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Academic Achievement of Children and Adolescents with High-Functioning Autism Spectrum Disorder with In-Depth Focus on Written Expression

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A thesis submitted in partial fulfillment of the requirements for the Doctor of Philosophy degree in Health and Rehabilitation Sciences

ACADEMIC ACHIEVEMENT OF CHILDREN AND ADOLESCENTS WITH HIGH-FUNCTIONING AUTISM SPECTRUM DISORDER WITH IN-DEPTH FOCUS ON WRITTEN EXPRESSION

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by

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Abstract

The goal of this research was to identify areas of strength and need in the academic abilities of students with high functioning autism spectrum disorder (HFASD).

Three studies were undertaken: 1) six meta-analyses investigated whether nonverbal IQ was in accordance with academic achievement scores in the areas of reading, writing, and math for students with HFASD; 2) the narrative writing skills of students with HFASD were examined in order to describe the ways their writing may differ from their typically developing (TD) peers; and 3) the persuasive writing of students with HFASD was examined to determine whether their texts resembled writer-based prose to a greater extent than their peers. Across all three studies, the role of language ability as a predictor of academic success was explored.

Results of the first study showed that students with HFASD were generally performing academically as would be expected by their Performance IQ. In addition, across all subject areas, there was great variability in student performance, such that some students with HFASD had strong academic skills and others had weaker skills. The second study demonstrated that the written narratives of students were HFASD were highly similar to those of their TD peers. However, the students with ASD were weaker in their use of narrative elements and form (narrative text structure, character development, integrating the inner worlds of their characters with the events in the story). The third study revealed that the persuasive writing of students with HFASD differed across several key indicators: syntactic complexity, lexical diversity, overall persuasive quality. As well, the texts of the group with HFASD could be characterized as writer-based prose to a greater extent than the texts of their peers. Finally, the importance of language ability in predicting academic achievement was confirmed across all studies.

The results of these studies highlighted the limitations of trying to characterize the academic skills of individuals with ASD using global scores of performance. The detailed descriptions of the written texts of students with ASD provided a critical foundation for developing educational interventions. These studies were the first of their kind.

Key words: high functioning autism spectrum disorder, academic achievement, meta-analysis, literacy, numeracy, written expression, narrative and persuasive writing, weak central coherence, integrative processing, theory of mind

Co-Authorship Statement

This dissertation includes an introductory chapter that provides background information on the research included in the dissertation (Chapter 1), three integrated manuscripts (Chapters 2-4), and a concluding chapter (Chapter 5). For all chapters, I, Heather M. Brown, am responsible for conceiving the work, conducting the literature reviews, researching and designing the methodologies, completing the data collection, analysing and interpreting the data, and writing the chapters. The three integrated manuscripts were made possible through collaboration and are planned for submission for publication. The contribution of the co-author, Dr. Janis Oram Cardy, on all three manuscripts was primarily through the supervision of the research, which included assistance in development of the methods and design, preparation of the ethics application, development of the coding systems, and intellectual and editorial support. Dr. Andrew Johnson, co-author on all three manuscripts, consulted on the project methodologies and statistical analyses, and provided comments and suggestions on earlier versions of the manuscripts. Dr. Lisa Archibald, co-author on the first manuscript, reviewed and suggested revisions to the manuscript. Ms. Rachael Smyth, co-author on the second and third manuscripts, assisted in the development of the coding system and in data collection, and served as one of the primary coders of the data.

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Chapter 1

Introduction

This dissertation examines the academic achievement of students with high functioning autism spectrum disorder (HFASD), with in depth focus on their written expression skills. This introductory chapter provides a brief overview of definitions and characteristics of HFASD, as well as a brief review of the literature on HFASD and each of academic achievement, language ability, and written expression skills. This chapter also provides a review of the literature on writing assessment and some of the best variables to use when assessing written texts. Finally, this chapter explores how the features of HFASD might lead to writing deficits, and provides an overview of the three studies included in this dissertation.

Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is the most common neurodevelopmental disorder (McPartland, Reichow & Volkmar, 2012). The prevalence of ASD in children is currently estimated to range between 1:130-180 in Canada, and 1:80-240 in the United States. On average, one child in every 110-155 has ASD (Autism and Developmental Disabilities Monitoring Network, 2009; Fombonne, Zakarian, Bennett, Meng & McLean-Haywood, 2006). Furthermore, males are more frequently diagnosed than females, at a rate of approximately 4:1 (Chakrabarti & Fombonne, 2005).

ASD is an umbrella term, which, up until recently, referred to three types of pervasive developmental disorders: Autistic Disorder, Asperger's Disorder and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) (American Psychiatric

Association, 2000). Formerly, Asperger's Disorder/Asperger Syndrome (AS) and Autistic Disorder (AUT) were differentiated in terms of general language delay. Specifically, individuals with AS did not demonstrate a general delay in language before the age of three years, whereas individuals with AUT were language-delayed, such that they did not use full words by age two nor meaningful phrases or sentences by age three (American Psychiatric Association, 2000; World Health Organization, 2010). The two groups were further differentiated by the criteria that individuals with AS did not have a cognitive impairment, whereas individuals with AUT had a wide range of intellectual ability, including individuals who were both impaired and not impaired (American Psychiatric Association, 2000). PDD-NOS was previously considered a milder form of ASD. However, recent conceptualizations of the autism spectrum suggest that the subcategories of ASD represent differing levels of symptom severity on a dimension from low to high functioning, rather than separate categories of disorders (American Psychiatric Association, 2013; Kamp-Becker, Smidt, Ghahreman, Heinzel-Gutenbrunner, Becker et al., 2010; Macintosh & Dissanayake, 2004). Further, the term *spectrum* is now considered to refer to the large amount of heterogeneity in the functional abilities of individuals with ASD (Groen, Zwiers, van der Gaag, & Buitelaar, 2008). Currently, the DSM-5 has removed the diagnostic subcategories of ASD in lieu of a single broad category: Autism Spectrum Disorder (McPartland et al., 2012). This dissertation focuses on individuals with high-functioning autism spectrum disorder (HFASD). This term broadly refers to individuals with ASD who have average to above average intellectual functioning.

Individuals with HFASD have deficits in two main areas of function: (a) social interaction and social communication; and (b) restricted, repetitive patterns of behaviour, interests or activities American Psychiatric Association, 2013). With regard to social and communicative deficits, individuals with HFASD tend to interact with markedly less social-emotional reciprocity, have difficulties with back and forth communication (e.g., holding one sided conversations about their own special interests); have abnormal eye contact and body language; and have greater difficulty developing and maintaining peer relationships (American Psychiatric Association, 2013). Moreover, many children and adolescents with HFASD have few or no close friends, despite their wish to do so, and commonly experience peer rejection and bullying (Autism Ontario, 2008; Koning & Magill-Evans, 2001; Kanai, Iwanami, Ota, Yamasue, Matsushima et al., 2011; Lasgaard, Nielsen, Eriksen, & Goossens, 2010).

Individuals with HFASD also tend to demonstrate restricted, repetitive behaviours. For example, an individual with HFASD may use lines from movies repetitively in everyday speech, have highly restricted and intense interests, demonstrate excessive adherence to routines, and show abnormal responses to sensory input, in that they can be over-sensitive or under-responsive to their environment (American Psychiatric Association, 2013). Individuals with HFASD often have a strong need to fixate (perseverate) on topics or processes and they can become very frustrated and upset if they are interrupted (Autism Ontario, 2008). Other individuals with HFASD may be highly sensitive to noise (e.g., the sound of a vacuum cleaner), light (e.g., bright sunshine), movement (e.g., someone repetitively shaking their foot), and many other

forms of sensory input. Unfortunately, many individuals with HFASD experience extreme distress when they fail to cope with overwhelming sensory input, input that many individuals without autism would be able to tune out and ignore.

Autism Spectrum Disorder and Academic Achievement

Media reports and popular opinion often either portray individuals with ASD as academically impaired or perpetuate the stereotype of *autistic genius*. For example, when considering the mathematical skills of individuals with ASD, the image many would have is of Raymond, the mathematical savant portrayed by Dustin Hoffman in the movie, Rain Man (Peter & Levinson, 1988). More recently, the memoir, "The Spark: A Mother's Story of Nurturing, Genius, and Autism" chronicled the life of Jacob Bennett, a young man who has autism and is believed to be smarter than Einstein (Barnett, 2013). Jacob's accomplishments are often in the news. On CTVNews.ca, one of the more recent headlines read, "15-year-old Jacob Barnett: One of the world's most promising physicists." The article reports that at the age of 15, Jacob had just started a Master's program in theoretical physics at the University of Waterloo (Commisso, 2013, October 1). These examples and many others (cf., Baron-Cohen, Wheelwright, Burtenshaw, & Hobson, 2007; James, 2003; 2009) have created a stereotyped representation of individuals with HFASD as being excellent mathematicians, scientists and engineers. Such stereotyped beliefs may inappropriately influence our expectations for individuals with HFASD and may affect remedial efforts. Further, the attitudes of society, which in turn impact the availability of governmental services and the supports available to

individuals with HFASD, have all been cited as increasing the vulnerability of this high risk group (Task Force on Autism, 2001).

Research has demonstrated that academic achievement varies widely in students with HFASD, ranging from severely impaired to exceptional (Griswold, Barnhill, Smith-Myles, Hagiwara & Simpson, 2002). Estes, Rivera, Bryan, Cali and Dawson (2011) reported that in their sample, 90% of the children with HFASD, all of whom had nonverbal IQ scores that were greater than 70, demonstrated a discrepancy between their expected achievement (based on intellectual functioning) and actual achievement in at least one of spelling, word reading or basic number skills. They also reported that in *at least one* of these three domains, 60% of students with HFASD had lower achievement levels than would be predicted by their intellectual functioning. Surprisingly, however, the opposite was also true: an equal percentage of children had higher achievement levels in at least one of the three domains than would be predicted by intellectual functioning. Supporting this finding of both academic strengths and weaknesses, Jones, Happé, Golden, Marsden, Tregay et al. (2009) examined the IQ-achievement discrepancies of a sample of students with ASD, who ranged in Full-scale IQ (FSIQ) from 55 to 119 (i.e., from *Profoundly Disabled* to *High Average*). They found four largely distinct subgroups of IQ-achievement discrepancies in the math and reading skills: *reading peak*, *reading dip*, *arithmetic peak* and *arithmetic dip*. That is, there were distinct groups of students who had higher than expected achievement in math and reading, as well as students who had lower than expected achievement in these two areas. However, most of the participants in the Jones et al. (2009) study (approximately

75%) had academic achievement scores in both math and reading that were not significantly different than their IQ scores. Nevertheless, in general, much research has emphasized weaknesses in the academic skills of individuals with HFASD. For example, four recent studies have identified rates of learning disabilities (LD) in the HFASD population by comparing academic abilities on standardized achievement tests to IQ scores (See Figure 1.1). Jones et al. (2009) indicated that discrepantly poor reading

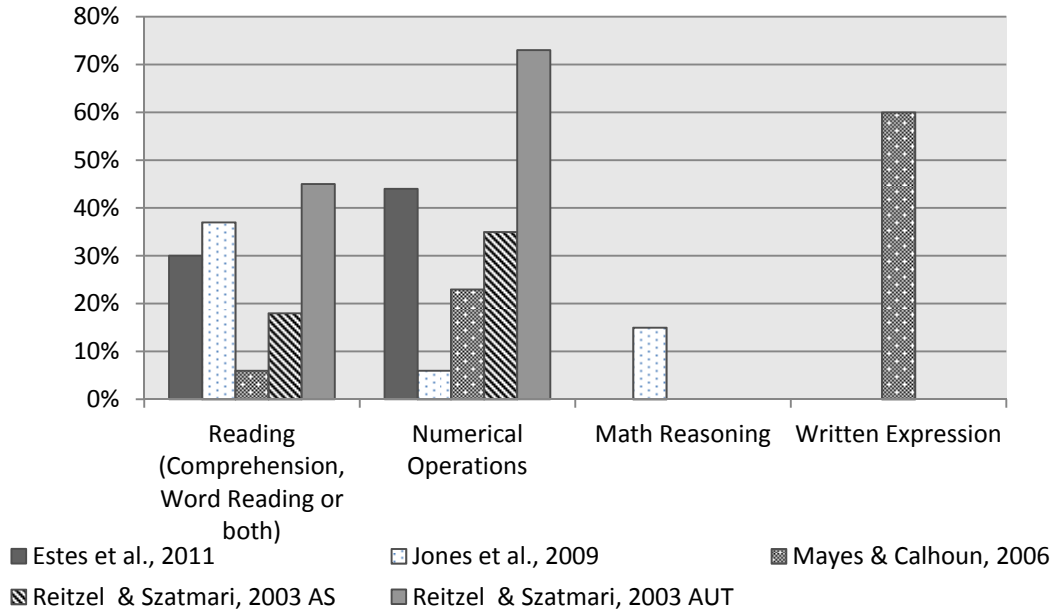

Figure 1.1 Percentages of individuals with HFASD and a learning disability across domains and studies

comprehension was the most prevalent profile among their sample of students with ASD. More specifically, 37% of students with ASD in this study had reading comprehension scores that were significantly lower than their FSIQ.

