found for settings or actions produced as reactions to story outcomes as these story components do not rely on perspective-taking skills.

Next, we examined the components requiring perspective-taking skills. We found significant group differences for two story grammar components that required perspective-taking skills: character introductions and internal terms as reactions to story outcomes. Children with ASD introduced fewer characters in their stories than the children with TD. Significant differences were also found between the bilinguals with ASD and the bilinguals with DLD for character introductions. Recall that we used a stringent scoring scheme for character introductions where introductions with a pronoun, which were frequent in the bilingual ASD group, were not counted. Although children with DLD can experience difficulties in using definite and indefinite articles (e.g., Zdorenko & Paradis, 2008; 2011), they were nevertheless more sensitive to their listeners' needs and introduced characters more frequently than the children with ASD. Partly consistent with our prediction, significant group differences were found for the number of internal state terms produced as reactions, with the bilingual ASD group producing significantly fewer internal terms as reactions than the bilingual DLD group. Although significant differences were not found with the bilingual TD group, possibly a result of the small sample size in this study, a trend towards significance was nevertheless found, indicating the production of internal terms as reactions to be an area that is particularly vulnerable in ASD, but not so in DLD. Finally, we did not find any group differences for two components that required perspective-taking skills – internal terms and internal responses. However, regardless of group, children produced very few internal terms or internal responses. As such, these findings may reveal developmental trends in the production of narratives (Berman & Slobin, 1994), and be more common in the narratives produced by older children and adolescents than children who are in average, less than seven, as were the participants in this study.

Our results suggest that a fine-grained analysis of individual story grammar components may reveal group differences that are masked by composite story grammar scores. When looking at only composite story grammar scores, both bilinguals with ASD and bilinguals with DLD presented similar profiles. However, breaking down story grammar scores revealed differences between these two groups. Although both clinical groups in our study were similar in their core narrative components, perspective-taking abilities were compromised in ASD. In DLD, they represented an area of relative strength.

3.5.3 Microstructure abilities in bilinguals with ASD: comparisons to bilinguals with TD and bilinguals with DLD

For our third research question, we examined the children's performance with the following microstructure components: lexical diversity, story length, syntactic complexity, and utterance length. Based on prior studies, we predicted that there would be group differences between the bilingual ASD and TD groups on all measures, and expected the bilinguals with ASD to pattern similarly to the bilinguals with DLD (Baixauli *et al*., 2016; Banney *et al*., 2015; Capps *et al*., 2000; Mäkinen *et al*., 2014; Norbury *et al*., 2014).

These predictions were partially supported, as group differences were found between ASD and TD for the measures of complexity (utterance length and complex syntax), but not for the measures of productivity (lexical diversity and story length). The bilinguals with ASD produced shorter utterances and used less complex syntax than the bilinguals with TD but did not differ from the bilinguals with DLD on these measures. The bilingual DLD group used significantly less complex syntax than the TD group, and a trend for the same pattern emerged for utterance length. As mentioned earlier, the extent to which structural language difficulties characterize ASD is a

matter of debate (e.g., Wittke *et al*., 2017), with the suggestion that a sub-group of children with ASD may also have a Language Disorder (e.g., Meir & Novogrodsky, 2019). Our findings add to the increasing evidence from the monolingual research that, in addition to the well-documented difficulties with pragmatics, some children with ASD also display deficits with structural language skills. It is crucial to note that our comparison group also consists of bilinguals. As noted in the introduction, bilinguals with TD are also acquiring English as an L2, and hence, may display similar difficulties with the tense- agreement verbal morphology to that experienced by monolinguals with DLD (e.g., Bedore & Peña, 2008; Paradis, 2005; 2008). Our findings therefore provide evidence that difficulties with structural language characterize some children with ASD (e.g., Wittke *et al*., 2017) in both bilinguals and monolinguals; thus, the structural language profile appears parallel between monolinguals and bilinguals with ASD. Our findings also indicate that bilinguals with ASD and bilinguals with DLD pattern similarly on measures of structural language and differ from bilinguals with TD. These results suggest that at least some bilinguals with ASD overlap with bilinguals with DLD. It must be noted that shorter utterances and reduced syntactic complexity can be, in part, attributable to limited narrative abilities. Further research is required to determine whether children with ASD show reduced complexity because of narrative abilities, or because of core structural language deficits.

While measures of productivity have been found to differentiate between children with ASD and children with TD, with a moderate effect size (Baixauli *et al*., 2016), no group differences were found in this study. Bilinguals in all three groups produced stories of similar length and used a similarly diverse vocabulary. Difficulties with productivity measures may be less apparent when producing stories with support (Losh & Capps, 2003) as the participants in all three groups were constrained by the wordless picture books used. Differences may however emerge for productivity

measures in a less structured task, such as spontaneous conversation, particularly for children with autism who are expected to struggle with social interaction. Furthermore, all three groups in this study were matched on receptive vocabulary. Differences on productivity measures such as lexical diversity may be present if groups that are not language-matched are compared.

3.5.4 Narrative difficulties in ASD: well-entrenched deficits

As children with ASD experience difficulties in social situations and in engaging with others, it is reasonable to conjecture that they might not be experiencing and up-taking linguistic input as effectively as their neurotypical peers. Therefore, in this respect, deficits in mechanisms for language learning could be implicated in ASD (Paradis & Govindarajan, 2017). Similarly, children with DLD typically show deficits in cognitive systems involved in language learning, such as verbal memory and processing speed (Leonard, 2014; Schwartz, 2009). Prior research has confirmed that bilinguals with DLD seem to make less efficient use of L2 input than bilinguals with TD (Blom & Paradis, 2015; Govindarajan & Paradis, 2019). As such, both groups would be expected to make less efficient use of the linguistic input they receive, in comparison to children with TD. Accordingly, we examined the impact of L2 English exposure on macro- and microstructure components. However, exposure to L2 English emerged as a significant predictor for only the global story grammar scores for story A2, and for the components *initiating events* and *outcomes* across stories. Furthermore, no interactions were found between exposure and group.

While we did not find differential effects for length of exposure in our study, it is important to note that while groups were closely matched on receptive vocabulary, the bilingual ASD group had significantly greater exposure to L2 English than the other two groups, as groups were not matched on exposure. As such, the bilinguals with ASD did not benefit from their additional L2

exposure and patterned similarly to the bilingual DLD group. Therefore, narrative abilities represent an area of persistent weakness in ASD.

Next, while previous studies have found bilingual children with DLD to make less efficient use of the input they receive than bilinguals with TD, they have also found maturation to bring improvements to the language processing deficits in DLD (Blom & Paradis, 2015; Govindarajan & Paradis, 2019; Paradis, Jia & Arppe, 2017). This observation could explain the lack of differential effects in our study. Note that two studies that have previously found differential effects had participants who had, on average, only been learning English for two years (Blom & Paradis, 2015; Govindarajan & Paradis, 2019). The bilingual DLD group in the present study had over three years of L2 English exposure, and as such, differential effects between bilinguals with DLD and bilinguals with TD may be more apparent when larger samples, with less exposure to L2 English are compared.

3.6 Conclusions and limitations

This study contributes to the growing body of research on autism and narratives and is the first to conduct a cross-disorder comparison with bilingual populations with ASD and DLD. This study is consistent with the monolingual findings and indicates that children with autism, whether they are monolingual or bilingual, show deficits in both narrative macrostructure and microstructure. Overall, in comparison to TD controls, bilingual children with ASD produce stories with reduced story content, use less complex syntax and produce shorter utterances. In terms of global story grammar scores and microstructure measures, the bilinguals with ASD pattern similarly to the bilinguals with DLD and differ from the bilinguals with TD. Finally, from a theoretical perspective, our results with these bilinguals align with the evidence from the

monolingual research indicating that autism can be characterized by difficulties with structural language in addition to difficulties with pragmatics. Furthermore, difficulties with structural language can extend to an overlap between some children with ASD and children with DLD.

While both clinical groups overlapped on structural language skills and global story grammar scores, differences were found on narrative skills that require perspective-taking abilities, such as character introductions, and internal state terms produced as reactions to story outcomes. These skills were compromised in the ASD group but represented an area of relative strength in DLD. This contrast suggests that children with ASD, whether bilingual or monolingual, have specific deficits in their narrative skills that are not common with DLD. Thus, this study found that the linguistic profile of children with ASD and DLD are both overlapping and distinct.

Finally, we would like to acknowledge certain limitations to our study. This study was limited by its small sample size, as a result of which, only two fixed effects could be entered in our models. Future research could examine the many sources of individual variation in L2 outcomes that have been examined in bilinguals with TD. The small sample size also reduces the potential for generalization and, thus, there is a need for additional cross-disorder comparisons with bilinguals to ascertain if the results of this study are borne out in others.

Appendix

Story Grammar Component	Description	Example
Characters	One point for introducing a character clearly. Introductions with pronouns were not counted. The number of characters in the story determined how many points they could score. Stories A1 and B1 contained two characters, stories A2 and B2 contained three characters and stories A3 and B3	*once there was a giraffe and a elephant playing with one or three balls* (Child 14, ASD, L1 Spanish, 6;5, 60 months of L2 exposure)

	contained four characters. Introductions with pronouns were not counted.	
Setting	One point for providing information about the setting.	*After four months, it was a July and they went to the sandbox* (Child 5, ASD, L1 Mandarin, 8;0, 60m months of L2 English Exposure)
Initiating Events	One point for mentioning the initiating event(s) that set(s) the story episode in motion. The number of initiating events possible ranged from one to three, depending on the complexity of the story and the number of episodes.	*and then he dropped it in the water by accident* (Child 6, ASD, L1 Mandarin, 9;6, 71 months of L2 English exposure)
Internal Responses	One point for mentioning how characters reacted to the initiating event. Depending on the complexity of the story, a child could score from one to three points.	*And dog got mad at the rabbit (*Child 70, TD, L1 Farsi, 6;0, 37 months of L2 English exposure)
Internal Plans	One point for mentioning how characters planned to deal with the Initiating Event. Depending on the complexity of the story, a child could score from one to three points.	*Failure elephant decided to run* (Child 5, ASD, L1 Mandarin, 8;0, 60m months of L2 English Exposure)
Attempts	One point for indicating how characters attempted to attain their goal. Depending on the complexity of the story, a child could score from one to three points.	*and then he tries to get it out.* (Child 6, ASD, L1 Mandarin, 9;6, 71 months of L2 English exposure)
Outcomes	One point for indicating the outcome or the consequence of the attempt. Depending on the complexity of the story, a child could score from one to three points.	*and then he got it out and give it back to the giraffe*. (Child 6, ASD, L1 Mandarin, 9;6, 71 months of L2 English exposure)
Internal State Terms as	How characters reacted to the outcomes. Only internal state terms	*the giraffe is so happy that he got his toy back*. (Child 6,

Reactions to Story Outcomes	were counted. The number of story episodes and the number of characters determined the number of points children could score (two to nine).	ASD, L1 Mandarin, 9;6, 71 months of L2 English exposure)
Actions produced as reactions to story outcomes	How characters reacted to story outcomes. Actions (physical and verbal) as well as manifestations of emotions such as *cry* were included. The number of story episodes and the number of characters determined the number of points children could score (two to nine).	*he said, thank you* (Child 14, ASD, L1 Spanish, 6;5, 60 months of L2 exposure)

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4. Internal State Terms in the Narratives of English L2 learners with Autism Spectrum Disorder, Developmental Language Disorder and Typical Development (Krithika Govindarajan & Johanne Paradis)

Abstract

Background: Cross-disorder comparisons can elucidate linguistic characteristics that are disorder-specific. To date, few cross-disorder comparisons have been conducted with bilingual children.