In a second study, Mayes and Calhoun (2006) reported that the proportion of students with HFASD (i.e., FSIQ ≥ 80) and academic weaknesses varied in the subject

area of their difficulties. They found that 60% of their participants with HFASD had a specific LD in writing, while 23% had an LD in math. However, only 6% of the participants with HFASD had a specific LD in each of reading comprehension and decoding, which is a much lower proportion than was reported by Jones et al. (2009).

In a third study examining the academic skills of students with AUT and AS, who had Leiter IQ scores of greater than 70, Reitzel and Szatmari (2003) reported that 73% of the individuals with AUT had a general LD in numerical operations and 45% had a general LD across a composite measure of reading ability, i.e., word reading and reading comprehension, compared to 35% and 18%, respectively, of individuals with AS. In sum, it seems that there is a large degree of heterogeneity in academic performance of students with HFASD. To date, no study has attempted to estimate the effect size of the differences between IQ and academic performance across this body of literature. One aim of the present dissertation was to address this gap in the literature.

The majority of investigations into the academic abilities of the HFASD population have involved standardized assessments. However, Reitzel and Szatmari (2003) caution against relying on standardized tests of academic achievement with the HFASD population. While they found that academic difficulties are experienced by a majority of individuals with HFASD, the academic achievement scores of these students were generally within the normal range. As such, these researchers pointed out that simple tests of academic achievement and IQ will not necessarily capture the types of difficulties students with HFASD experience at school, most notably difficulties with focus and attention, problem solving, abstract conceptual learning, and coming up with

creative solutions to complex problems (Reitzel & Szatmari, 2003). Furthermore, these authors stressed that oral language ability plays a large role in the academic success of individuals with HFASD. As previously highlighted, individuals with AUT performed significantly worse on tests of academic achievement compared to individuals with AS. Reitzel and Szatmari (2003) assert that this is because AUT is essentially AS comorbid with core oral language impairment (LI). Further, these researchers assert that these weaknesses in core oral language ability are strongly predictive of significantly lower academic achievement across individuals with HFASD.

Autism Spectrum Disorder and Language Ability

Language ability is often represented as consisting of three primary components: form, content, and pragmatics (Helland, Biringer, Helland & Heimann, 2012; Owens, Metz & Farinella, 2011). Form refers to the basic structure of language and includes three main areas: phonology, morphology and syntax (Owens et al., 2011). The perception and production of speech sounds is called phonology (Groen et al., 2008), whereas morphology refers to the smallest units of language that have meaning and the rules for how to combine morphemes into words (Owens et al., 2011; Stothers & Oram Cardy, 2012). Analogously, grammar or syntax refers to the rules for combining words into clauses, phrases and sentences (Groen et al., 2008; Owens et al., 2011).

While the form of language refers to the structure of language, content refers to the meaning of words, i.e., semantics (Groen et al., 2008; Owens et al., 2011). Knowing the meaning of a word or having a semantic representation of a word involves creating a mental model of the word and its referent (Andrews, Vigliocco, & Vinson, 2009).

Furthermore, an individual's semantic representations can be described in two ways: (a) the number of words a person knows, or the *breadth* of their word knowledge; and (b) the richness, detail and/or quality of their word knowledge, i.e. the *depth* of their semantic representations (Stothers & Oram Cardy, 2012; Volden, 2004).

The final component of language is pragmatics, that is, the conventions or rules governing language use for the purpose of communication (Groen et al., 2008; Helland et al., 2012). These rules change depending on social context and dictate the language form and semantic representations to choose when communicating in a particular context (Helland et al., 2012; Nippold, 2000; Owens et al., 2011). Some examples of pragmatic rules include how to appropriately: (a) start and stop a conversation; (b) maintain a topic; (c) listen and interrupt; (d) offer emotional support; and (e) express emotions, such as humor, anger and affection. Although there are many communication disorders that cover a wide range of deficits in language, only those disorders of relevance to this dissertation will be explored.

Specific Language Impairment. Specific Language Impairment (SLI) affects approximately 7% of kindergarten children (Tomblin, Records, Buckwalter, Zhang, Smith et al., 1997). SLI broadly refers to children who fail to develop language at the usual rate, despite having normal intelligence and sensory abilities as well as typical environmental exposure to language (Alloway, Rajendran & Archibald, 2009). In general, children with SLI have difficulties with understanding and producing spoken language (Bishop, 2006). More specifically, children with SLI tend to use simplified speech sounds as well as inaccurate morphological and grammatical structures (Bishop, 2006; 2010). Also, they

tend to have limited semantic representations (Bishop, 2006; Kjelgaard & Tager-Flusberg, 2001). Although there is some disagreement across the literature about the precise range of deficits that characterize SLI, throughout this paper, SLI is defined as problems with language form and content, but relatively spared pragmatics (Bishop, 2010).

In contrast, it is well documented that individuals with HFASD struggle to master the pragmatics of language (Tager-Flusberg, 1999; Tager-Flusberg, 2006). For example, children and adolescents with HFASD tend to: (a) lecture about their own interests; (b) introduce irrelevant comments into conversation; (c) use stereotyped language; (d) be repetitive; and (e) have problems finding words when conversing (Burke, 2005; Church et al., 2000; Tager-Flusberg, 1996; Tager-Flusberg, 1999). As well, individuals with HFASD tend to: (a) have difficulty initiating, elaborating and expanding conversational topics; (b) understanding irony and metaphor; and (c) interpreting ambiguous language (Church et al., 2000; Groen et al., 2008; Tager-Flusberg, 1996; Tager-Flusberg, 1999).

Although pragmatic deficits are pervasive in the population of individuals with HFASD, it is believed that a subgroup of individuals with HFASD also have a language profile that mirrors SLI, that is, deficits in grammar, phonology and vocabulary (Bennett et al., 2008; Groen et al., 2008; Kjelgaard & Tager-Flusberg, 2001; Lindgren, Folstein, Tomblin & Tager-Flusberg, 2009). Studies have demonstrated that individuals with HFASD + SLI, hereto termed Autism with Language Impairment (ALI), tend to have difficulties with the production and comprehension of syntactic elements of language,

often produce more tense errors, and use less complex sentences (Bennett et al., 2008; Norbury & Bishop, 2003; Szatmari et al., 2009).

In a landmark study, Kjelgaard and Tager-Flusberg (2001) investigated the variability of language skills across a sample of individuals with ASD (*n* = 44) who had intelligence scores in the average and below average range (FSIQ: *M* = 85; *SD* = 17.3). The researchers divided the ASD group into subgroups based on their overall language scores as measured by the *Clinical Evaluation of Language Fundamentals* (*CELF-III*; Semel, Wiig, & Secord, 1995). Their impaired group, approximately 48% of their sample, had *CELF-III* scores below 70 as well as vocabulary scores[1] and phonology scores (nonword repetition) that were generally one standard deviation or more below the normal mean. In other words, their impaired group showed a language profile that was very similar to the language profile of individuals with SLI. In contrast, 23% of their ASD sample (10/44) had overall language scores, vocabulary scores and nonword repetition scores within the normal range. This second subgroup seemed to consist of individuals with ASD, without co-morbid SLI, i.e., Autism Language Normal (ALN; Kjelgaard & Tager-Flusberg, 2001).

A more recent study by Lindgren et al. (2009) directly compared groups of individuals with ALI, SLI and ALN on a comprehensive battery of language assessments. Individuals with ALI and SLI performed similarly on most measures, but less well than their peers with ALN. Specifically, participants with ALI and SLI demonstrated similar

[1] The vocabulary score was an average of the children's scores on the Peabody Picture Vocabulary Test - III (PPVT-III; Dunn & Dunn, 1997) and the Expressive Vocabulary Test (EVT; Williams, 1997).

deficits on IQ measures, tests of phonology (e.g., nonword repetition, phonological awareness), vocabulary (*PPVT*), and overall language scores (*CELF-III*). Across all these measures, the ALI and SLI groups were performing one or more standard deviations below the normal mean, whereas, the ALN group performed at or above the normal mean on all of these language measures. In sum, these two studies suggest that there is a subgroup of individuals with HFASD (ALI) who have a language profile typical of those with SLI. As well, there is a second subgroup of individuals with HFASD (ALN) who have essentially normal grammatical, phonological and vocabulary skills (Kjelgaard & Tager-Flusberg, 2001; Lindgren et al., 2009; Loucas, Charman, Pickles, Simonoff, Chandler et al., 2008).

Despite the aforementioned evidence supporting the profile of ALN, other studies suggest that even the most able individuals with HFASD tend to have mild weaknesses in vocabulary ability. In a recent meta-analysis, Brown, Oram Cardy and Johnson (2013) demonstrated that there tended to be a discrepancy between the vocabulary knowledge of individuals with HFASD compared to their typically developing (TD) peers of -0.5 SD (Hedge's g). Further, it was predicted that for any given sample of individuals with HFASD, they would show either semantic knowledge weaknesses or strengths compared to their TD peers, with the size of these differences ranging from -2.2 SD (strong weaknesses) to +1.2 SD (moderate strengths). However, it is important to note that across the samples included in the meta-analysis, semantic knowledge was primarily measured by either the vocabulary subtest from the Wechsler intelligence scales or by picture vocabulary tests, such as the *PPVT-III*. It has been suggested that

these types of vocabulary assessments measure the size of the participant's vocabulary (i.e., vocabulary breadth), but not the level of detail of the participants' semantic representation for any given word (Stothers & Oram Cardy, 2012).

There is some evidence that the semantic representations of individuals with HFASD may also be less rich and of poorer quality than those held by their TD peers (Volden, 2004; Stothers & Oram Cardy, 2012). For example, Lewis, Murdoch and Woodyatt (2007) asked children with HFASD to complete the ambiguous sentences subtest of the *Test of Language Competence-Expanded Edition* (Wiig & Secord, 1989). In this subtest, participants needed to give two possible interpretations of a given sentence. These researchers reported that children with HFASD scored significantly lower on the ambiguous sentences subtest compared to TD controls. Further, this difference (d = -1.6 SD) was large and clinically meaningful, in the sense that these children would likely be viewed by various professionals as having weak semantic representations.

The aforementioned research all supports the finding of highly variable language abilities within the population of individuals with HFASD. Further, it demonstrates that a subgroup of individuals with HFASD have core oral language deficits. Because language has been shown to be a strong predictor of academic achievement (c.f., Johnson et al., 1999; Reitzel & Szatmari, 2003), it is imperative that future research studies accurately assess the language skills of their participants with HFASD when investigating their academic achievement. Although accurately assessing language skills is an important first step regardless of the academic domain being studied, there are few subjects where

language ability would be predicted to have a greater impact than in the written expression skills of individuals with HFASD.

Autism Spectrum Disorders and Written Expression

Some of the earliest investigations into the writing of individuals with HFASD were case studies that highlighted a range of deficits (cf., Chavkin, 2004; Happé, 1991; Jurecic, 2007). For example, case studies have suggested that individuals with HFASD struggle to create transitions, have a tendency to roam from one subject to another, and have difficulty filtering out irrelevant information (Chavkin, 2004; Happé, 1991; Jurecic, 2007). Second, the language of the texts by individuals with HFASD is often unclear. The writers were noted to use undefined idiosyncratic terms without giving any explanation as to their personal meaning (Happé, 1991). As well, these writers would make odd word choices, such as complimenting the colour of a girl's hair by describing it as *mousy*. In addition, they seemed to use ambiguous referents and vague expressions that conveyed only a general meaning to the reader (Chavkin, 2004; Happé, 1991; Jurecic, 2007). Jurecic (2007) concluded that the writing of her undergraduate male with HFASD seemed to have a distorted sense of audience and, more specifically, that he seemed to use *writer-based prose*.

Writer-based prose, as originally defined by Flower (1979), might be best described as the writer's private thoughts written down by the writer to himself and for himself. From Flower's list of characteristics of writer-based prose, I identified two main features of this writing style: *problems with integration of details into higher order concepts* and *decreased clarity of expression*. In terms of problems with integration,

writer-based prose may express ideas without proof or development, demonstrate an overreliance on formulaic transitions and fail to place details in larger, integrated frameworks (Flower, 1979). It is believed that although novice writers may be able to recognize complex relationships, they are not necessarily able to describe them in written language (Scardamalia & Bereiter, 1983). As a result, their writing may seem like a survey of all the information stored in the writer's memory with little attempt on the writer's part to adapt the contents for the reader, i.e., a *retrieve and write* strategy (Flower, 1979). In other words, the novice writer seems to be a knowledge teller (McCutchen, 1988). The second feature of writer-based prose is decreased clarity of expression. Often novice writers use unclear or vague language. At times, it seems as if the word choices have rich context for the writer that is not made known to the reader (Happé, 1991). The novice writer's lack of clarity "can range from a mere missing referent or an underdeveloped idea to an unfocused and apparently pointless discussion" (Flower, 1979, p. 19). One aim of the present dissertation was to examine the question of whether the writing of children and adolescents with HFASD can be categorized as writer-based prose to a greater degree than their TD peers.

It is important to note that some case studies have identified some individuals with HFASD who are excellent writers. Church et al. (2000) stated that two of their five participants were excellent at creative fictional writing. Similarly, Happé (1991) noted that one of her authors with HFASD was an enthusiastic and highly skilled writer. Furthermore, he gave considerable evidence in his writing that he possessed both a social awareness and a sense of audience. For example, he used jokes and deceptions

effectively, and showed an appreciation and interest in subtle social interactions. Finally, he also gave appropriate background information to create relatively coherent texts (Happé, 1991). Thus, it seems that for some individuals with HFASD, their texts not only show significant strengths, but also give evidence of considerable talent in areas where these individuals are theorized to have significant weaknesses.

Empirical quantitative studies may be helpful to clarify the question of whether there are specific strengths and weaknesses in the writing of students with HFASD. Currently, there are ten studies describing eleven samples in which standardized assessments were used to examine the written expression skills of individuals with HFASD (Assouline, Foley Nicpon & Dockery, 2012; Foley Nicpon, Assouline & Stinson, 2012; Griswold, Barnhill, Smith-Myles, Hagiwara, and Simpson, 2002; Jones, 2007; Mayes & Calhoun, 2003; 2008; Sivertson, 2010; Smith-Myles, Huggins, Rome-Lake, Hagiwara, Barnhill, et al., 2003; Smith-Myles, Simpson and Becker, 1994). All ten of these studies examined the ability profiles of students with HFASD compared to students with other exceptionalities, their non-disabled peers or the norms of the test. Although the studies differed in focus and intent, all of them involved students with HFASD, standardized IQ tests and standardized academic achievement tests.

These studies demonstrate that although there is a wide variety of writing ability within the HFASD population, overall, the data suggest a global writing deficit. Seven of the eleven samples reported a standardized written expression score that was lower than some measure of IQ, with the difference between the two ranging from *d* = -0.4 SD to *d* = -1.8 SD or from *mild* to *severe* writing impairments (Assouline et al., 2012; Foley

Nicpon et al., 2012 Asperger Syndrome; Griswold et al, 2002; Jones, 2007; Mayes & Calhoun, 2003; 2008). In contrast, in three of eleven samples, there was no difference between written expression and IQ with effect sizes of 0.0, 0.1, and 0.2, respectively (Silvertson, 2010; Foley Nicpon et al., 2012 Autistic Disorder; Smith-Myles et al., 2003). Finally, one study did report a greater written expression score than IQ score, *d* = 0.3 SD, but this result must be interpreted with caution as the authors state the sample of individuals with HFASD who wrote the written expression subtest was too small to be included in their statistical analyses (Smith-Myles et al., 1994). In sum, it would seem that many individuals with HFASD may have significant difficulties with written expression, whereas others may be performing reasonably well. Yet, these studies fail to describe *how* the written texts of individuals with HFASD are similar or different compared to the writing of their peers.

To date, only three studies with multiple participants have attempted to describe the specific characteristics of the writing of those with HFASD. Smith-Myles et al. (2003) compared students with HFASD with controls on the *Test of Written Language – III* (*TOWL-III*) and found no significant differences between the groups on any of the *TOWL-III* subtests or composite scores. However, the researchers also quantified nine text variables outside of those normally scored in the *TOWL-III* and demonstrated that individuals with HFASD produced briefer and less complex texts. Subsequently, Barnes, Lombardo, Wheelwright and Baron-Cohen (2009) compared the written narratives of individuals with HFASD to their NT peers. After viewing four scenes from a video containing highly emotional and mentalistic content, participants were asked to write

four different narratives describing what they saw. The HFASD group wrote shorter narratives, used fewer mental state terms, and attributed mental state terms to fewer characters in each of the scenes. Most recently, Brown and Klein (2011) examined the narrative and expository writing of adults with HFASD and their NT peers. They found that adults with HFASD wrote narrative and expository texts that were poorer in quality and narratives that were shorter in length. Nevertheless, Brown and Klein (2011) noted that quality of the texts of the adults with HFASD ranged from quite impaired to exceptional.

Although previous literature suggests that many students with HFASD struggle to write, this body of research has left several unanswered questions. The current dissertation aimed to explore the narrative and persuasive writing of children and adolescents with HFASD in depth. This consisted of systematic analysis of multiple features of their written texts in order to obtain a clear picture of their strengths and weaknesses. The success of this endeavour was contingent upon the whether the measures used to assess their writing were considered *good* writing measures.

What is a *Good* Writing Measure?

When measuring the written expression skills of students, it is important for researchers to choose *good* writing measures. However, writing assessment is of one of the least researched topics across writing research studies. In an examination of 1,502 writing research articles published between 1999 and 2004, only 7.5% of the articles investigated writing assessment and evaluation practices (Juzwik, Curcic, Wolbers, Moxley, Dimling et al., 2006). Although there is little research on the best measures to

use when evaluating student writing, there is a plethora of research that nonetheless evaluates the written expression skills of students (Scott, 2009; Wolf-Nelson & Van Meter, 2007). Research that does explore how to accurately assess writing suggests that *good* measures of writing capture developmental changes over time and differentiate between typical and atypical performance (Wolf-Nelson & Van Meter, 2007).

Writing can be evaluated at several different levels: discourse, sentence and word (Scott, 2009; Wolf-Nelson & Van Meter, 2007) as well as using lower order vs. higher order measures. Several measures of writing were chosen for use in the present dissertation; some were specific to only one genre (e.g., character development in narratives), whereas other measures were used across both genres (e.g., total number words). In the following section, the rationale for using each measure is described.

Lower Order Writing Variables

Productivity. Productivity is often measured using total words and total t-units, both of which have been found to be robust measures of developmental growth (Scott, 2009; Wolf-Nelson & Van Meter, 2007). For example, Smith-Myles et al. (2003) demonstrated that children and youth with HFASD generally wrote fewer t-units and fewer total words compared to their TD peers. Similarly, Brown and Klein (2011) reported that adults with HFASD tended to write shorter narratives (in total words and sentences, d = 0.8 SD) than their peers. The t-unit, which consists of one independent clause and any clauses dependent upon it, was originally defined by Hunt (1965).

Syntactic complexity. To be a good writer, an individual must master complex syntax (Scott, 2009). Syntactic complexity is commonly measured using mean length of

t-unit (MLTU, i.e., the number of words per t-unit) and clausal density (i.e., the number of clauses per t-unit; Nippold, Mansfield & Tomblin, 2008; Scott, 2009). It is believed that as sentence length increases, in general, so does sentence complexity (Scott, 2009). Both measures show modest increases throughout elementary and secondary school, but there tends to be a great deal of variability within groups (Scott, 2009). Further, it has been shown that TD students write more complex sentences as indicated by their MLTU scores compared to students with language impairments in the expository genre (Nippold et al., 2008). Further, Brown and Klein (2011) identified a non-significant trend in the data for the adults with HFASD to show less complex syntax in terms of MLTU (*d* = 0.6 SD) and percentage of large t-units (*d* = 0.7 SD) in their narrative writing.

Another measure of syntactic skill is grammatical acceptability, i.e., the proportion of writing that is free of basic grammar errors, as defined by Duques (1989). Grammar errors are often measured by tallying sentence fragments and run-ons, since these types of grammar errors frequently appear in students' writing (Scott, 2009). Previous research has shown that grammar error rates are higher in the written texts of students with SLI compared to their TD peers and grammar errors are considered a reliable clinical marker for SLI (Scott & Windsor, 2000).

Lexical complexity. Measures of lexical knowledge can also be important indicators of writing quality. Generally, students whose vocabulary knowledge is broad and deep will use a wider variety of words in their writing, leading to texts with highly specific and diverse language choices and ultimately better quality (Scott, 2009). Lexical diversity, the number of different words in a written text, is a common metric used

when assessing lexical knowledge, since this measure is believed to reflect the student's vocabulary size and control (Scott, 2009). Another important measure of lexical knowledge is lexical complexity or word length. In English, longer words tend to be more sophisticated, have greater structural complexity and occur less frequently (Berman & Nir-Sagiv, 2007). There are several ways to measure lexical diversity and complexity. Some common measures include: (i) a count of the number of different words in the text divided by the total number of words (type/token ratio; TTR); (ii) the number of large words (as defined by either the number of letters or syllables); and (iii) the number of low frequency words (Scott, 2009).

TTR is influenced by number of words analysed in each text (Scott, 2009). As text length increases, so does the number of closed-class words (e.g., the, a, this, in) and repeated content words (e.g., revenge, bully, computer, limited). The overall result is that longer pieces of writing, which generally contain vocabulary that is more diverse and complex, nevertheless can earn lower TTR scores due to repetition of content and closed class words; repetitions that are necessary to maintain textual coherence (Scott, 2009). In contrast, if TTR is calculated on a predetermined number of words per text for every participant, then the TTR score more accurately captures the differences between texts written by TD students and those written by students with LD (Scott, 2009). However, there are difficulties with calculating TTR on a specified number of words per text across participants because several participants in a given sample may not be able to reach the predetermined text length (Scott, 2009). As well, researchers disagree on how many words constitute the ideal sample size (Owen & Leonard, 2002).