Aims: This study investigated the narrative abilities of child English L2 learners with Autism Spectrum Disorder (ASD), Developmental Language Disorder (DLD) and Typical Development (TD). Monolingual children with ASD have difficulties with aspects of narratives that rely on perspective-taking, such as the use of internal state terms (ISTs). Accordingly, we asked whether children with ASD would show similar difficulties in their L2 and if they would differ from L2 children with DLD.

Methods & Procedure: A standardized English narrative test was administered to 29 L2 children with ASD (L2-ASD), DLD (L2-DLD) and TD (L2-TD), Participants had diverse L1 backgrounds and were matched for age (mean=6;8), non-verbal intelligence (mean=101.98) and vocabulary (PPVT mean=87.47). Narratives were coded for the following categories of ISTs: physiological terms, perceptual terms, consciousness terms, emotion terms and cognitive terms. The total number of ISTs produced was then calculated.

Results: Regression modeling showed that L2-TD and L2-DLD produced more ISTs overall than L2-ASD, as well as more emotional and cognitive terms that are particularly reflective of perspective-taking abilities. No differences were found between L2-TD and L2-DLD. Participants with ASD did not benefit from their significantly greater L2 English exposure.

Conclusions & Implications: Our findings parallel those from the monolingual literature and indicate parallel profiles for children with ASD in their first and second languages. We conclude that children with ASD have difficulties with perspective-taking in narratives in their L2, while perspective-taking abilities represent an area of relative strength in DLD when groups matched on language abilities are compared. Our findings can inform clinical practice by identifying targets for intervention.

Keywords: Autism Spectrum Disorder, Developmental Language Disorder, bilingual, narratives, Internal State Terms

4.1 Introduction

Narratives provide rich information about children's linguistic abilities and have been studied extensively to assess language development across different cultures (e.g., Berman & Slobin, 1994). Traditionally, narratives are analyzed at two different levels: *macrostructure*, which refers to the overall organization of the story, and *microstructure*, which refers to a more local level of analysis and includes linguistic devices such as utterance length or the use of complex syntax. Telling a story requires both linguistic and conceptual skills, however, perspective-taking abilities are central to successful narratives, as children must keep their listener's needs in mind, and accordingly adapt their stories. Perspective-taking abilities are also reflected in the use of Internal State Terms (ISTs) or language indicating story characters' internal states such as *happy* or *hungry*. The use of ISTs may prove to be particularly challenging for children with Autism Spectrum Disorder (ASD) or autism, who by definition have difficulties with social communication (American Psychiatric Association (APA), 2013).

One popular psychological theory of autism considers limitations in Theory of Mind (ToM) abilities to be the primary impairment in autism (Baron-Cohen *et al*., 1985; Baron-Cohen, 2000). As Bang, Burns and Nadig (2013) point out, the overall reduced use of ISTs by individuals with autism is a natural corollary of this theory. However, very little is known about how bilinguals with autism use ISTs as much of what we know about the narrative abilities of children with ASD comes from research with monolinguals (e.g., Capps *et al*., 2000; Diehl *et al*., 2006; Norbury & Bishop, 2003; Norbury *et al*., 2014). The majority of the existing research on bilingualism and autism has focused on comparing preschool-age monolingual and bilingual children with ASD in order to assess the capacity for bilingualism in children with ASD (e.g., Hambly & Fombonne, 2012; Ohashi *et al*., 2012; Petersen, Marinova-Todd & Mirenda, 2012; Reetzke, Zhou, Sheng &

Katsos, 2015; Valicenti-McDermott *et al*., 2013). While this body of research has yielded significant findings suggesting children with ASD who are exposed to two languages are not delayed compared to monolinguals with ASD in their communicative development, it does not inform us about how bilingualism unfolds in children with ASD as they grow older, especially if they show linguistic characteristics similar to those of monolinguals with ASD.

Interpreting the language development of bilingual children with ASD needs to include comparisons to TD bilinguals. Furthermore, cross-disorder comparisons involving bilinguals with ASD and bilinguals with Developmental Language Disorder (DLD) have not yet been conducted. Such comparisons are valuable as the overlap between the linguistic profiles of ASD and DLD has been the subject of much debate (e.g., Tager-Flusberg & Joseph, 2003), and such profiles would include the use of ISTs. Again, a comparison group of bilinguals with DLD would be more informative than a group of monolinguals with DLD.

This study aimed to address these gaps in knowledge by comparing the ISTs produced by bilingual children with ASD, TD and DLD on an elicited narrative task. From a theoretical perspective, this study would clarify the extent to which the production of ISTs represents an area of weakness in ASD by looking at bilingual populations. Differences between bilinguals with ASD on one hand, and bilinguals with TD and or DLD on the other, would indicate the production of ISTs to be particularly vulnerable in ASD. This is because, since all of these bilingual groups are in the process of acquiring their L2, specific difficulties in the use of ISTs in the bilinguals with ASD could not be attributed to incomplete L2 skills. Similarly, from a theoretical perspective, understanding the potential overlap in the use of ISTs between bilinguals with ASD and bilinguals with DLD would contribute evidence from bilingual populations to the debate regarding overlap in ASD and DLD linguistic profiles. From a clinical perspective, the findings from this study

could identify targets for intervention, for bilinguals with ASD, DLD or both. More generally, this study would also yield a better understanding of the profiles of bilinguals with ASD, which is particularly relevant in linguistically diverse societies such as Canada, the United States, the United Kingdom, Australia and many Western European countries (e.g., Kay-Raining Bird, Genesee & Verhoeven, 2016; Paradis & Govindarajan, 2018).

4.1.1 Production of ISTs by monolingual children with ASD

ISTs are traditionally classified into semantic categories such as perception terms (e.g., see), physiological terms (e.g., hungry), desire terms (e.g., want), emotion terms (e.g., happy) and mental/cognitive terms (e.g., think). The use of ISTs is considered to reflect an understanding of psychological states or theory of mind (ToM, e.g., Bretherton & Beegly, 1982). As such, children with ASD would be expected to produce fewer ISTs than their neurotypical peers (Bang, Burns & Nadig, 2013).

At first blush, the monolingual literature may appear to present an inconsistent pattern of results. While some studies have found significant differences for the production of ISTs between children with autism and their neurotypical peers (e.g., Baixauli *et al*., 2016; Brown, Morris, Nida & Baker-Ward, 2012; Rumpf, Kamp-Becker, Becker & Kauschke, 2012; Siller, Swanson, Serlin & Teachworth, 2014), others have not found differences for the production of ISTs (e.g., Bang *et al*., 2013; Norbury & Bishop, 2003; Mäkinen *et al*., 2014). Both early and more recent studies have presented such a conflicting pattern of results. However, even when differences have not been found for the number of ISTs, children with ASD nevertheless struggle with producing causal explanations for ISTs and have difficulties telling stories within a causal framework when

compared to children with TD (Tager-Flusberg & Sullivan, 1995; Capps *et al*., 2000; Losh & Capps, 2003; Diehl *et al*., 2006).

Conflicting findings notwithstanding, the bulk of evidence supports an ASD-specific deficit in the production of ISTs (Brown *et al*., 2012; Kauschke, van der Beek & Kamp-Becker, 2016; Peristeri, Andreou & Tsimpli, 2017; Rumpf *et al*., 2014; Siller *et al*., 2014). A recent meta-analysis by Baixauli and colleagues indicates that the production of ISTs is an area of weakness for children with ASD, with a moderate effect size (Baixauli, Colomer, Roselló & Miranda, 2016). For example, in Brown *et al*. (2012), 6 to 14-year old children with ASD recalled their earliest memories, as well as emotional experiences. Children with autism included fewer emotional, perceptual, or cognitive terms than children with TD with whom they were matched on age, intelligence and verbal comprehension abilities. Similar results were obtained in Rumpf *et al*. (2014) in which a standardized narrative test was used. Eight to 12-year-old children with autism produced fewer references to internal states, especially to characters' cognitive states when compared to both children with TD and children with Attention Deficit Hyperactivity Disorder with whom they were matched on age, intelligence and overall language abilities. In Siller *et al*. (2014) and Kauschke *et al*. (2016), participants with autism showed a reduced use of emotion terms in particular.

Methodological issues could explain why some studies have found no differences in the use of ISTs by children with ASD. For example, in Mäkinen *et al*. (2014), the narratives produced by 5 to 10-year-old Finnish speaking children were analyzed for different narrative measures, including the use of ISTs referring to characters' thoughts and emotions. Participants were matched on age. No group differences were found, however, the authors noted that the production of ISTs was also scarce in the TD group, and that some picture books may elicit fewer ISTs than

others. Methodological differences may also partly underlie the divergent findings reported in the literature, as studies have differed in how many categories or sub-types of ISTs they have examined, as well as how they have classified ISTs. For example, "want" is analyzed as a desire term in Bang *et al*. (2013), but as a cognitive term in Mäkinen *et al*. (2014). As such, this might lead to different results for ISTs as a broad category or for sub-types of ISTs. Finally, several studies such as Norbury and Bishop (2003) have examined ISTs within the broader category of evaluative devices which may also include diverse narrative features such as the use of character speech, onomatopoeia, and hedges. Examining ISTs within this broader category may dilute between-group differences (Colozzo, Morris & Mirenda, 2015). Hence, when designing our study, we used picture books clearly illustrating characters' internal states, examined ISTs belonging to different categories and did not examine ISTs within the broader category of evaluative devices.

4.1.2 Cross-disorder comparisons of monolingual children's production of ISTs

The boundaries between ASD and DLD have been debated (e.g., Bishop, 2010), with the suggestion that some children with ASD exhibit language profiles similar to those characteristic of DLD (Meir & Novogrodsky, 2019; Tager-Flusberg & Joseph, 2003; Wittke *et al*., 2017). As such, comparisons between ASD and DLD are valuable as they can clarify the areas of strengths and weaknesses in these two clinical populations (Norbury & Bishop, 2014). So far, only a handful of studies on narratives have examined ISTs and included both children with ASD as well as children with DLD (Colozzo *et al*., 2015; Engberg-Pedersen & Christensen, 2017; Mäkinen, 2014; Manolitsi & Botting, 2011; Norbury & Bishop, 2003; Norbury *et al*., 2014). Three different patterns of results can be identified in this emergent body of research, which indicates further studies with this three-group design are needed.