Nevertheless, previous research has found that TTR analysis on a sample of natural oral language of varying lengths distinguished between children with ASD[2] and children with non-specific developmental delays (Eigsti, Bennetto & Dadlani, 2007).

With regards to long words, research has demonstrated that adolescents and adults use longer words (three or more syllables and/or greater than seven letters) compared to children (Berman & Nir-Sagiv, 2007; Strömqvist, Johansson, Kriz, Ragnarsdottir, Aisenman et al., 2002). Further, it has been shown that children with LD used fewer big words (seven or more letters) compared to their TD peers (Houch & Billingsley, 1989). Thus, frequency or counts of long words seem to be a *good* measure of text construction ability (Berman & Nir-Sagiv, 2007).

Several measures of lexical diversity can be easily calculated with language analysis software. For example, Scott (2009) compared the use of an online word-frequency text profiler to handpicking low frequency words. She found that the computer generated list was very similar to the one where she had identified the low frequency words by hand. She also noted that the computer generated list correlated well with other diversity measures such as TTR and number of different words (Scott, 2009).

Writing Conventions. The mechanics of writing involve proper spelling, punctuation and capitalization. Spelling has been shown to be sensitive to differences in grade and ability, that is, spelling distinguishes between younger children and older

[2] The nonverbal IQs ranged from 49-111 for the ASD group and from 52-106 for the control group (Eigsti, Bennetto & Dadlani, 2007).

children as well as between children with LD and TD controls (Wolf-Nelson & Van Meter, 2007). In addition, children with language impairments tend to demonstrate marked deficits on measures of spelling and punctuation in their written texts. Indeed, pronounced weaknesses on measures of spelling and punctuation are considered the most sensitive indicator of language impairment (Bishop & Clarkson, 2003). Similarly, Wakely, Hooper, de Kruif and Swartz (2006) noted that children who were experiencing difficulties with written expression, particularly in the area of semantics, were also less sure about what was or was not considered correct punctuation according to the Index of Self-Efficacy for Writing. Although there is less research that reports specifically on the capitalization skill demonstrated in the writing of children, Houch and Billingsley (1989) reported that capitalization errors (and spelling errors) successfully distinguished between students with LD and TD students.

With regards to individuals on the spectrum, Brown and Klein (2011) noted a slight trend (p = .07) for adults with HFASD to make more spelling errors (d = 0.7 SD) than non-disabled controls. In comparison, in a sample of 42 students with HFASD with FSIQs ranging from 80-143, researchers demonstrated a wide range of spelling ability on the *WIAT* spelling subtest with standard scores ranging from 72 – 148, despite the fact that the overall group mean for spelling was average (i.e., M = 102, SD = 17; Mayes & Calhoun, 2003). Thus, it seems that there may be great variability within the population of individuals with HFASD in their use of writing conventions.

Higher Order Writing Variables

Rubrics. Scoring rubrics are one of the most common methods of examining discourse-level writing competence (Scott, 2009). Rubrics are descriptive scoring schemes or a set of rules/benchmarks that guide the evaluation of written texts by describing what is expected at each score level (Moskal, 2007; Westby & Clauser, 1999). It is believed that *good* rubrics are based on developmental writing research with regards to children, youth and adults and uses the developmental/age-related changes in writing skills to create the delineations between levels (Westby & Clauser, 1999). For example, Wolf and Gearheart (1994) based their development of the *Writing What You Read Rubric*, a six-point narrative rubric, on previous research of the development of writing skill in children. The rubric evaluated their participants' texts in the areas of theme, character, setting, plot and communication.

There are two main types of rubrics: holistic rubrics and trait rubrics (Moskal, 2007; Westby & Clauser, 1999). Holistic rubrics ask evaluators to make broad judgements on their overall impression of the writing given a set of anchor papers (Moskal, 2007). In contrast, trait rubrics try to define and quantify the features of *good* writing in particular genres. Analytic scoring rubrics were used in the present research because they have the most potential to provide direction for future writing interventions (Westby & Clauser, 1999).

Analytic rubrics often vary in the number and types of writing features that they assess as well as in how extensively each writing feature is evaluated (Scott, 2009). For example, Crawford, Helwig and Tindal (2004) used a six-point rubric to assess children's

texts across four genres (narrative, imaginative, persuasive and expository) in four main areas: ideas/content, organization, sentence fluency, and writing conventions. They demonstrated that the written texts of students with LD were rated more poorly than their TD peers across three of the traits (organization, sentence fluency and writing conventions) analysed, but both groups wrote texts with similar levels of coherence and clarity of ideas (i.e., ideas/content). Similarly, Scott (2009) reported that children and adolescents with lower language skill performed worse on rubric measures of text quality.

Brown and Klein (2011) also used analytic rubrics to assess the narrative and expository texts of adults with HFASD and their non-disabled peers. Unique scoring rubrics were devised to evaluate the two different pieces of writing, which is a common practice (Moskal, 2007; Scott, 2009). The texts were scored using five-point rubrics that evaluated the following traits: Quality, Context, Global Coherence, Structure and for narratives only, Balance between Landscapes (action vs. consciousness). It was found that adults with HFASD wrote narrative texts that were rated more poorly across all five trait measures in comparison to the texts of their peers, yet their expository texts were rated more poorly only on Global Coherence (Brown & Klein, 2011). The current dissertation uses several of the same trait variables that were used by Brown and Klein (2011). A discussion of each higher-order variable used in the current study follows.

Coherence and cohesion. Coherence refers to the global representation of story meaning or the temporal and causal structure of a story (Diehl, Bennetto, & Carter-Young, 2006; Karmiloff-Smith, 1985). Coherence helps the reader perceive the

relationships between and within the sentences of the text (Weiser, 1996). By using grammar and lexical devices, a text is coherent when every sentence makes a relevant contribution to the topic (Struthers, Lapadat & MacMillan, 2013; Weiser, 1996)

In contrast, cohesion refers to the local connectiveness of a text. Although coherence is often difficult to measure directly, there are several quantifiable indicators of cohesiveness (Diehl et al., 2006; Struthers et al., 2013). Two measures of cohesiveness that will be discussed are: connectives and cohesive reference. Connectives mark the relationship between adjacent clauses and support the local connectedness of the text (Murray, 1997; Struthers et al., 2013). Particular connectives (i.e., *but, so, and, also*) as well as temporal connectives (e.g., *then, when, after, before*, etc.) tend to appear earlier in children's writing, while causal and adversative connectives (e.g., *therefore, however, although*) tend to appear later (Bloom, Lahey, Hood, Lifter & Fiess, 1980; Crowhurst, 1987). As well, Gillam and Johnston (1992) demonstrated that TD children tended to use more connectives in their written texts than children with language and reading impairments.

A second indicator of cohesiveness is cohesive reference. Cohesive reference refers to the extent to which each sentence in the text makes reference to the subject or predicate of the sentence that precedes it. Brown and Klein (2011) found that the expository texts of adults with HFASD tended to contain fewer sentences that made reference to the one before it (d = 1.0 SD), a difference that was clinically meaningful.

In sum, measures of cohesion, like frequency of connectives and cohesive reference, are more easily quantified than measures of coherence, which tend to be a

holistic judgement. Further to this, research has shown that written texts that make skillful use of cohesive devices also tend to be rated as more globally coherent and of higher quality than texts with less proficient cohesion (Struthers et al., 2013). Consequently, it has been suggested that cohesion may be a better indicator of coherence in students' writing.

Structure and organization. A discourse schema is a person's understanding of how a typical story is organized and structured, and this structure differs across genres (Newcomer, Barenbaum, Nodine, 1988). In general, the persuasive discourse schema is thought to be more complex than the chronological order of typical narrative schema (Crowhurst, 1990). However, both genres require an understanding of their typical features. Moreover, the facility with which students structure their narrative and persuasive texts increases over time.

Persuasive writing is considered one of the most complex and cognitively demanding genres because persuasive texts are highly organized and require the student to use hierarchical thinking (Westby & Clauser, 1999). The structure of a persuasive text includes: introduction of an argument, presentation of reasons and support, consideration counter arguments and presentation of refuting evidence, conclusions, and an overall attempt to influence the reader to adopt writer's point of view (Midgette, Haria & MacArthur, 2008; Westby & Clauser, 1999).

The acquisition of a mature understanding of the persuasive discourse schema develops over time. Young children can generally state their opinion on the topic, but the texts of these writers may resemble a *logic chain*, that is, their texts may be simply a

related series of ideas (Westby & Clauser, 1999). Conversely, by about age 12 years, students are beginning to develop a basic persuasive schema, in that they can introduce an argument, express their opinions and support them with reasons (Westby & Clauser, 1999). For example, Midgette et al. (2008) demonstrated that eighth graders, compared to fifth graders, were more successful at including the elements of persuasive writing in their essays. On the other hand, an elaborate argumentation structure is generally acquired around the age of 15 or 16 years (Westby & Clauser, 1999). Older students create more complex persuasive texts using logical, inductive/deductive argumentation that relates to the overall topic or theme of the text. Consequently, the persuasive texts of older adolescents are generally seen as more capable of influencing readers (Westby & Clauser, 1999).

In comparison, the basic narrative schema includes six elements ordered sequentially:

(a) a beginning: an initiating event for the protagonist's reaction;

(b) a simple reaction: the protagonist's emotional and/or cognitive reaction;

(c) a goal: the protagonist's intentions in terms of dealing with the initiating event;

(d) an attempt: protagonist's attempt to achieve the goal;

(e) an outcome: the result of the attempt; and

(f) an ending: the characters' reactions to the outcome and/or the long term consequences of the events (Genereux & McKeough, 2007; McKeough & Genereux, 2003; McKeough, Genereux & Jeary, 2006).

This basic narrative schema is often mastered between the ages of 6 and 8 years, yet narratives can have differing levels of complexity (Genereux & McKeough, 2007; McKeough, Palmer, Jarvey, & Bird, 2007). For example, by 10 years, students' narratives might include additional failed attempts before the protagonist ultimately reaches his/her goal (McKeough et al., 2006). Whereas, by 14 years, the students' narratives become even more complex in that they may reference two central conflicts: an external conflict between people and internal struggle between opposing inner goals, drives or traits. Consequently, the assessment of narrative structure and organization has been shown to be sensitive to both differences in age and ability (McKeough & Genereux, 2003; Wolf-Nelson & Van Meter, 2007). Brown and Klein (2011) demonstrated that adults with HFASD wrote narrative texts that were more poorly structured (*d* = 0.9 SD) compared to their non-disabled peers.

Background information. In contrast to text structure, the features of appropriate background information tend not to change with text genre. Background information refers to whether or not the student was able to give the reader enough detail and explanation to understand the text. However, it is important to note that the extent of the student's knowledge about a topic, as well as her age, greatly influences the student's ability to provide detail and elaboration (Westby & Clauser, 1999). Young writers tend to include minimal or limited description and elaboration as well as extraneous or misleading information in their texts (Westby & Clauser, 1999). Over time, students can learn to include rich elaboration of the topic in addition to providing vivid descriptive details of setting, character and events in their written texts.