Some studies have found no differences between the two clinical groups (Norbury & Bishop, 2003; Engberg-Pedersen & Christensen, 2017, Manolitsi & Botting). For example, in Norbury and Bishop (2003), the narratives produced by 6 to 10-year old children with autism were compared to those produced by age-matched children with DLD and with TD. No group differences were found, however, regardless of group, children rarely produced verbs reflecting characters' internal states. It is possible that some picture books may not elicit ISTs to the same extent as others, as noted above. Hence, in our study we used the Edmonton Narrative Norms Instrument (ENNI; 2005) in which the illustrations clearly depict the story characters' emotions. Furthermore, studies have also differed in how they have analysed ISTs. While Manolitsi and Botting (2011) did not find any differences for the production of ISTs between 4 to 13-year old Greek speaking children with ASD or DLD, matched on gender, age and non-verbal intelligence, ISTs were included in a narrative "micro-skills" category, which also included devices such as adjectives, modal verbs, the use of connectors and character speech. As such, the results from this study are not sufficiently fine-grained as those of other studies on ISTs. Accordingly, in the present study, ISTs are examined in isolation from other microstructure skills.

In contrast to the above studies, Colozzo *et al*. (2015) found children with ASD to produce fewer ISTs than both children with TD, and children with DLD with whom they were matched on age. Two different narrative elicitation tasks were used. The children with ASD produced fewer ISTs than the children with DLD, who in turn, produced fewer ISTs than the children with TD. The children with ASD also showed a reduced use of cognitive terms, when compared to the children in the other two groups. Similar results were also reported in Ziatas, Durkin and Pratt (1998), in which children's comprehension and production of belief terms was examined.

Finally, two studies have found children with DLD to produce fewer ISTs, when compared to children with ASD and/or children with TD (Norbury *et al*., 2014; Mäkinen, 2014). It is important to note that participants from the three groups were not matched on language in either study. For example, in Norbury *et al*. (2014), the narratives produced by 6 ½ to 15-year-old children with ASD, DLD and TD were examined. Groups were matched for age and non-verbal abilities, but only the ASD and TD groups were matched for structural language abilities. When differences are found between children with DLD and children with ASD on the production of ISTs, they are likely because of linguistic deficits in DLD, rather than reduced ToM abilities in DLD (Mäkinen *et al*., 2014; Norbury *et al*., 2014). This observation is relevant to a study with bilingual children who are in the process of learning their L2. Accordingly, in the present study, the bilingual children with ASD, DLD and TD were matched for vocabulary.

Taken together, the research comparing the use of ISTs by children with DLD and children with ASD shows inconsistent findings; however, differences in wordless book selection, matching strategies and scoring schemes for ISTs may partly underlie the conflicting findings reported. As children with DLD do not struggle with narrative components requiring perspective-taking abilities such as character introductions to the same extent as children with ASD (Goldman, 2008), it is possible that the production of ISTs may therefore represent an area of relative strength in DLD. Hence, our study was designed to include an appropriate narrative elicitation instrument, well-matched groups and a scoring scheme specifically aimed at ISTs.

4.1.3 Production of ISTs by bilingual children with ASD

So far, only two studies have examined narrative production in bilingual children with ASD (Baldimsti *et al*., 2016; Hoang *et al*., 2018). These studies have not found any differences between

bilinguals with ASD and bilinguals with TD for the production of ISTs. There are, however, several limitations to both these studies, as a result of which, more research is required with bilinguals with ASD. In Baldimsti *et al*. (2016), bilingual children with and without ASD (mean age= 9;8) produced narratives when presented with story A3 of the Edmonton Narrative Norms Instrument (ENNI, Schneider, Dubé & Hayward, 2005) and no between-group differences emerged. Three points must be made about this study: First, the ENNI is designed for 4-9 year-old children. It is possible that the children in this study were not engaged and hence, may have produced fewer ISTs. Hence, in our study, we used the ENNI with somewhat younger children. Second, only one of the six ENNI stories was used in this study. A short narrative may not be conducive for eliciting ISTs, hence in our study, we used all six ENNI narratives. Third, Baldimsti *et al*. (2016) did not provide information regarding length of exposure to the L2 for the ASD group, which complicates interpretation of the results. Moving to Hoang *et al*. (2018), narratives produced by French-English bilingual children with and without ASD were examined for use of "evaluative devices", a category which encompasses a number of narrative features such as the use of character speech, intensifiers, onomatopoeia and hedges. Narratives were elicited using a picture sequencing task. While no group differences were found for evaluative devices, which includes ISTs, the authors noted that their picture sequencing task was not designed for eliciting ISTs in particular. In sum, it is important for studies looking at the use of ISTs to (1) use assessment tools that can elicit the use of ISTs and (2) to not collapse ISTs within the larger category of evaluative devices.

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4.1.5. Production of ISTs by bilingual children with DLD

As with monolinguals with DLD, the production of ISTs has rarely been examined in bilinguals with DLD (Altman, Armon-Lotem, Fichman & Walters, 2016; Boerma, Leseman, Timmermeister, Wijnen & Blom, 2016; Tsimpli, Peristeri & Andreou, 2016), and to date, no cross-disorder comparison has been conducted. One study did not find differences between TD

bilinguals and bilinguals with DLD for the use of ISTs (Altman *et al*., 2016), but two other studies did find differences (Boerma *et al*., 2016; Tsimpli *et al*., 2016). These three studies differed as to whether they used story generation tasks or story retell tasks; however, they used the same testing instrument and classified ISTs in a similar way. In the MAIN (Gagarina *et al*., 2012), communication terms such as *say* are classified as ISTs, however with the exception of a few studies (e.g. Engberg-Pedersen & Christensen, 2017; Norbury & Bishop, 2003), this is largely not the case in the monolingual studies on ISTs in children with ASD. The use of verbs like *say*, could be vulnerable for children with DLD because they select complement clauses (Tsimpli *et al*., 2016), and thus could confound results. Furthermore, all three studies matched participants on age, rather than on the basis of language abilities. The question of how bilingual children with DLD would compare to bilingual children with ASD, especially children matched on language, remains to be answered. Hence, in our study we compared bilingual groups that were matched not just on age, but also on language, and we did not include *say* as part of the ISTs.

4.2 Research questions and predictions

The existing research on monolinguals, on balance, reveals that compared to their neurotypical peers, children with ASD produce fewer ISTs, which can be possibly attributed to their limitations with ToM abilities. Further research is however required with children with DLD and children with ASD to determine whether the two groups show similar profiles with respect to ISTs, as the existing research with monolinguals has found some conflicting findings. When it comes to bilinguals with ASD or DLD, the existing research is sparse and shows conflicting findings when compared to the monolingual literature. Furthermore, studies have differed greatly in both the way ISTs have been analysed and groups have been matched. Such methodological differences may partly explain the divergent pattern of results. The present study extends and

builds on this line of research with bilinguals by including both children with DLD and children with ASD who are matched for L2 vocabulary size, as well as age with their TD peers. The methods for analysing use of ISTs in narratives improve on prior research with both monolinguals and bilinguals (e.g., Hoang *et al*., 2018; Norbury *et al*., 2014).

For our study, narrative samples were gathered using a standardized narrative story generation instrument from three groups of age-matched and vocabulary-matched children (mean age= 6;8) with diverse L1 backgrounds who were learning English as their L2. Narratives were analysed for the use of ISTs. Our analyses were guided by the following two research questions.

1) Do bilingual children with ASD produce fewer ISTs than bilinguals with TD and bilinguals with DLD?

Based on the existing research with monolinguals with ASD (e.g., Rumpf *et al*., 2012; Siller *et al*., 2014) as well as from the recent meta-analysis on narrative production in ASD (Baixauli *et al*., 2016), we predicted that bilinguals with ASD would produce fewer ISTs than bilinguals with TD, as well as produce fewer causal explanations than bilinguals with TD (Capps *et al*., 2000). As noted in the literature review, few studies have examined the production of ISTs by children with DLD. However, differences between children with TD and children with DLD for the production of ISTs could be a result of linguistic reasons, rather than differences in perspective-taking abilities (Mäkinen *et al*., 2014; Norbury *et al*., 2014). Hence, we expected the children with DLD to pattern similarly to the children with TD, as our participants were matched on language.

2) Do bilingual children with ASD produce fewer emotional and cognitive terms than bilinguals with TD and bilinguals with DLD?

For our first research question, we examined ISTs belonging to different semantic categories. For our second research question, we focused on two categories of ISTs, namely emotional and cognitive terms. Compared to physiological and perceptual terms, emotional and cognitive terms are less directly observable from pictures, and as such, more reflective of perspective-taking abilities. We predicted that bilinguals with ASD would produce fewer emotional and cognitive terms than both the bilinguals with TD, and the bilinguals with DLD, as our participants were matched on language. Consistent with previous studies, we predicted significant group differences for emotional terms (Siller *et al*., 2014), as well as cognitive terms (Rumpf *et al*., 2012).

4.3 Method

4.3.1 Participants

Data from 9 English L2 learners with ASD, 10 L2 learners with TD and 10 L2 learners with DLD were analyzed for this study. Children's L1 backgrounds have been summarized in Table 4.1. The children with TD and with DLD were chosen from participants from previous studies (Paradis, Schneider & Sorenson Duncan, 2013; Paradis, 2011; Paradis, Rusk, Sorenson Duncan & Govindarajan, 2017) according to matching criteria with the ASD group (see below), but the sample in this study was not identical to that in any previous study. The children with ASD were chosen from a corpus of 32 English L2 learners with ASD (Paradis, Govindarajan & Hernandez, 2018). All children in this study came from first generation immigrant and refugee families where both parents were foreign-born and L2 speakers of English. The Research Ethics Board at the University of Alberta granted approval for this study.

Children with TD were recruited through schools as well as through agencies offering help to newcomers. The children with DLD were referred for this study by speech-language

pathologists who were working with them in a school setting. Children with DLD met standard exclusionary criteria, e.g., no hearing impairment, no frank neurological damage, no autism symptoms (for more information on this group, see Paradis *et al*., 2013). Children with ASD were recruited through schools and from agencies helping newcomers. All the children referred to us had a clinical diagnosis of ASD established through a multidisciplinary assessment protocol at a rehabilitation hospital which is the only facility licensed to provide an ASD diagnosis in the health district. All the children had qualified for intervention services based on their diagnosis. Our testing time with each child did not allow us to include diagnostic measures specific to DLD or ASD, nor did we have access to health records for these children. Therefore, we included a parent questionnaire, ALDeQ (Paradis, Emmerzael & Sorenson Duncan, 2010 – see below) to provide additional information about children's early and current L1 development.

Table 4.1

L1 backgrounds of participants in each group

Group	L1	Number of speakers
ASD	Mandarin	4
	Spanish	3
	Cantonese	1
	Arabic	1
DLD	Cantonese	3
	Vietnamese	1
	Spanish	4

	Urdu	1
	Arabic	1
TD	Arabic	4
	Farsi	1
	Cantonese	1
	Mandarin	1
	Spanish	1
	Urdu	1
	Punjabi	1

As outlined above, the participants with TD and the participants with DLD were selected from larger corpora. The 10 children with TD and the 10 children with DLD were selected from a larger sample on the basis of criteria that allowed the three groups to be matched. First, participants without complete narrative samples were excluded from the larger samples of children with TD, DLD and ASD. Second, sub-samples of children with a similar mix of L1 typological backgrounds were selected, for example, South Asian languages, Chinese languages, Spanish etc (see Table 4.1). Third, children were eliminated from the samples until all the group-wise matching criteria were met. A parental questionnaire, the Alberta Language Environment Questionnaire (ALEQ; Paradis, 2011), a non-verbal IQ screen, the Columbia Mental Maturity Scales (CMMS; Burgemeister, Blum & Lorge, 1972) and a receptive vocabulary measure, the Peabody Picture Vocabulary Test (PPVT-III; Dunn & Dunn, 1997) provided the information required for group-wise matching (see next section for descriptions of these measures) . Using the non-parametric Kruskal-Wallis test, we determined that there were no significant group differences for age at testing ($\chi^2(2)=2.89$, $p= 0.24$). for non-verbal cognitive abilities ($\chi^2(2)=3.4$, $p= 0.18$), or for

differences for receptive vocabulary ($X^2(2)=1.32$, $p= 0.52$) Participants in all three groups also did not differ in the amount of time they spent with native speaker friends or using print or audio visual media in English in an average week ($X^2(2)= 3.68$, $p= 0.16$). Concurrent relative use of the L2 and L1 at home among family members was not included in the matching because prior research with these samples indicated that it was not predictive of L2 abilities (Paradis, 2011; Paradis *et al*., 2017; Paradis *et al*., 2013). In sum, participants in this study were matched group-wise on age, non-verbal intelligence, receptive vocabulary, and concurrent richness of their L2 environments outside school.

On average, the children with TD and the children with DLD had little or no exposure to English before they were about four years of age, which coincided with their entry into an English-speaking preschool programme. However, on average, the participants with ASD had exposure to English before they were three years old, when they started receiving intervention in English. Significant group differences were therefore present for cumulative exposure to English ($X^2(2)=7.71$, $p= 0.02$), as the participants with ASD had more exposure to English than both the participants with TD and the participants with DLD. (A trend towards significance was observed for age of L2 acquisition: $(X^2(2)= 6.17$, $p=0.05)$. Even though the groups were matched for L2 vocabulary and concurrent richness of the L2 environment, differences in length of English L2 exposure could, potentially, play a role in between-group differences on our dependent measures because length of exposure predicts stronger L2 skills across many linguistic domains (e.g., Chondrogianni & Marinis, 2011; Paradis, 2011; Paradis *et al*., 2017). To control for this, length of L2 exposure was entered as a co-variate in the regression models to specify any variance due to this factor separately from variance due to group (ASD, DLD, TD).

Significant differences between the groups were also reported on a parental report of first language development, the Alberta Language Development Environment Questionnaire (ALDeQ; Paradis, Emmerzael & Sorenson Duncan, 2010 – see next section). The ALDeQ contains questions about early developmental and linguistic milestones, current abilities in the L1, behaviour patterns and interests, as well as family history of language delays/disorders. Scores closer to 1.0 are more characteristic of children with TD. Not surprisingly, significant group differences were reported for the ALDeQ total scores ($X^2(2)= 20.29$, $p<.001$), with the group with ASD and the group with DLD obtaining lower scores than the group with TD. We were unable to administer a screening test such as the Autism Diagnostic Observation Schedule (ADOS) because of time limitations, so the ALDeQ was used instead to examine L1 development. Participant characteristics have been summarized in Table 4.2.

Table 4.2

Participant characteristics

Characteristic	Group	M	SD	Range
Age	ASD	85.22	16.08	64-114
	TD	79.1	6.81	64-86
	DLD	77.3	15.7	64-109
Exposure[a]	ASD	55	15.83	33-71
	TD	30.3	10.11	19-48
	DLD	38	17.93	17-73

AOA	ASD	30.22	11.29	14-45
	TD	48.8	13.08	30-66
	DLD	39.3	21.81	7-86
CMMS	ASD	100.75	24.68	58-137
	TD	107.5	10.5	96-124
	DLD	97.7	11.41	83-120
ALDeQ[a]	ASD	0.60	0.12	0.43-0.81
	TD	0.82	0.07	0.7-0.96
	DLD	0.44	0.13	0.21-0.65
Richness	ASD	0.76	0.13	0.5-0.94
	TD	0.65	0.14	0.38-0.83
	DLD	0.64	0.14	0.38-0.81
PPVT	ASD	84	12.12	72-104
	TD	90.2	20.65	56-126
	DLD	88.2	18.56	40-105

Notes: Age, Age at testing in months; Exposure, Overall exposure to English in months; AOA= Age of acquisition in months; CMMS, Columbia Mental Maturity Scales; ALDeQ, Alberta Language Development Questionnaire, Richness= English language richness; PPVT= Peabody Picture Vocabulary test. [a]Groups differed significantly on this measure.

4.3.2 Materials and Procedure

Children were tested at home or in schools where they completed the narrative task, a non-verbal IQ test and a test of receptive vocabulary. At home, parents were given questionnaires about their child's language learning history in L1 and L2 and their current language environment. A cultural broker or interpreter was present if the families desired so.

The Edmonton Narrative Norms Instrument (ENNI; Schneider, Dubé & Hayward, 2005) was the instrument used to elicit narratives. The ENNI is a normed and standardized instrument that consists of two sets of three stories of increasing complexity. There are a total of 6 stories. Children are shown picture books of increasing story complexity and asked to tell the stories while the experimenter cannot see the pictures. The stories produced by the children are then recorded, transcribed using the CHAT system (MacWhinney, 2000) and analyzed. The ENNI can also be scored for a range of story grammar and linguistic measures. In this study, a unique coding scheme was developed to analyze the presence of internal state language in the narratives produced by bilingual children with ASD, DLD and TD.

Coding for internal state language. Narratives were coded for the presence of ISTs. ISTs were defined and coded into the categories of *perception*, *physiology*, *consciousness*, *emotion,* and *cognitive/mental* based on previous taxonomies (Bretherton & Beeghly, 1982; Gagarina *et al*., 2012). Classifying ISTs into different categories enabled us to distinguish between ISTs that were more reflective of perspective-taking abilities, namely emotion and cognitive/mental terms, from those that were not, and helped us address the second research question. Example terms for each category, as well as a description of the different categories have been provided in Table 4.3. Only terms referring to characters' internal states were coded. Behavioural manifestations of emotions

such as *smile* or *cry* were also excluded from the analysis, as they could be directly observable from the pictures. Internal state terms could be individual words such as *happy* as well as phrases such as *has a stomachache*. As judgment is involved in scoring for ISTs, 31% of the corpus was re-scored by a separate research assistant. Comparisons of scoring for ISTs yielded reliability of 97%.

Each story-related utterance produced by the child was examined. The number of internal state terms in each utterance was counted and these terms were then classified into one of the five possible categories. A proportion score was calculated for the use of internal terms by dividing the number of internal terms produced across all six stories by the number of utterances produced. Utterances were also examined to see whether a causal explanation was provided for each internal state term. A proportion score for causal explanations was calculated by dividing the number of causal explanations provided, by the total number of internal state terms. Causal explanations had to be explicitly marked by words such as *because* or *so* such as in (1). Hence, utterances such as (2) in which an internal state term is merely labelled or (3) in which the causal explanation is not explicit were not considered adequate causal explanations. Unusual causal explanations or unusual uses of internal state terms were also noted as prior research has found children with ASD to produce more "bizarre" utterances in their narratives (Capps *et al*., 2000; Diehl *et al*., 2006).

(1) And then the elephant was **happy because** the giraffe gives him the ball back.
(child, 118, DLD, Spanish, 6;3, 22 months of exposure to English)

(2) the giraffe was mad at the elephant
(child, 08, ASD, Spanish, 6;3, 33 months of exposure to English)

(3) and then they got it back.
And the giraffe was really happy.
(child, 118, DLD, Spanish, 6;3, 22 months of exposure to English)

Table 4.3

Categories for the classification of internal state terms

Category	Description	Examples
Perceptual	Terms for perceptions	hear, see, look
Physiological	Terms for physical sensations	hungry, tired, sore
Consciousness	Terms for states of consciousness	Alive, dead
Emotional	Terms labelling emotions	Happy, sad, mad
Cognitive	Terms for mental states and intentions	Think, know, want

The Alberta Language Environment Questionnaire (ALEQ; Paradis, 2011; https://www.ualberta.ca/linguistics/cheslcentre/questionnaires). The ALEQ is a parent questionnaire with questions on language input factors, age, and family demographics. This questionnaire was administered to parents with the assistance of interpreters or cultural brokers. The ALEQ contains questions about the following topics: age of arrival in Canada, parents' self-rated proficiency in English, parent education, current language use by family members in the house (parents, other adults, siblings and the target child), age at which the child started learning English in school, exposure to English measured in months (age of acquisition subtracted from the age at testing) as well as the richness of the English language environment.

The Alberta Language Development Questionnaire (ALDeQ; Paradis *et al*., 2010; https://www.ualberta.ca/linguistics/cheslcentre/questionnaires).The ALDeQ is a parent questionnaire with sections that focus on (a) early milestones, (b) current abilities in the first language, (c) activity and behaviour patterns shown by the child and (d) family history of language

and or learning disabilities. The ALDeQ yields a total proportion score with a range from 0-1 and lower scores on the ALDeQ are more typical of children with DLD. For the children with ASD, we also noted children's age at diagnosis, intervention received, as well as whether children exhibited ASD specific developmental characters such as regression or loss of early language, or behaviours such as echolalia.

The Columbia Mental Maturity Scales (CMMS; Burgemeister al., 1972). The CMMS is a test of non-verbal intelligence in which children are shown patterns of increasing complexity and asked to identify the pattern that does not logically belong in each sequence. Children who have a standard score greater than 80 score within the normal range on this test.

The Peabody Picture Vocabulary Test (PPVT-III; Dunn & Dunn, 1997). The PPVT is a test of receptive vocabulary in which children are shown pictures and asked to identify the picture that corresponds to the word spoken by the experimenter. The PPVT has a standard score of 100, with the normal range being from 85-115.

4.4 Results

4.4.1 Descriptive Statistics

Overall, some general tendencies could be observed in the production of ISTs (see Table 4.3 for counts). Hardly any consciousness terms were produced, and all groups produced more perceptual terms than physiological terms. For all three groups of participants, cognitive terms represented the largest category. Participants in all three groups produced very few causal explanations.