Balance between landscapes (of action and consciousness). Narratives unfold simultaneously on two levels: (a) the *landscape of action*, which defines the physical events within the story; and (b) the *landscape of consciousness,* that is, the characters' perceptions of those events, or what the characters in the story know, think, or feel (Bruner, 1986; Westby & Clauser, 1999). Very young children write stories that involve physical events and states linked in simple sequence (Genereux & McKeough, 2007). Their narratives have "a sequence of temporally, causally, or referentially related actions and events that occur exclusively in the physical world" (McKeough et al., 2007, p. 60). By 6 years, children's writing includes explicit or implicit reference to the mental states that motivate action (McKeough et al., 2007), a transition that signals the beginning of the integration of the *landscape of consciousness* with the *landscape of action*. In order to help create the *landscape of consciousness,* adjectives referring to emotions and metacognitive verbs (e.g., think, guess, plan, remember) begin to be used (Westby & Clauser, 1999). By age 10 years, their narratives begin to display an *intentional* understanding of human action, that is, an understanding that immediate feelings, thoughts and goals of a character motivate the character's actions (Genereux & McKeough, 2007). By adolescence, students give more explicit commentary on the inner nature of the characters and they begin to take a meta-position on mental states. In other words, their stories involve *interpretative* states, i.e., reflection on the internal experiences of characters and an attempt to interpret their psychological significance (McKeough & Genereux, 2003). By late adolescence, skilled narrative writers are able to

combine and resolve both the internal and external struggles of characters and their stories create a masterful balance between landscapes (Genereux & McKeough, 2007).

Character development. Very young children's initial attempts at crafting stories usually contain one or two flat, static characters and the relationships between the characters are mostly action driven (Wolf & Gearheart, 1994). By age 8 to 10, their narratives usually include characters whose multiple *intentional* states motivate the action of the story. As well, their texts begin to include evidence that the characters change and grow as a result of events throughout the story (McKeough et al., 2007). By 12 to 14 years, characters have mental states and traits that last across time and situations, such as loneliness or extroversion (McKeough & Genereux, 2003). Also at this time, student writers start to interpret why characters hold particular mental states, which allow the students to compose stories that have characters with particular psychological profiles (McKeough & Genereux, 2003). As well, students tend to add additional enduring traits/states, such as contrary tendencies in same character, to create an internal psychological conflict (Genereux & McKeough, 2007). By late adolescence, skilled narrative writers place more emphasis on interpreting the underlying meaning of acts and experiences of characters, make inferences about character's dispositions and offer psychological explanations for behaviours (Genereux & McKeough, 2007). As well, the narratives of skilled writers demonstrate that growth occurs as a result of the complex interactions between characters (Wolf & Gearheart, 1994).

Tone. In order for argumentative writing to be persuasive, the text must have an appropriate tone. If the tone of the text is off-putting, it increases resistance in the reader and alienates those the writer hopes to persuade (Midgette et al., 2008). Thus, it is important in persuasive writing to be considerate of the intended audience. An appropriate tone often includes the use of respectful and/or formal language, markers of politeness, and hedges, such as, *it could be* or *I think that*, which indicate narrator uncertainty and, thus, multiple possible interpretations or perspectives of an event (Losh & Capps 2003; Midgette et al., 2008). As well, it is important that the author takes the topic seriously, shows interest and commitment to the topic, and has mature arguments. In contrast, a text that has a tone that is rude, angry, harsh, narrow-minded, arrogant, whiney, lifeless or mechanical would generally be considered a text that fails to persuade.

Choosing *good* writing measures is essential to the success of the current dissertation research. Research suggests that *good* writing measures capture change as children and adolescents mature and differentiates between students with and without written expression weaknesses (Wolf-Nelson & Van Meter, 2007). However, individuals with HFASD are not, by definition, poor writers and thus writing measures that differentiate between children with writing disabilities and those without may not necessarily distinguish between written texts of individuals with HFASD and their TD peers. Given the lack of research examining their written expression skills in any detail, hypotheses were generated about how autism might impact written expression in order

to guide the choices of both higher and lower-order measures to use in the current studies.

Why might HFASD lead to Weaknesses in Written Expression?

If the texts of people with HFASD are less well-written than those of their TD peers, it raises the question of how features of autism might lead to writing deficits. Two theories exist to explain why individuals with HFASD have problems communicating and interacting in the social world: Impaired Social Cognition and Weak Central Coherence. Although much research has investigated the plausibility of both of these accounts, there have been inconsistent results and continued debate. The present dissertation research adapted these theories for writing, and sought to explore which of these explanations may be most likely.

One domain that is thought to be critically impaired in individuals with HFASD is social cognition. It has been demonstrated that individuals with HFASD struggle to understand mental states (such as beliefs, desires, intentions) as applied both to themselves and to others, a phenomenon often referred to as poor *theory of mind* (ToM; Baron-Cohen, Leslie & Frith, 1985; Tager-Flusberg, 2007). One of the major consequences of a limited ToM is believed to be difficulty envisioning the perspective of others (Colle, Baron-Cohen, Wheelwright, & van der Lely, 2008; Tager-Flusberg, 2007). Further to this, individuals with HFASD tend to: (a) have limited social knowledge; (b) lack intuitive knowledge of social behaviour; (c) have difficulties comprehending the social world; and (d) be unaware of rules that govern social actions (Baron-Cohen et al., 1985; Bowler, 1992).

The original research into the ToM of individuals with autism involved the use of false belief tasks, which required the participant to distinguish between the real world and another person's false representation of the world (Baron-Cohen et al., 1985; Tager-Flusberg, 2007). In the Baron-Cohen et al. study, 20 children with AUT and IQs ranging from 70 to 108 were asked to complete the Sally-Anne task. In this task, Sally places a marble in a basket and then leaves the room. While she is gone, a second girl moves the marble. Sally returns and participants are asked the belief question, "Where will Sally look for the marble?" While 85% of TD preschoolers and 86% of children with Down's syndrome passed the belief question, 80% of the children with AUT failed it (Baron-Cohen et al., 1985). Despite this, traditional false-belief tasks are generally not sensitive to the perspective-taking deficits in adolescents and adults with HFASD (Bowler, 1992; Happé, 1994; Kaland, Callesen, Møller-Nielsen, Mortensen & Smith, 2008), and the research examining more complex perspective-taking tasks in the HFASD population has produced mixed results.

In a study by Volden, Magill-Evans, Goulden and Clarke (2007), individuals with HFASD and their TD peers, aged 6 to 16 years, were asked to describe how to go to a restaurant to four puppet listeners: an adult, a baby, a peer and non-native speaker. They found that participants with HFASD *were* able to spontaneously simplify their language to listeners who were less linguistically competent, but that they did so with less skill than controls, and individuals with HFASD tended to add more tangential information. This study and others like it (cf., Begeer, Malle, Nieuwland & Keysar, 2010; Volden & Sorenson, 2009) suggest that individuals with HFASD have some awareness

and appreciation of listener's needs and that, in some experimental contexts, they have shown the ability to take the perspective of another. In contrast, on other experimental tasks, such as the Social Attribution Task and the Strange Stories Test, individuals with HFASD typically perform more poorly than peers (Happé, 1994; Klin, 2000).

The Social Attribution Task (SAT) assesses participants' ability to spontaneously attribute social meaning to ambiguous visual stimuli. Klin (2000) asked 20 adolescents and adults with HF-AUT, 20 participants with AS, and 20 non-disabled controls to watch a sixty second video of two triangles and a circle moving within and around a large rectangle. The shapes in the video move together, against one another and in response to the action of another shape. The goal of the task is to assess the facility with which participants spontaneously search for social meaning in the visual stimuli (Klin, 2000). Across all SAT indices, individuals with HF-AUT and AS were less likely to attribute social meaning to the movement of the shapes compared to controls.

Although the extent of the deficits in ToM is not well defined, many researchers suggest that a majority of individuals with HFASD have difficulty understanding minds. In terms of writing, ToM deficit might underlie writing problems of students with HFASD because they may not realize the importance of making their writing comprehensible to the reader (perspective-taking) and/or their writing may reflect the difficulties these students have with comprehending the social world. As a result, their texts may have a lack of background information or context, and a lack of explicit connections that lead the reader through the text (Colle, Baron-Cohen, Wheelwright, & van der Lely, 2008; Loveland, McEvoy, Tunali & Kelley, 1990). Secondly, their decreased social knowledge

could affect the ability of students with HFASD to write about thoughts and feelings and particularly impact their narrative writing skills as the social and psychological aspects of their texts could be missing or atypical (Loveland et al., 1990). In the only study to date that has examined this directly, Brown and Klein (2011) found that ToM, as measured by the SAT, was indeed related to narrative and expository text quality.

It has been proposed that deficits in ToM could also lead to a style of writing called *writer-based prose.* This style of writing may result from the writer's failure to understand that the text must be organized so that the readers are better able to integrate facts and details into memory stores. As well, the ToM account predicts that *writer-based prose* may result when the writer assumes that the reader has the same knowledge that he does, a common problem with the perspective-taking aspect of ToM. For example, the writer may choose to use words and phrases that mean something to him, but could not be understood by the reader without an explanation.

The second theory is drawn from Frith's (1989) original conception of Weak Central Coherence (WCC), which proposed that persons with HFASD had impaired global processing skills, and that they experienced a relative failure to extract the gist or see the big picture in many situations. However, only one aspect of WCC, integrative processing, was of interest to the present dissertation. Integrative processing is the ability to combine disparate parts into a unified whole. Research has suggested that this integrative aspect of WCC does lead to difficulties achieving coherence in language-based tasks. For example, Joliffe and Baron-Cohen (1999; 2000) found that individuals with HFASD were less accurate than their TD peers at integrating words and sentences

into meaningful wholes, and that they had the most difficulty with items that placed the greatest demands on integration to achieve higher order meaning. The present dissertation set out to explore whether students with HFASD have difficulties relative to their peers with the tasks used by Joliffe and Baron-Cohen (1999; 2000) and whether integrative processing could explain writing strengths and weakness in this population.

In sum, a deficit in ToM suggests that individuals with HFASD do not understand that they need to meet the needs of readers. The integrative aspect of WCC suggests that they may understand the need to meet the needs of readers, but have troubles doing so. Perspective-taking alone will not allow a writer to create a well-structured text containing an integrated framework of ideas. Therefore, both ToM and integrative processing should be required to create quality texts.

Overview of the Three Studies Included in this Dissertation

Previous research investigating the academic achievement of individuals with HFASD shows widely disparate findings. It is valuable to examine how well students with HFASD, as a group, perform academically. Researchers, clinicians, and teachers need to know whether having HFASD predicts academic success or failure in order to develop effective interventions and supports. Moreover, demonstrating significant group level differences, despite the large heterogeneity within the population of individuals with HFASD, highlights important shared features or traits that characterize this highly diverse population. Thus, the first study in this integrated article-style dissertation:

(a) involved a meta-analysis to determine the size, direction, and consistency of differences between academic achievement scores and performance IQ (PIQ)

among individuals with HFHFASD, and to determine whether PIQs are discrepant from the normal mean.

(b) explored whether the effect sizes within each of five academic areas (written expression, reading comprehension, decoding, math computation, and math reasoning) and within PIQ scores are heterogeneous.

(c) described the range within which the predicted discrepancy between PIQ and academic achievement falls for any given sample of individuals with HFHFASD

(d) determined the extent to which language ability may predict variability in the discrepancies between academic achievement and PIQ across studies.

Gaining a better understanding of the learning profiles of individuals with HFASD is needed to provide accurate information to policy makers, teachers, parents and the general public, since this information impacts supports and services available to the HFASD population. This study sought to provide much needed empirical evidence about the academic performance of students with HFASD.

The second and third study focused on the written expression skills of children and adolescents with HFASD in more depth. Although much of the previous literature suggests that many students with HFASD struggle to write, this body of research has left several unanswered questions. To date, much of the quantitative assessment of the writing of people with HFASD has documented a global writing deficit, but has not explored the strengths and weaknesses in the written texts of *children and adolescents* with HFASD beyond standardized achievement tests. Descriptive studies evaluating the written texts of students with HFASD are necessary as they are a critical first step to

garnering evidence of a group's unique characteristics (Assouline, Nicpon & Dockery, 2011). Additionally, it is important to examine their writing in multiple genres as the features of autism may have a greater impact in some genres compared to others. Finally, Brown and Klein (2011) suggest that core oral language abilities and integrative processing (i.e., the ability to combine disparate parts into a unified whole) may be important variables to consider in evaluating written expression in HFASD.