Table 4.4

Average number of internal state terms produced, and causal explanations provided

Category	Group	Mean	SD	Range
Perceptual	ASD	2.44	2.69	0-7
	TD	4.1	2.85	0-8
	DLD	3.3	3.13	0-10
Physiological	ASD	1.67	1.22	0-4
	TD	3.7	1.57	2-7
	DLD	3.1	2.02	0-6
Consciousness	ASD	0	0	0
	TD	0	0	0
	DLD	0.1	0.32	0-1
Emotional	ASD	2.67	2.12	0-6
	TD	5.70	4.67	2-15
	DLD	6.60	4.69	2-16
Cognitive/Mental	ASD	6.22	3.73	1-12
	TD	7	3.71	2-15
	DLD	5.60	4.27	0-15
Number of ISTs	ASD	13	6.67	3-22
	TD	20.5	8.39	9-38
	DLD	18.7	11.55	5-40

Utterances	ASD	76.67	31.30	54-147
	TD	74.1	17.34	54-108
	DLD	75.4	18.05	55-107
IST Proportion	ASD	0.20	0.13	0.03-0.39
	TD	0.27	0.06	0.13-0.35
	DLD	0.24	0.11	0.08-0.38
Causal	ASD	1.2	1.87	0-6
	TD	1.5	1.96	0-5
	DLD	1.2	1.87	0-6

Notes. Perceptual= perceptual terms, Physiological=physiological terms, Consciousness= consciousness terms, Emotional= emotional terms, Cognitive= cognitive terms, Number of ISTs= Number of internal state terms, Utterances= number of utterances across all six ENNI stories, IST proportion= Number of internal state terms/Number of utterances, Causal= Number of Causal Explanations.

4.4.2 Overall production of ISTs

To address our first research question, we examined whether there were between-group differences in children's overall production of ISTs. We examined ISTs from five different categories: perception, physiology, consciousness, emotions, and cognition. As there were no significant group differences for the number of utterances produced ($X^2(2)$=0.5, p=0.78) by the participants in the three groups, the analysis could be conducted on the number of internal state terms produced, rather than on the proportion scores.

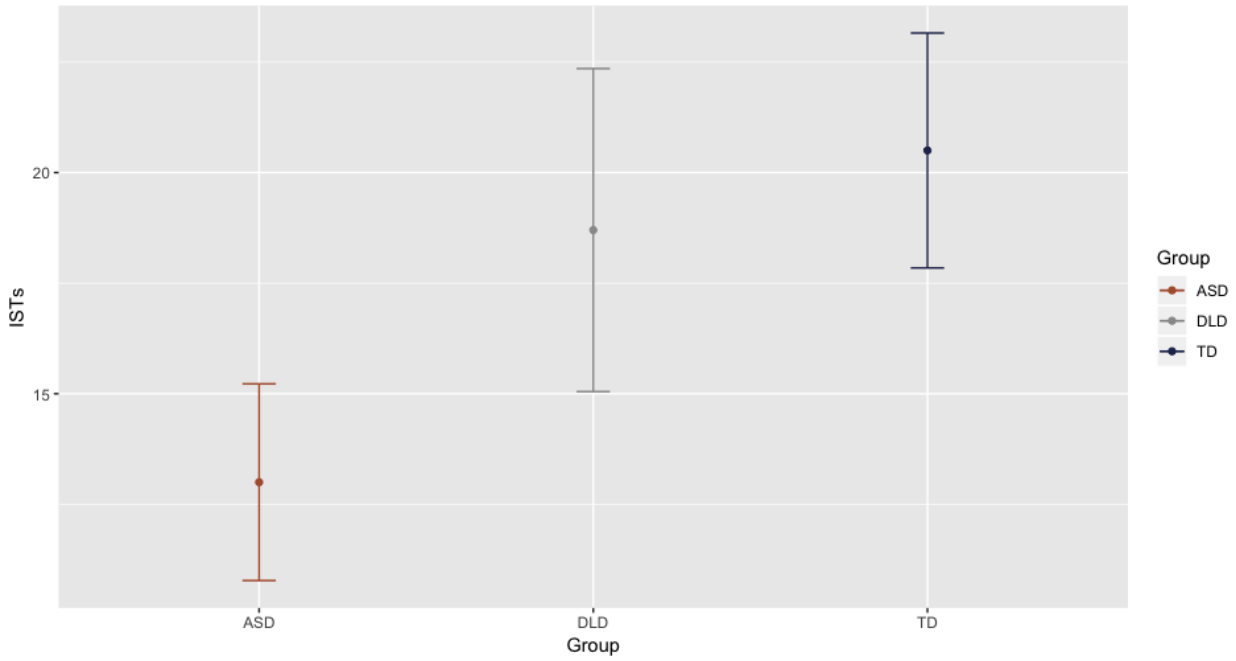
In order to determine the impact of group and exposure to L2 English on the production of internal state terms in narratives, we fitted a series of Poisson regression models using the glmer

function in R (R Core Team, 2013), with group (ASD, TD or DLD) as the independent variable or fixed effect, and the overall number of ISTs as the dependent variable. Length of exposure to L2 English was also entered as a fixed effect in the models to specify the variance in scores due to differences in experience with L2 input. Participant was entered as a random effect in the model.

Group and exposure were significant predictors, with both the TD group and the DLD group producing more ISTs than the group with ASD. All groups of participants produced more internal state terms with more exposure to English. The TD group and the DLD group did not differ significantly from each other. No significant interaction was found between group and exposure to English, indicating that differences in length of L2 exposure did not differentially impacted IST production across groups. These results have been summarized in Table 4.5 and in Figure 4.1. For causal explanations, no predictor emerged as significant as children in all three groups patterned very similarly.

Figure 4.1

Overall production of ISTs



Note. This figure shows the overall production of ISTs. Significant group differences were found not only between the bilinguals with ASD and the bilinguals with TD, but also between the bilinguals with ASD and the bilinguals with DLD.

Table 4.5

Group and exposure predict the number of ISTs produced

Predictor	Estimate	SE	z value	p
Intercept	-0.01	0.39	-0.02	0.99
Group DLD	0.59	0.24	2.41	0.02*
Group TD	0.87	0.27	3.25	0.001**
Exposure	0.02	0.006	2.57	0.01*

Note: Exposure= length of exposure to English measured in months; *= significance code when $p<0.05$; **= significance code when $p<0.01$.

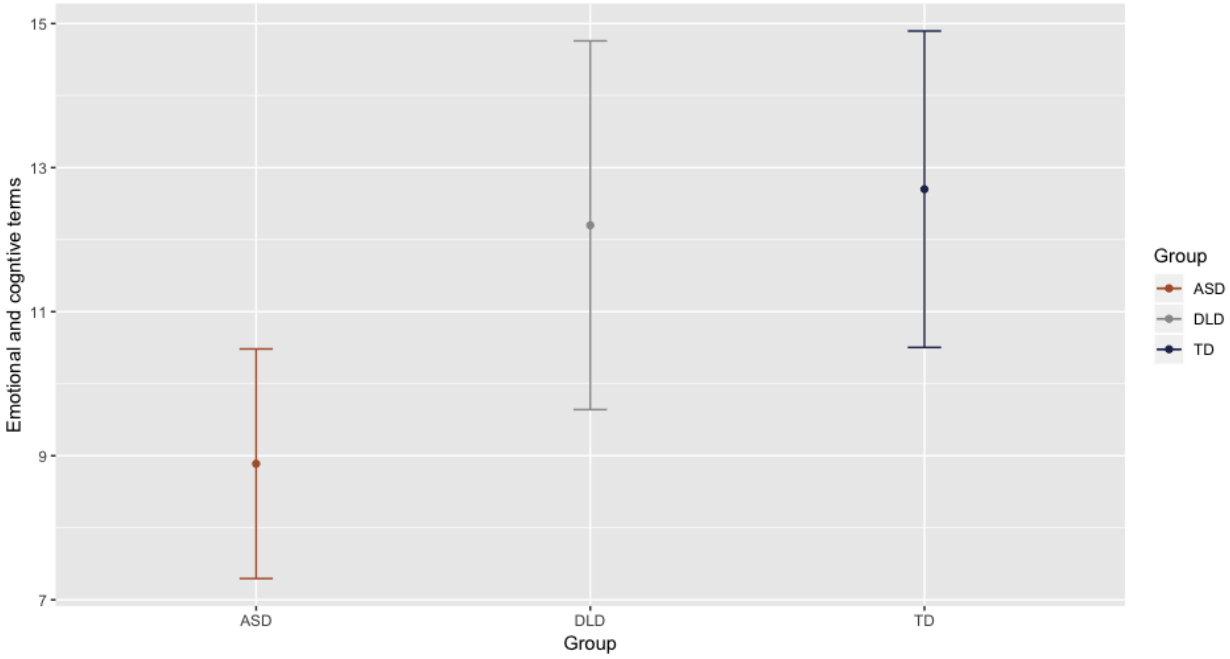
4.4.3. Production of emotional and cognitive terms

For our second research question, we analyzed the production of emotional and cognitive terms only. As there were no significant differences for the number of utterances produced across groups, the analyses were conducted on counts, rather than on the proportion scores. First, emotional and mental terms were examined together. Next, emotional and cognitive terms were examined separately. A series of Poisson regressions were fitted with group and L2 exposure as the predictor variables, participant as the random effect and emotional and mental terms as the outcome variables.

When emotional and mental terms were combined, both group and exposure emerged as significant predictors. The participants with TD, as well as the participants with DLD, produced more emotional and mental terms than the participants with ASD. The participants with DLD did not differ significantly from the participants with TD. All groups of participants produced more emotional and cognitive terms with increased exposure to English. No significant interaction was found between group and exposure. These results have been summarized in Figure 4.2 and Table 4.6.

Figure 4.2

Production of emotional and mental/cognitive terms



Note. This figure shows the production of emotional and mental/cognitive terms. Significant group differences were found not only between the bilinguals with ASD and the bilinguals with TD, but also between the bilinguals with ASD and the bilinguals with DLD.

Table 4.6

Group and exposure predict the number of emotional and mental terms produced

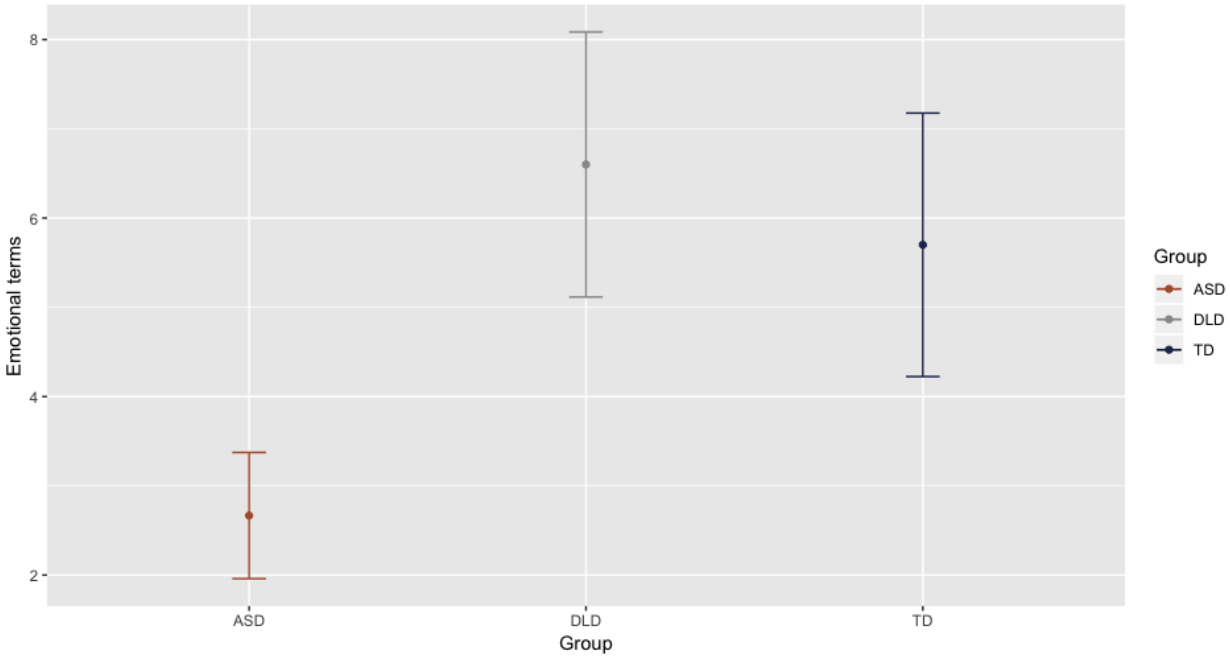
Predictor	Estimate	SE	z value	p
Intercept	0.55	0.41	1.34	0.18
Group DLD	0.53	0.26	2.02	0.04*
Group TD	0.73	0.29	2.52	0.01*
Exposure	0.02	0.007	2.36	0.02*

Note: Exposure= length of exposure to English measured in months; *= significance code when $p<0.05$

In the next analysis, emotion and cognitive terms were examined separately. A series of Poisson regressions were fitted with group and exposure as the predictor variables, participant as the random effect and emotion or mental terms as the outcome variables. Models were constructed stepwise and non-significant predictors were eliminated. Exposure to L2 English did not predict the production of emotional terms. No significant interaction was found between group and exposure. Group however, emerged as a significant predictor with the participants with DLD producing more emotional terms than the participants with ASD. A trend towards significance was also found for the participants with TD. The participants with TD did not differ significantly from the participants with DLD. These results have been illustrated in Figure 4.3 and summarized in Table 4.7. No significant predictors were found for the production of cognitive terms.

Figure 4.3

Production of emotional terms



Note. This figure shows the production of terms reflecting characters' emotional states. The production of emotional terms emerged as an area of weakness in ASD, but as an area of strength in DLD as significant differences were found between ASD and DLD. A trend towards significance was observed for TD.

Table 4.7

Bilinguals with DLD produced more emotional terms than bilinguals with ASD; a trend towards significance was observed for bilinguals with TD

Predictor	Estimate	SE	z value	p
Intercept	0.88	0.28	3.10	0.002**
Group DLD	0.85	0.36	2.38	0.02*
Group TD	0.68	0.36	1.89	0.06*

Note: Exposure= length of exposure to English measured in months; *= significance code when $p<0.05$; **= significance code when $p<0.01$.

4.5. Discussion

The existing research on bilingual development in children with ASD is characterized by many limitations such as, a focus on preschool age children, few comparisons to bilinguals with TD and no comparisons to bilinguals with DLD. Our research was formulated to address some of these limitations, as well as to examine some characteristics of narratives that may not be analyzed by focusing on narrative macrostructure or microstructure as broad categories. Our objective was to determine the extent to which perspective-taking abilities are affected in bilinguals with ASD, as reflected in children's use of ISTs in their L2. We addressed this objective by comparing the use of ISTs on a narrative task by bilinguals with TD, with DLD and with ASD who were group-wise matched for age, non-verbal IQ, and receptive vocabulary.

4.5.1 Overall production of ISTs

For the first research question, we examined the overall production of ISTs belonging to different semantic categories. We predicted that the bilinguals with ASD would produce fewer ISTs than the bilinguals with TD (e.g., Rumpf *et al*., 2012), as well as the bilinguals with DLD as participants were matched on receptive language skills, and that using ISTs within a causal framework would prove particularly challenging for the children with ASD (e.g., Bang & Nadig, 2015). Our findings partially supported these predictions as the children with ASD produced fewer ISTs than the children in the other two groups but did not differ when it came to producing causal explanations.

Overall, our results add to the growing body of research that indicates the production of ISTs to be particularly challenging for children with ASD, for both monolingual and bilingual speakers (e.g., Baixauli *et al*., 2016; Rumpf *et al*., 2012; Siller *et al*., 2014). As such, this study revealed that aspects of narratives that rely on perspective-taking abilities are compromised in ASD. However, these results diverge from those reported in some other studies on narrative abilities in ASD, such as Mäkinen and colleagues (2014) or Norbury and Bishop (2003). The limitations of some of the existing research, as well as some distinct characteristics of our study may indicate some possible directions to adopt in future studies. First, studies may analyze fewer or more categories of ISTs or collapse ISTs within the broader category of evaluative devices. For example, Mäkinen *et al*. (2014) restricted their analysis to only emotional and cognitive terms. While emotional and cognitive terms are more indicative of perspective-taking abilities than, say, perceptual terms, examining ISTs from different categories may provide, at least initially, a more comprehensive picture of children's use of ISTs. Next, for the most part, studies have relied on a single narrative task. As noted earlier, some picture-books may elicit fewer ISTs than others. By using the ENNI, we provided the children with six picture books, and therefore, more opportunities

for producing a greater range of ISTs. Rethinking how ISTs are classified, as well as how narratives are elicited, may give us a better idea of how children with ASD produce ISTs.

Coming to the bilinguals with DLD, our results were consistent with our prediction that the bilingual children with DLD would produce more ISTs than the bilinguals with ASD. The narrative research on children with DLD has largely focused on macrostructure and microstructure components; studies examining their use of ISTs have reported contradictory patterns of results when comparing children with DLD to children with ASD (e.g., Colozzo *et al*., 2015, Norbury & Bishop, 2003; Engberg-Pedersen & Christensen, 2017). However, these studies have used different matching strategies. Crucially, in the studies reporting null results, participants were not matched on language (Norbury *et al*., 2014; Mäkinen, 2014). A reduced use of ISTs in children with DLD is generally attributed to reduced lexical skills, rather than difficulties with perspective-taking (Mäkinen, 2014; Norbury *et al*., 2014).

Regarding causal explanations, our study results indicate that, contrary to our prediction, we did not find any differences for causal explanations. Regardless of group, children produced very few causal explanations. A possible reason for these null results might lie in the relatively young age of our participants as children become more sophisticated storytellers as they become older (e.g., Bamberg & Damrad-Frye, 1991). Our participants (mean age = 6;8) were younger than the children in some studies that have found children with ASD to produce fewer causal explanations (e.g., Losh & Capps, 2003).

Finally, in line with previous studies (Capps *et al*., 2000; Diehl *et al*., 2006), unusual uses of ISTs or causal explanations were identified only in the bilingual ASD group. While such examples were few, only the children in the ASD group indicated emotional states for inanimate

objects, such as in (1), or provided causal explanations that were contrary to expectations, such as in (2). Such unusual uses could be a signature characteristic of children with ASD, but further research would be needed to better understand this phenomenon.

(1) his moustache look happy

(Child, ASD, L1 Spanish, 8;06 months of exposure to English, 71 months of exposure to English)

(2) the elephant failure was happy that her knee was broken

(Child, ASD, L1 Mandarin, 8;01, 70 months of exposure to English)

4.5.2 Production of emotional and cognitive terms

For our second research question, we focused on two categories of ISTs that rely on greater perspective-taking abilities, and hence, may prove to be particularly challenging for children with ASD- emotional and cognitive terms. We predicted significant group differences, between the bilinguals with ASD, and the bilinguals in the other two groups. Our predictions were supported by the results. The bilinguals with ASD produced fewer emotional and cognitive terms combined than the bilinguals in the other two groups. Emotional terms, in particular, were compromised in the ASD group, as reported previously in some studies (e.g., Siller *et al*., 2014). Taken together, our findings indicate the production of ISTs, including ISTs particularly reflective of perspective-taking abilities, to be vulnerable in children with ASD, whether monolingual or bilingual.

4.5.3 Use of ISTs: well-entrenched difficulties in ASD

While cumulative exposure to L2 English was entered as a predictor in our models, we did not find any interaction between group and exposure. It is important to keep in mind that the bilingual ASD group had significantly greater exposure to L2 English than the other two groups,

as they began to learn English about one year younger than the other groups due to the onset of intervention post diagnosis. Hence, in our models, exposure to L2 English was entered as a co-variate to correct for this difference between the groups. However, it was the bilingual ASD group that produced fewer ISTs than the other two groups in spite of having longer exposure to the L2.

Both children with ASD and children with DLD may be expected to make less efficient use of the input they receive in the L2 because of difficulties with social interaction in the case of ASD, and deficits in cognitive systems, e.g., verbal memory, involved in language learning in the case of DLD (Paradis & Govindarajan, 2018). Prior research on bilingual children with DLD has indicated that they seem to make less efficient use of the input they receive compared to bilinguals with TD for morpho-syntax and narrative macrostructure/microstructure (Blom & Paradis, 2015; Govindarajan & Paradis, 2019). This was not what we found in the present study, however, as the bilinguals with DLD did not differ from the bilinguals with TD, and in fact, performed better than the bilinguals with ASD when it came to the production of ISTs. While both clinical groups may perform similarly on traditional macrostructure and microstructure components (e.g., Norbury *et al*., 2014), aspects of narratives that rely on perspective-taking abilities, such as the use of ISTs, could be areas of relative strength in DLD compared with ASD. Thus, for bilingual children with ASD, the same narrative aspects represent an area of persistent weakness.

4.6. Conclusions and limitations

We would like to acknowledge that the small sample size in this study decreases the ability to generalize from the results, and that future research is needed to better understand how characteristic they are of the language abilities of bilingual children with ASD. Nevertheless, this study adds to the growing body of research on narratives and autism and is among very few that

have examined the production of ISTs in bilingual populations. By examining bilingual populations, this study provides additional evidence that the production of ISTs is vulnerable in ASD, in particular because the children were matched for receptive vocabulary and age with bilinguals with DLD and with TD. We found that the production of ISTs represents an area of entrenched difficulty that is resistant to increased L2 input, and may be a distinguishing linguistic feature not just between children with TD and children with ASD, but also between children with ASD, and children with DLD. From a clinical perspective, these finding could help identify targets for intervention for clinicians and educators working with these two clinical populations. From a theoretical perspective, these findings reveal profiles of both strengths and weaknesses in these two clinical groups, which may not be evident when only narrative macrostructure or microstructure components are examined. Furthermore, language profiles of children with ASD and DLD appear to be similar whether they are examined in their L1 or their L2.

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5. Conclusion

My thesis focuses on the narrative abilities of bilingual children with ASD, DLD and TD. When I am asked to explain what my thesis is about, my explanation generally starts with some version of the previous sentence. What this sentence does not however convey is the reason why I decided to focus on narratives in these bilingual populations. I started conceptualizing this thesis partly because of the many limitations (see section 1.3) of the existing research on bilingualism, especially on bilingualism and ASD. Some of the limitations of the existing research are summarized below.