Overall, the second and third study in this dissertation sought to examine how having HFASD may impact a student's ability to compose texts. This included determination of characteristic strengths and weaknesses in their written compositions and examination of which characteristics of the HFASD population might predict writing competence. More specifically, the second and third study examined the narrative and persuasive writing skills of adolescents with HFHFASD, respectively, and focused on the following objectives:

(a) To describe the narrative and persuasive texts of children and adolescents with HFASD compared to their TD peers on measures of length, syntactic complexity, lexical diversity, writing conventions, overall narrative clarity, overall narrative form and overall persuasive text quality.

(b) To determine if the persuasive writing of the group with HFHFASD resembled writer-based prose more so than their peers .

(c) To examine the impact of age, language ability, PIQ and social responsiveness on overall writing quality across groups.

Although much more research that examines the written expression skills of students with HFASD is needed, these two studies were conceived as an initial contribution to developing a better understanding of the development of narrative and persuasive writing in youth with HFASD. This, in turn, will help us to develop interventions where their abilities may need support. It is critical that students with HFASD have access to appropriate writing education to prepare them for later employment, which will in turn help them to achieve economic independence and allow them to contribute meaningfully to society.

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Chapter 2

Six Meta-Analyses Examining the Academic Achievement of Individuals with HFASD in Reading, Writing and Mathematics[3]

One of the most defining features of autism spectrum disorder (ASD) is variability, both across the spectrum and within each individual (Towgood, Meuwese, Gilbert, Turner, & Burgess, 2009). There are many possible sources of this heterogeneity. It may be that the "heterogeneity in ASD… is not simply due to noise or the complex unfolding of development, but is an unavoidable consequence of variation" (Happé, Ronald & Plomin, 2006, p. 1220) along the dimensions of social interaction, communication, and repetitive and stereotyped behaviours/interests. Heterogeneity might also be a consequence of multiple and differing comorbidities. For example, while all individuals with ASD have pragmatic deficits (De Villiers, Stainton & Szatmari, 2007), only a subgroup of individuals with ASD have a pattern of difficulties consistent with specific language impairment (SLI), that is, protracted development of grammar, phonology and vocabulary (Kjelgaard & Tager-Flusberg, 2001; Lindgren, Folstein, Tomblin & Tager-Flusberg, 2009). As well, it has been estimated that approximately half of individuals with ASD have co-morbid intellectual impairments, i.e., IQ < 70 (Charman, Pickles, Simonoff, Chandler, Loucas et al., 2011); whereas the rest of individuals with ASD have average to above average intellectual functioning and will be referred to as having high functioning autism spectrum disorder (HFASD).

[3] A version of this chapter will be submitted for publication as follows: Brown, H.M., Oram Cardy, J., Johnson, A.M., & Archibald, L.M.D. (*in preparation*). Six meta-analyses examining the academic achievement of individuals with HFASD in reading, writing and mathematics. *Research in Autism Spectrum Disorders.*

Despite the heterogeneity in the HFASD population, it is still of interest to examine how well students with HFASD, as a group, perform academically. Researchers, clinicians, and teachers need to know whether having HFASD predicts academic success or failure in order to develop effective interventions and supports. Similarly, it is important to understand whether having a diagnosis of HFASD predicts that a student will have a particular academic profile. Given the heterogeneity across the spectrum, it may not be appropriate to use a diagnosis of HFASD alone to predict school performance. However, previous research has shown that a diagnosis of HFASD generally predicts that most of these students will struggle with reading comprehension (Brown, Oram Cardy, & Johnson, 2013; Jones, Happé, Golden, Marsden, Tregay et al., 2009). Thus, the examination of group level differences can be useful, because the emergence of significant findings *despite* the large heterogeneity within the sample with HFASD exemplifies the power of the results.

Many studies have begun to examine the question of whether there are differences between intelligence and academic achievement in individuals with HFASD, since intelligence is a strong predictor of school performance in typically developing (TD) populations (Neisser et al., 1996). For example, a recent meta-analysis by Chiang and Lin (2007) examined standardized mathematics achievement across eight studies, nine samples and 332 participants with HFASD. However, it is important to note that these researchers did not distinguish whether the studies included in the meta-analysis measured math computation, math reasoning or both. Their analysis found a small (d = -0.3), albeit reliable difference between math achievement and full-scale IQ (FSIQ),

suggesting that FSIQ is a strong predictor of math achievement for individuals with HFASD.

In contrast, other studies of individuals with HFASD reported quite large differences between IQ and achievement. For example, Estes, Rivera, Bryan, Cali and Dawson (2011) reported that 90% of their participants with HFASD demonstrated a discrepancy between their expected and actual achievement in at least one of spelling, decoding or math computation. However, inspection of the regression lines plotted on Estes et al.'s (2011) figure comparing academic achievement against full-scale IQ (FSIQ) suggests that intelligence predicts achievement fairly well (see p. 1048). Jones et al. (2009) created subgroups within their sample of 99 individuals with ASD, whose FSIQ ranged from 50 to 119, by comparing each student's FSIQ to decoding skill and then to math computation skill. Six groups resulted: math peak, math dip, reading peak, reading dip, students with no discrepancy between FSIQ and decoding, and students with no discrepancy in math computation and FSIQ. Similar to Estes et al., the authors reported that "73% of the sample had at least one area of literacy or mathematical achievement that was highly discrepant (approximately 14 standard score points) from full-scale IQ" (p. 718). However, they also found that most students with ASD demonstrated no discrepancy between FSIQ and decoding (75%), or between FSIQ and each of math computation and math reasoning (77%). Therefore, it is possible that the IQ/achievement discrepancies described for individuals with HFASD are less dramatic or common than currently reported in the literature. As such, these meta-analyses

examined whether or not academic achievement was generally in accordance with intelligence across students with HFASD.

Oral language skill is also an important predictor when assessing the academic skills of individuals with HFASD. As mentioned previously, researchers have identified language-ability subgroups within the HFASD population. Across several studies, it has been found that there is a subgroup of individuals with HFASD who have a language profile typical of those with SLI, and a second subgroup of individuals with HFASD who have grammatical, phonological and vocabulary skills within the normal range (Bennett, Szatmari, Bryson, Volden, Zwaigenbaum, et al., 2008; Kjelgaard & Tager-Flusberg, 2001; Lindgren, Folstein, Tomblin & Tager-Flusberg, 2009).

Language has also been shown to be a strong predictor of academic achievement. For example, Johnson, Beitchman, Young, Escobar, Atkinson et al. (1999) conducted a longitudinal study of a community sample of children with and without speech and/or language impairments. In terms of academic achievement, TD children and children with only articulation impairments significantly outperformed children with language impairments on measures of reading, spelling and mathematics (Johnson et al., 1999) and on measures of passage comprehension (Johnson, Beitchman, & Brownlie, 2010). Furthermore, semantic knowledge, one aspect of language ability, has been shown to predict the reading comprehension skills of individuals with HFASD (Brown et al., 2013). Thus, it is of interest to determine the extent to which language skill predicts the size of the discrepancy between academic achievement and intelligence across individuals with HFASD.

The current study examined whether or not, academic functioning is generally in accordance with nonverbal IQ (NVIQ) across five academic areas: reading comprehension, decoding, written expression, math computation and math reasoning. NVIQ was chosen over FSIQ and verbal IQ because language impairments are common in HFASD (Eigsti, de Marchena, Schuh & Kelley, 2011) and can compromise VIQ and resultant FSIQ scores. Thus, NVIQ may be a more pure measure of intellectual ability for individuals with HFASD. Further, to avoid circularity, it was of interest to examine whether NVIQ was generally lower in individuals with HFASD across all samples included in these analyses. Finally, oral language skill was examined to see if it accounted for additional variability in any NVIQ/achievement discrepancies in these meta-analyses.

Aims

1. To use meta-analysis to determine the size, direction, and consistency of differences between academic achievement scores and NVIQ among individuals with HFASD, and to determine whether NVIQs are discrepant from the normal mean.
2. To explore whether the NVIQ/discrepancy scores are heterogeneous within each of five academic areas (written expression, reading comprehension, decoding, math computation, and math reasoning) as well as within the standardized mean differences between the HFASD group and controls in terms of NVIQ.
3. To describe the range within which the predicted discrepancy between NVIQ and academic achievement falls for any given sample of individuals with HFASD.

4. To determine the extent to which language ability may predict variability in the achievement/NVIQ discrepancy scores.

Method

The current study examined five areas of academic achievement: Reading Comprehension, Decoding, Math Computation, Math Reasoning, and Written Expression. Standardized tests of reading achievement often included both decoding ability (i.e., the ability to read and identify letters, words, and/or nonwords) and reading comprehension skill, which generally required participants to read sentences or a short text and then to use their understanding of what they read to complete some task (Brown et al., 2013). Standardized mathematical achievement tests usually covered two main areas of mathematical ability: math computation skills (that is, the ability to perform math calculations) and math reasoning skills (i.e., the ability to read a math word problem, recognize the procedure necessary to solve the problem and then perform the calculations; Woodcock, McGrew & Mather, 2001). Finally, written expression was assessed in most cases by analyzing the texts students wrote in response to a given prompt, often a detailed picture (Woodcock et al., 2001).

To determine whether, on the whole, groups of individuals with HFASD have mean academic achievement scores that are in accordance with their intellectual functioning, their achievement scores were compared to NVIQ. The focus of this comparison was not to detect learning disabilities per se, but rather to investigate relative strengths and weaknesses. Nevertheless, it was of interest to indicate whether the discrepancy scores between achievement and intelligence would be clinically

meaningful in the sense that the student with HFASD would be seen by various professionals as having a weakness in that academic area. Thus, a *clinically significant discrepancy* will refer to a common definition used to identify learning disabilities where differences of one standard deviation or more between academic achievement and intelligence are considered to reflect a clinically meaningful discrepancy (Learning Disabilities Association of Ontario, 2003).

Four computerized databases (PsycINFO, ERIC, Scopus, and Proquest Theses and Dissertations) were searched for relevant articles using several combinations of the following keywords: autism, autistic disorder, autism spectrum disorder, Asperger syndrome, Asperger's disorder, academic achievement, academic profiles, mathematics, problem solving, math reasoning, arithmetic, computation, reading comprehension, word decoding, literacy, single word reading, word recognition, hyperlexia, writing skill, written expression, and written composition. Articles were included in the meta-analysis if they met a set of predetermined criteria. The studies must have included: (i) participants on the autism spectrum; (ii) a standardized measure of academic achievement in one of the five areas; (iii) a measure of NVIQ; (iv) a measure of language ability; (v) original empirical data; and (vi) means, standard deviations, and sample sizes. The number of studies examined for each academic area ranged from four to fourteen studies and 200 to 574 participants per academic area. Detailed information about the number of studies, samples and participants included in each analysis can be found in Table 2.1. The following articles were included in one or more of the five analyses: Åsberg, Kopp, Berg-Kelly and Gillberg, 2010; Ashcraft-Bills, 2009; Foley-Nicpon,

Assouline & Stinson, 2012; Goldstein, Beers, Siegel & Minshew, 2001; Goldstein, Minshew and Siegal, 1994; Griswold, Barnhill, Smith-Myles, Hagiwara & Simpson, 2002; Heavey, Phillips, Baron-Cohen & Rutter, 2000; Jones, 2007; Jones et al., 2009; Lindgren et al., 2009; Mayes and Calhoun, 2003; Mayes and Calhoun, 2008; Minshew, Goldstein, Taylor and Seigel, 1994; Nation, Clarke, Wright and Williams, 2006; Reitzel and Szatmari, 2003; Smith-Myles, Simpson & Becker, 1994; and Smith-Myles, Huggins, Rome-Lake, Hagiwara, Barnhill, et al., 2003. The coding system had four categories consisting of: (a) sample sizes for each group and/or sample size of the normative group for a given standardized measure, (b) academic achievement scores, (c) NVIQ, and (d) language ability, which was generally a measure of receptive vocabulary using pictures or orally presented words.