When it comes to bilinguals with ASD, the research has largely focused on their capacity for bilingualism and as a result, has limited itself to comparisons to monolinguals with ASD. These comparisons have mainly examined the development of lexical skills and developmental milestones (e.g., Hambly & Fombonne, 2012; 2014; Ohashi *et al*., 2012; Petersen, Marinova-Todd & Mirenda, 2012; Reetzke *et al*., 2015; Valicenti-Mc Dermott *et al*., 2013). Very few studies have included comparisons to bilinguals with TD who are also in the process of acquiring their L2, and hence, likely to experience similar linguistic input and environments (e.g., Baldimsti *et al*., 2016), and even fewer (to date only 3 studies) have examined narrative samples produced by both bilinguals with ASD and bilinguals with TD (Baldimsti *et al*.,2016; Hoang, Gonzalez-Barrero & Nadig; 2018; Yang, 2011). Furthermore, there have been no comparisons to bilinguals with DLD. Such comparisons are important as the boundaries between ASD and DLD have been questioned, with the suggestion that a sub-group of children with ASD may overlap with DLD (e.g., Wittke *et al*., 2017; Meir & Novogrodsky, 2019; Tomblin, 2011).

My thesis addressed the limitations outlined above. It went beyond the question of whether bilinguals with autism have the capacity to acquire two languages by looking at larger, connected discourse – oral narratives – produced by older school-age bilinguals with ASD. The narratives produced by the bilinguals with ASD were compared not only to those produced by bilinguals with TD, but also to those produced by bilinguals with DLD. By including a group of bilinguals with DLD (along with the bilingual TD group), I could examine both similarities and differences between the two clinical groups.

It is also important to note that this thesis went beyond simply addressing the gaps in the literature by examining larger theoretical questions about the nature of linguistic difficulties in ASD (e.g., is autism characterized by difficulties with structural language?), but also in DLD (e.g., do bilinguals with DLD make use of L2 input to the same extent as bilinguals with TD?). Looking at narratives was an effective, yet simple, way of addressing these larger questions as producing a story requires both linguistic and pragmatic skills, and narratives can be analyzed at both a conceptual or macrostructural level, as well as at a linguistic or microstructural level. Hence, I was able to address the larger theoretical questions discussed in Chapter 1(also discussed in this chapter in Section 5.2), such as the question of whether autism is also characterized by difficulties with structural language, as well as the question of whether narrative macrostructure represents an area of strength of weakness in DLD. In this chapter, the narrative profiles of the three groups are first presented (section 5.1), before the larger theoretical questions and the implications/take home messages of this thesis are presented (section 5.2), and the limitations of this research are acknowledged along with possible directions for future research (section 5.3).

5.1. Linguistic profiles of bilingual children with ASD, DLD and TD: characteristics of the narratives produced by the children in each group

The three studies that constitute this thesis examined the narrative abilities of bilingual children with ASD, DLD and TD in the following ways. In the first study (discussed in Chapter 2), the narrative abilities of bilinguals with DLD were compared to those of bilinguals with TD with whom they were matched on both age and exposure to English. Both macrostructure (i.e., story grammar scores) and microstructure components (e.g., referring expressions in first mentions, lexical diversity) were examined, as well as the role of input factors on narrative production.

Each study in this thesis built on the previous one. In the second study (discussed in Chapter 3), the narrative abilities of bilinguals with ASD, DLD and TD were examined. The participants in this three-way comparison were matched on age, non-verbal cognitive abilities, receptive vocabulary, and had similarly rich English language environments. Crucially, they were not matched on exposure as the children with ASD had significantly greater exposure to English than the children in the other two groups. Both macrostructure (global story grammar scores as well as individual story grammar components) and microstructure components (e.g., complex syntax, MLU) were examined.

Part of the focus of the second study was the production of story grammar components requiring perspective-taking skills such as unambiguous character introductions and character reactions. As discussed below in Section 5.2.3, differences were found for these components between not only the bilinguals with ASD and the bilinguals with TD, but also between the bilinguals with ASD and the bilinguals with DLD. These findings led to the third study (discussed in Chapter 4) in which a component specifically requiring perspective-taking skills was examined: Internal State Terms (ISTs) or terms reflecting story characters' internal states. The main findings that emerged across the three studies are discussed below.

5.1.1. Macrostructure abilities in bilinguals with ASD, DLD and TD

In this section, the macrostructure abilities of bilinguals with ASD are first discussed and compared to those of bilinguals with TD, before the macrostructure abilities of bilinguals with DLD are discussed and compared to those of both bilinguals with ASD and bilinguals with TD. Starting with bilinguals with ASD, bilinguals with ASD may be expected to show weaker macrostructure abilities according to one of the theoretical explanations of ASD. According to the *Weak Central Coherence* (WCC) account of autism, children with ASD have a bias towards processing information at a local level, and tend to focus on details, rather than the big picture (Happé & Frith, 2006). An effective story is a coherent one in which information is situated within a whole, and as such, children with ASD would be expected to struggle with telling a structured and connected story. Though initially seemingly characterized by contradictory results for narrative macrostructure (e.g., Norbury & Bishop, 2003 vs. Norbury *et al*., 2014), the recent meta-analysis by Baixauli and colleagues (on the monolingual literature) nevertheless confirms narrative macrostructure as an area of weakness in ASD (Baixauli *et al*., 2016). Differences have been noted for both composite macrostructure scores, such as story grammar scores, as well as for individual macrostructure components, such as conclusions (Diehl *et al*., 2006). The results from Chapter 3 largely mirrored those from the monolingual literature, with the bilingual ASD group obtaining significantly lower story grammar scores than the bilingual TD group on four of the six stories used. Telling a coherent story is a challenge for children with ASD – being bilingual does not change this fact. Children with ASD – both monolinguals and bilinguals – produce stories with fewer story grammar components. In addition to looking at composite story grammar scores, individual story grammar components were also examined in Chapter 3. The bilinguals with ASD produced fewer initiating events, attempts and outcomes – core narrative components – than the

bilinguals with TD. As such, providing the 'big picture' details of stories is challenging for children with ASD.

Coming to the bilinguals with DLD, their macrostructure abilities were examined in Chapters 2 and 3. In Chapter 2, the comparison was between bilinguals with DLD and bilinguals with TD, i.e., there was no 3-way comparison. Bilinguals with DLD are expected to differ from bilinguals with TD on microstructure components that draw upon linguistic knowledge such as the use of complex syntax or MLU, as DLD is primarily characterized by difficulties with morpho-syntax. However, for macrostructure, the results – both in the monolingual and the bilingual literature – are unclear, as some studies have found both children with DLD and children with TD to perform similarly (e.g., Altman *et al*., 2016; Iluz-Cohen and Walters, 2012), whereas others have found children with DLD to have weaker macrostructure skills than children with TD (e.g. Boerma *et al*., 2016; Rezzonico *et al*., 2015). The findings for narrative macrostructure in Chapters 2 and 3 are presented with reference to the above statement. In Chapter 2, the bilinguals with DLD had significantly lower story grammar scores compared to the bilinguals with TD consistent with some previous research (e.g. Boerma *et al*., 2016; Rezzonico *et al*., 2015). However, in Chapter 3, the bilinguals with DLD did not have significantly lower story grammar scores than the bilinguals with TD, although a trend towards significance was found for two out of the six stories examined. Again, this null result is also consistent with some previous research (e.g., Altman *et al*., 2016; Iluz-Cohen and Walters, 2012). What could explain this seemingly contradictory pattern of results within, well, the same thesis? The reason could well lie in the bilingual proficiency of the participants. In Chapter 3, a smaller sub-sample of the DLD group was included, and this subsample differed from the one in Chapter 2 as the participants in chapter 3 had more exposure to L2 English than the participants in Chapter 2. Taken together, the results from these two studies

indicate that the answer to whether children with DLD struggle with narrative macrostructure is a nuanced one, which is further discussed in Section 5.2.1. In Chapter 3, as stated earlier, the bilinguals with DLD did not differ significantly from the bilinguals with TD on macrostructure abilities; they did not also differ from the bilinguals with ASD who did differ significantly from the bilinguals with TD. More research with larger samples is required to determine whether, for story grammar abilities, children with DLD possibly occupy an intermediate position between ASD and TD.

5.1.2. Microstructure abilities in bilinguals with ASD, DLD and TD

Coming to narrative microstructure, the prior research with monolinguals with ASD confirms that both measures of productivity, such as story length, and measures of complexity, such as MLCU are areas of weaknesses in ASD when compared to TD, albeit with moderate effect sizes (Baixauli *et al*., 2016). However, null findings have also been reported (e.g., Kauschke *et al*., 2016; Rumpf *et al*., 2014). Looking at microstructure components, particularly measures of complexity, can help determine whether structural language represents an area of weakness in autism. Comparing bilinguals with ASD to bilinguals with TD is particularly helpful as all bilinguals are in the process of acquiring their second language. Any differences found on structural language measures between bilinguals with ASD and bilinguals with TD would suggest the presence of structural language deficits in ASD.

The results for the bilingual ASD group in Chapter 3 were partially consistent with the monolingual literature: while significant differences were found between the bilinguals with ASD and the bilinguals with TD for the measures of complexity (MLCU and syntactic complexity), no differences were found for the measures of productivity (story length or lexical diversity).

However, this does not rule out differences between children with ASD and children with TD when a more open-ended method – such as eliciting personal narratives – is used, rather than story generation using picture-books which represents a naturalistic, but still structured task (Losh & Capps, 2003). Children with ASD struggle on less structured tasks, and hence, may produce fewer utterances, or use a less diverse vocabulary in spontaneous conversation compared to children with TD. Recall that Chapter 3 had a 3-way comparison of bilinguals with ASD, DLD and TD. The advantage of having a 3-way comparison was that by comparing the microstructure abilities of bilinguals with ASD to bilinguals with DLD, the question of whether ASD is characterized by difficulties with structural language could be further elucidated. In Chapter 3, the bilinguals with ASD and the bilinguals with DLD performed similarly, and produced shorter utterances (trend for DLD) and used less complex syntax (both groups differed significantly from the bilinguals with TD) than the bilinguals with TD.

Finally, coming to the bilinguals with DLD, the findings in Chapter 3 must be compared to the findings in Chapter 2 in which the narratives produced by bilinguals with DLD were compared to those produced by bilinguals with TD. Almost by definition, children with DLD would be expected to differ from children with TD on microstructure components, as these components, such as the use of complex syntax or MLU, draw on specific linguistic knowledge. However, in contrast to the findings in most studies – with both monolinguals and bilinguals – in Chapter 2, no significant differences were found between the groups on microstructure components. What could explain this finding? The reason could again lie in the bilingual proficiency of the participants as both groups in Chapter 2 had only about 24 months of exposure to L2 English. The implications of the null findings in Chapter 2 – after all, children with DLD

would be expected to differ on structural language measures – are further discussed in Section 5.2.1.