Statistical Analysis

The standardized mean discrepancy (SMD) score represented the standardized difference between NVIQ and academic achievement scores. The Grand SMD is the overall summary effect and broadly similar, conceptually, to the mean of all the standardized mean differences (SMDs) in the analysis. Given the known heterogeneity of the HFASD population, the six meta-analyses completed in this study were run under a random effects model, which assumed that the SMDs vary from study to study (Borenstein, Hedges, Higgins & Rothstein, 2009). Under this model, the *Z*-test determined whether the Grand SMD was reliably different from zero. The *Q*-Test tested the heterogeneity of SMDs and indicated whether or not the variation in SMDs was due to random error. In other words, a significant *Q*-test suggested that the amount of

Table 2.1.

Summary of the Number of Studies, Samples and Participants Included in the Analysis for each Academic Area

Academic Area	Number of Studies	Number of Samples	Total Number of Participants
Reading Comprehension	13	20	538
Decoding	14	21	574
Math Reasoning	4	8	210
Math Computation	8	13	392
Written Expression	7	8	200

"total variance is more than we would expect based on within-study error" (Borenstein et al., 2009, p. 191). The *Q*-test is also described by two statistics: I^2 and Tau^2 (T^2; Borenstein et al., 2009). I^2 explained what proportion of the variance was real and not simply due to random error. In contrast, T^2 quantified the amount that the SMDs varied from one study to the next and was used to quantify a confidence interval determined by the formula: Prediction Interval = SMD ± 1.96*(Tau) (Borenstein et al., 2009). This prediction interval (PI) represents the range in which the SMDs would fall, if we had been able to test every single person diagnosed with HFASD. In other words, the prediction interval tells us that if we randomly chose one individual with HFASD, or a sample of individuals with HFASD, we would predict that the individual, or the group, will have a discrepancy score between academic achievement and NVIQ that will fall within that interval. All of these analyses were completed using the Comprehensive Meta-Analysis (CMA) computer program (Borenstein et al., 2005).

The Hedge's g standardized mean difference comparing NVIQ between the HFASD group and TD controls was calculated for each study; however, there were some methodological challenges in computing these differences. For example, many studies reported only the standardized NVIQ score for individuals with HFASD and did not include a control group. In these cases, in order to satisfy our requirement for the mean, standard deviations and sample sizes for both HFASD and control groups, the control group's mean and standard deviation were assumed to be 100 and 15, respectively, and the sample size was the reported sample size used to norm the standardized test. For example, Jones et al. (2007) gave participants with ASD the *Wechsler Abbreviated Scale of Intelligence* (WASI; Wechsler, 1999), which was normed on 1,100 children and 1,145 adults (Lindskog & Smith, 2001). Therefore, the standardized mean difference for this study was calculated using a control sample size of 1,100 and an HFASD sample of 99.

Hedge's *g* SMDs were also calculated by comparing NVIQ to each of decoding, reading comprehension, math computation, math reasoning, written expression and language ability. It is important to note that the moderator variable, language ability, was converted to the Hedge's *g* SMD in comparison to NVIQ in order to avoid losing valuable information about which samples of individuals with HFASD also had language skills that were in accordance (or not) with their NVIQ. It was felt that this Hedge's *g* language score was a more accurate representation of whether the language skills of each sample were weak, average or strong.

***Publication bias*.** There is a potential for publication bias to impact the outcome of a meta-analysis because studies with findings that are significant are published more

often than those that find null results. In addition, a disproportionate number of small studies with large effects tend to be published along with fewer larger studies showing moderate effects (Borenstein et al., 2009). These phenomena can bias the summary effect in a meta-analysis. In an a priori attempt to offset publication bias, studies published in grey literature were located, primarily theses and dissertations. As well, post-hoc analyses were conducted to determine the degree of impact that potential publication bias may have had on grand SMDs. First, funnel plots were created. These plots tested the extent to which studies conformed to a priori expectations as to what would happen in the absence of publication bias (i.e., were the studies distributed symmetrically about the Grand SMD?), per the recommendations of Borenstein et al. (2009). When publication bias was present, however, it was important to estimate the impact of this bias using Duval and Tweedie's trim and fill procedure (Borenstein et al., 2009). This procedure forced the funnel plot to become symmetrical by imputing the missing studies to the plot and then computing the best estimate of the unbiased SMD (Borenstein et al., 2009). The second method used to estimate publication bias was Rosenthal's Fail-safe N, which computed the number of studies that would be needed to be incorporated into the meta-analysis to nullify the grand SMD or, in other words, the number of studies that would need to be added to make the grand SMD essentially zero (Rosenthal, 1995).

Results

Nonverbal IQ

Many of the studies included groups of individuals with HFASD who tended to have lower NVIQs than their TD peers (g = -0.1 SD), but the overall effect was essentially zero (SE = 0.16, Z = -0.726, p = .47) (see Figure 2.1). The precision interval for the Grand SMD was -0.4 SD to +0.2 SD with the most frequent SMDs falling between -0.5 SD and zero (see Figure 2.2). The test for heterogeneity suggested that for any given sample of individuals with HFASD, we would expect their Grand SMD to fall between -1.5 SD and +1.3 SD, $Q(23) = 303.45$, $I^2 = 92.42$, $p < .001$. Thus, when sampling individuals with HFASD, some samples will show deficits in NVIQ compared to controls, whereas others will have NVIQs in the normal range.

Duval and Tweedie's trim and fill analysis imputed five studies, providing some evidence of publication bias in the studies analyzed (see Figure 2.3). The original estimate for the Grand SMD for the NVIQ analysis was g = -0.1 SD; yet the unbiased estimate was g = +0.1 SD. However, this change had little substantive implications. Overall, across all of the academic achievement studies included in this meta-analysis, a diagnosis of HFASD was not generally associated with lower NVIQ.

Literacy

***Reading*.** The performance of individuals with HFASD on reading comprehension measures was slightly lower than their expected performance based on their NVIQ; however, there was no difference between expected and actual performance in the area

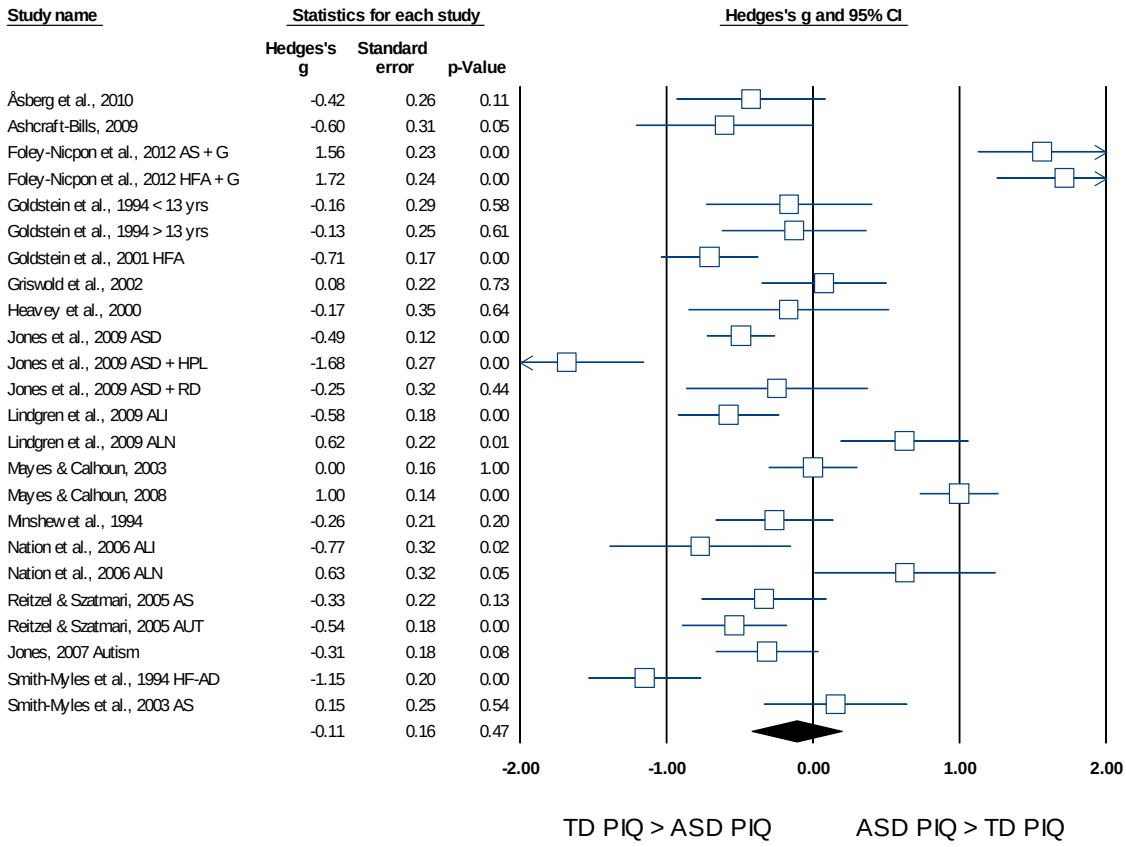

Figure 2.1. Standardized mean differences in NVIQ between groups with HFASD and controls.

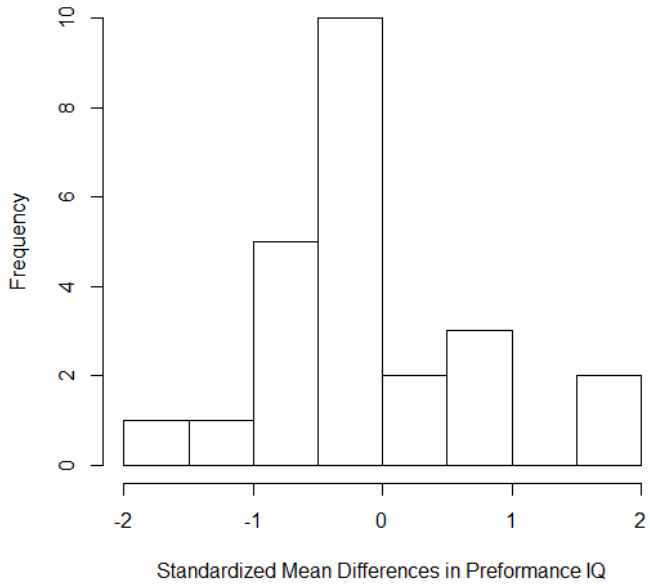

Figure 2.2 Frequencies of SMDs between HFASD and control groups.