5.1.3. Narrative components requiring perspective-taking skills: ISTs, character introductions and reactions

According to the Theory of Mind (ToM) deficit account (Baron-Cohen *et al*., 1985), individuals with ASD struggle with attributing mental states to themselves and to others. A natural corollary of this account is the reduced use of ISTs by children with ASD compared to their neurotypical peers (Bang *et al*., 2013). As Kimhi (2014) notes, many studies have shown reduced ToM abilities in individuals with ASD (e.g., Mathersul, McDonald, & Rushby, 2013; Peterson, Wellman, & Slaughter, 2012). It must be noted though that ToM deficits are nuanced as individuals with higher linguistic abilities may be able to pass false-belief tasks, but still display mild ToM deficits (e.g., Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997). As with the findings for macrostructure and microstructure, at first, the findings for the production of ISTs appear contradictory and inconclusive (Colozzo *et al*., 2015 vs. Norbury *et al*., 2014); however, the meta-analysis by Baixauli and colleagues indicates the production of ISTs as an area of weakness in ASD (Baixauli *et al*., 2016). Looking at how children with DLD – monolingual or bilingual – produce ISTs has rarely been the focus of research. When studies have found children with DLD to produce fewer ISTs than children with TD, linguistic explanations have been proposed, rather than the presence of reduced ToM abilities. To produce ISTs, children with DLD need to have the vocabulary to do so (Mäkinen, 2014; Norbury *et al*., 2014) and so, such differences may not be apparent when participants matched on language abilities are compared.

The production of ISTs was examined in Chapter 4, in which the narratives produced by bilinguals with ASD, DLD and TD who were matched on age, non-verbal intelligence, and

receptive vocabulary were examined. Significant differences were found for the overall production of ISTs (perceptual, physiological, emotional, and cognitive terms) as well as for ISTs particularly reflective of internal states (emotional and cognitive terms). These differences were found not only between the bilinguals with ASD and the bilinguals with TD, but also between the bilinguals with ASD and the bilinguals with DLD, who did not differ from the bilinguals with TD. When participants are language-matched, the production of ISTs is an area of weakness in ASD, but an area of relative strength in DLD. In fact, when children with DLD have the lexical skills to produce ISTs, they do not differ from TD controls.

In addition to differences in the production of ISTs, differences were also found between the bilingual ASD group and both other groups in the production of two-story grammar components requiring perspective-taking skills. In Chapter 3, individual story grammar components were examined, in addition to composite story grammar scores. In fact, looking only at composite story grammar scores can eclipse important differences about the stories produced by children with ASD and children with DLD. When individual story grammar components were scrutinized in Chapter 3, the following pattern could be identified: when it came to the core narrative component – initiating events, attempts, and outcomes – both bilingual clinical groups patterned similarly and differed from the bilinguals with TD. Consistent with some prior literature (e.g., Tager-Flusberg, 1995; Yang, 2011), the bilinguals with ASD produced stories with less informative content, but so did the children with DLD. When it came to two components requiring perspective-taking abilities – (1) clear and unambiguous character introduction and (2) story characters' reactions to story outcomes – a different pattern emerged: the bilingual children with ASD produced fewer of these components compared to both the bilinguals with DLD and the

bilinguals with TD. Crucially, the bilinguals with DLD did not produce fewer story grammar components requiring perspective-taking skills compared to the bilinguals with TD.

To conclude, the narrative profiles of bilinguals with ASD are similar to the narrative profiles of monolinguals with ASD: bilinguals with ASD, like monolinguals with ASD, produce stories with reduced content, less complex syntax, shorter utterances, and fewer components reflecting characters' internal states. Being bilingual does not change this pattern of results. Having a 3-way comparison helped reveal both similarities and differences compared to children with DLD. The implications of these findings are discussed in the next section.

Implications/Take home messages

5.2.1 Macrostructure abilities in DLD

While some studies have found macrostructure to be an area of vulnerability in DLD, others have not. This is the case for both the monolingual (e.g., Norbury & Bishop, 2003 vs. Bishop & Donlan, 2005) and the bilingual research on narratives (e.g., Iluz-Cohen & Walters, 2012 vs. Rezzonico *et al*., 2015). At first, the findings from Chapter 2 and Chapter 3 appear to contradict each other as the bilinguals with DLD obtained significantly lower story grammar scores than the bilinguals with TD in Chapter 2 but did not differ significantly in Chapter 3.

The explanation for these divergent findings would lie in the bilingual proficiency of the participants as well as in the processing limitations inherent to DLD. Recall that the participants in Chapter 3 had more exposure to English than the participants in Chapter 2. During the early stages of L2 acquisition, bilingual children with TD overlap with monolinguals with DLD on morphosyntactic measures and so, are at risk of being over-identified as having DLD (e.g., Bedore

& Pena, 2010; Paradis, 2005; Paradis, 2008). As a result, many prior studies have focused on how to differentiate TD and DLD groups among bilingual children.

Coming back to Chapter 2, the participants (both in the DLD group and in the TD group) had, on average, only about 24 months of exposure to English; it is therefore not surprising that no differences were found for narrative microstructure components as both groups were in the early stages of L2 English acquisition. However, prior research has shown that skills that do not draw on specific linguistic knowledge – such as story-grammar skills – can potentially be transferred from one language to another (Paradis, 2011; Paradis, 2014), and hence, bilinguals with TD converge on monolingual age-based norms faster for story grammar skills than for microstructure skills that require specific L2 knowledge as they are able to share skills at the cognitive-linguistic interface faster than bilinguals with DLD. Thus, story grammar scores can differentiate bilingual children with TD from those with DLD better than microstructure components during the early stages of L2 acquisition. When bilinguals with TD and DLD have more exposure to English, as did the participants in Chapter 3, skills that draw on specific linguistic knowledge, i.e., microstructure components, differentiate between bilinguals with TD and bilinguals with DLD. To conclude, the question of whether children with DLD struggle with narrative macrostructure does not lend itself to an easy, binary answer of yes or no. Instead, the profiles expected of bilingual with DLD could depend on how advanced they are in their L2 development.

5.2.2. Do structural language difficulties characterize ASD?

A larger theoretical question on the nature of language difficulties in ASD is whether morpho-syntax is affected, in addition to the acknowledged difficulties with discourse-pragmatics. Examining narrative microstructure components, particularly measures of complexity, e.g., MLU

and the use of complex syntax, can clarify this question. The findings of this thesis suggest that some bilinguals with ASD overlap with bilinguals with DLD on measures of structural language and differ significantly from bilinguals with TD. These findings with bilinguals point to the presence of stable structural deficits in ASD and strengthen the findings from the monolingual literature.

5.2.3. ASD and DLD: areas of relative strength and weaknesses

In some ways, bilingual children with ASD and bilingual children with DLD tell similar stories. They do not differ on story grammar when composite story grammar scores are examined and both groups produce fewer core narrative components than bilinguals with TD. However, when groups that are matched on language are compared, bilinguals with DLD do not differ from bilinguals with TD on narrative components that require perspective-taking skills. As this thesis shows, such components are compromised in ASD. As all groups were in the process of acquiring English, the specific difficulties in the use of ISTs in the bilinguals with ASD could not be attributed to incomplete L2 skills. From a theoretical perspective, narrative components requiring perspective-taking abilities represent an area of relative strength in DLD, but an area of relative weakness in ASD when participants matched on language abilities are compared. These findings strengthen the findings from the monolingual literature previously noted by Baixauli and colleagues (2016).

5.2.4. How do children with ASD and children with DLD make use of the linguistic input they receive?

As children with DLD have processing limitations (e.g., Kohnert, Windsor & Danahy Ebert, 2009; Leonard, 2007; Schwartz, 2009) and children with ASD, by definition, struggle with

social interaction (APA, 2013), mechanisms for language learning are implicated in both DLD and ASD (Paradis & Govindarajan, 2018). While there is limited research suggesting that bilinguals with DLD do not use the L2 input they receive to the same extent as bilinguals with TD (Blom & Pardis, 2013; 2015), very little is known about how children with ASD – monolingual or bilingual – make use of their linguistic environments (Bang & Nadig, 2015).

The results reported in chapter 2 dovetail with those previously reported by Blom and Paradis (Blom & Paradis, 2013; 2015) in which bilingual children with DLD did not show the same uptake from their L2 input as their TD peers. In Chapter 2, exposure to English and having access to a richer English language environment predicted narrative scores for the bilinguals with TD, but not for the bilinguals with DLD who did not significantly benefit from having longer exposure to L2 English, or from having a richer English language environment,

Coming to chapters 3 and 4, the participants with ASD had significantly greater L2 exposure than the participants in the other two groups. Exposure was entered as a covariate in all models. No significant interaction was found between group and exposure: the bilinguals with ASD struggled with various narrative components when compared to the bilinguals with DLD and bilinguals with TD despite having significantly greater L2 exposure. In other words, the narrative difficulties that characterize ASD are well-entrenched difficulties.

From a theoretical perspective, this thesis helps in identifying (1) whether macrostructure is an area of weakness in DLD, (2) whether structural language difficulties characterize ASD, (3) areas of strengths and weaknesses in ASD and DLD, and (4) how different bilingual groups make use of L2 input and how this is compromised in both ASD and DLD. While the take-home messages are largely theoretical, the findings from this thesis can also help in clinical practice by

identifying targets for intervention: story grammar for bilinguals with DLD during the early stages of L2 acquisition, as well as core narrative components for both bilinguals with DLD and bilinguals with ASD during the later stages of acquisition.

5.3 Limitations and future research directions

Looking at narratives is an effective way of gathering information about a child's linguistic abilities. As an elicitation method, story generation tasks using picture-books represent both a naturalistic as well as a structured context for obtaining language samples. This is particularly relevant for children with autism who experience more difficulties in less structured contexts (Losh & Capps, 2003). Narratives represent a valuable clinical tool for clinical assessment, and narrative samples can inform clinical practice as well as address larger theoretical questions about the nature of language difficulties in clinical populations. There are several limitations to this dissertation that must be acknowledged.

First, there was great variability on all narrative components, as well as in the participants, particularly in the clinical groups. Next, chapters 2 and 3 were limited by their small sample size, one of the challenges of working with atypical populations. This reduces the potential for generalization and further research is required with bilinguals with ASD, DLD and TD to determine whether these results are also borne in other studies. The models were limited because of the small sample size. The many sources of individual variation examined in studies with bilinguals with TD need to be examined in studies with bilinguals with ASD. Coming to the narratives themselves, there is much more that needs to be examined such as children's use of referring expressions –a skill that entails both pragmatic and linguistic knowledge – as well as autism specific features such as the presence of extraneous information in narratives and

neologisms. When coding these narratives, unusual uses of language, such as attributing emotional states to inanimate objects, were noted only in the ASD group. However, as only a few such examples were found and these were produced by only two children with autism, these differences could not be analyzed statistically, and therefore, need to be examined systematically in future research.

Despite the shortcomings mentioned above, the body of research in this dissertation advances knowledge in the following ways: it addresses the gaps in the existing research, discusses larger theoretical issues, and perhaps more importantly, helps shift the focus of research from monolinguals with ASD to bilinguals with ASD. When gathering data, I had the opportunity to interact with several children with ASD, as well as with their families. These interactions impressed upon me the fact that concerns about bilingualism are not just theoretical for these families or children. We need more research about language in bilinguals and multilinguals with ASD (and in other clinical populations) perhaps for the simple reason that we need research that attempts to adequately represent reality.

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