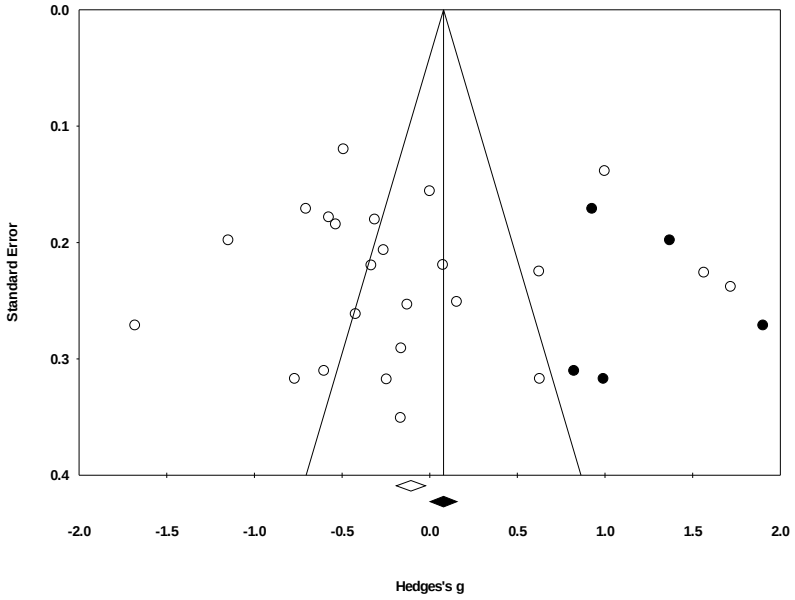

Figure 2.3. Funnel plot for NVIQ analysis.

of decoding. The Grand SMD for reading comprehension was *g* = -0.4 SD (*SE* = 0.10, *Z* = -4.14, *p* < .001), which is a reliable difference, but not a clinically significant discrepancy. In comparison, the Grand SMD for decoding was not reliably different from zero (*SE* = 0.12, *Z* = 0.04, *p* = .97) (see Figures 2.4 and 2.5). These findings suggest that when the reading skills of individuals with HFASD are assessed using standardized measurements of achievement, their abilities are generally in accordance with their PIQ.

The heterogeneity analysis predicted the range of discrepancy scores that we would expect to find between each of reading comprehension and decoding compared to PIQ for any given sample of individuals with HFASD. The prediction interval for the range of discrepancies between reading comprehension and PIQ was PI_{RC} = -1.0 SD to +0.2 SD, *Q*(19) = 45.13, I^2 = 57.90, *p* = .001. This prediction interval showed that while

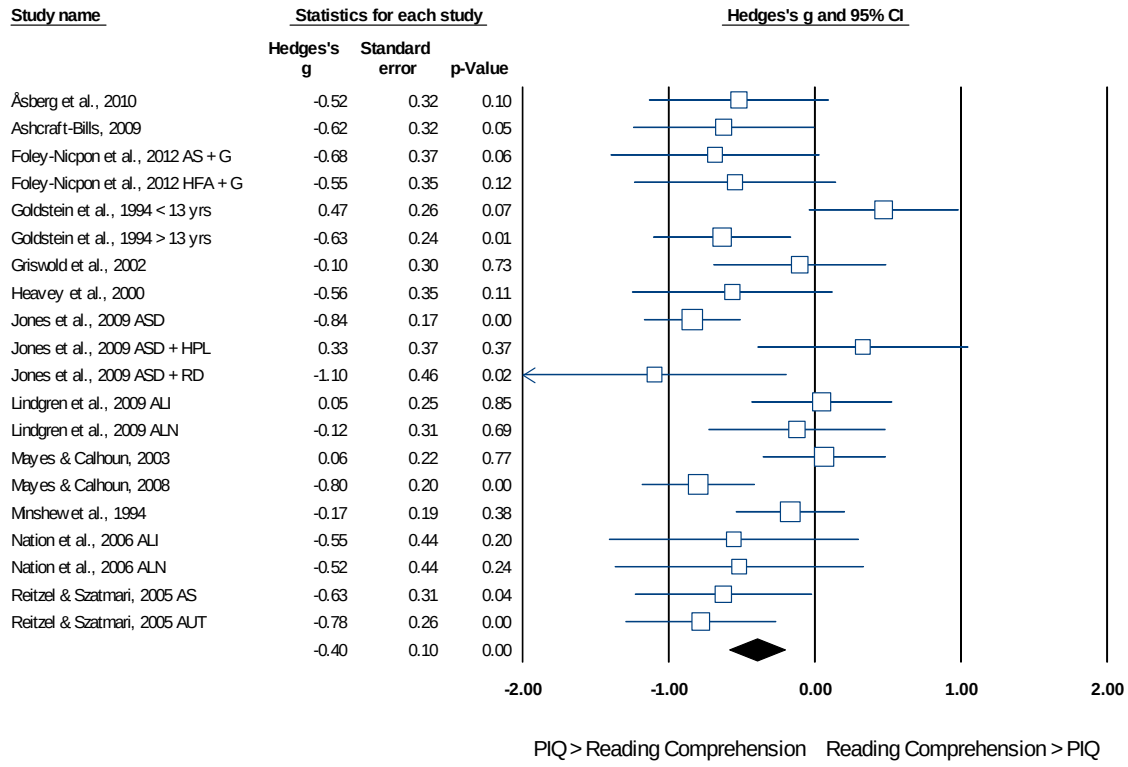

Figure 2.4. Discrepancy scores (SMDs) between reading comprehension and NVIQ.

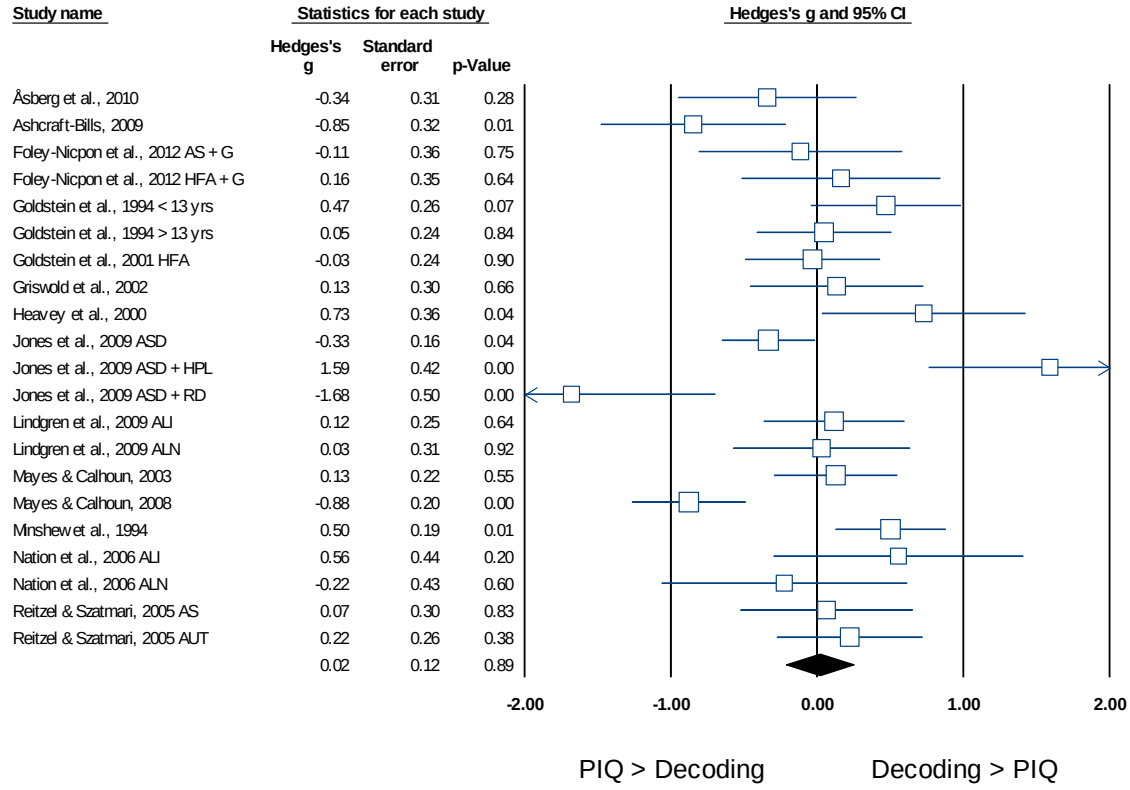

Figure 2.5. Discrepancy scores (SMDs) between decoding and NVIQ.

any given sample of individuals with HFASD is unlikely to have stronger reading comprehension skills than predicted by their NVIQ, their negative discrepancy scores are unlikely to be considered a clinically significant discrepancy as they are predicted to fall within one standard deviation of their NVIQ.

In comparison, the prediction interval for decoding was PI_{DC} = -0.7 SD to +1.1 SD, $Q(20) = 71.68$, $I^2 = 72.10$, $p < .001$. Given that the prediction interval is essentially symmetrical around zero, samples of individuals with HFASD are as likely to have higher than expected scores on tests of decoding as they are to achieve lower than expected scores (as indicated by NVIQ). Furthermore, since the discrepancy scores at both ends of the distribution fall within approximately ± one SD, it is likely that very few individuals with HFASD have clinically meaningful discrepancies in decoding ability.

Written expression. There was a modest and reliable difference between written expression scores and NVIQ scores, in that the Grand SMD was g = -0.6 SD (SE = 0.26, Z = -2.11, p = .04) (see Figure 2.6). This finding suggested that, overall, individuals with HFASD were performing more poorly than expected on standardized measures of written expression, but the discrepancy was modest and not clinically meaningful. Further, there was significant heterogeneity in the discrepancy scores, Q(7) = 44.67, I2 =84.33, p < .001, and it was predicted that the discrepancy scores would fall between PI_{WE} = -1.3 SD to +0.8 SD for any given sample of individuals with HFASD. This prediction interval suggests that some individuals or groups of individuals with HFASD will demonstrate more difficulty writing than would be expected by their NVIQ; yet there are

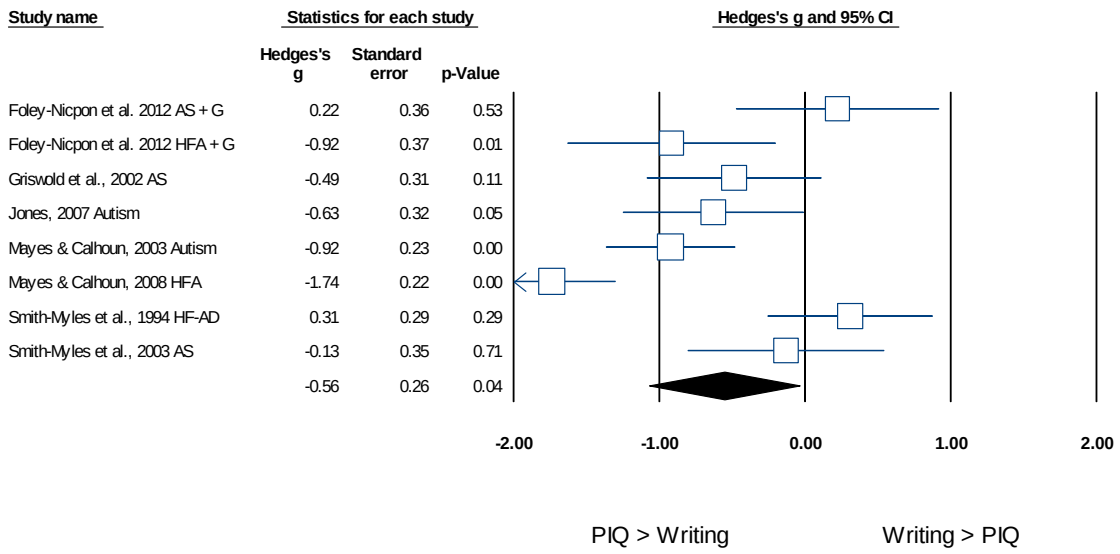

Figure 2.6. Discrepancy scores (SMDs) between written expression and NVIQ.

other samples that write better than might be expected. In addition, the bottom of the prediction interval was greater than -1 SD suggesting that some samples of individuals with HFASD will have clinically meaningful discrepancies in written expression.

Numeracy

Similar to the findings on reading above, both math reasoning and math computation skills were generally in accordance with NVIQ. The Grand SMD for math reasoning scores compared to NVIQ scores was *g* = -0.2 SD (SE = 0.16, *Z* = -1.20, *p* = .231), which was not significantly different than zero (see Figure 2.7). Comparably, the grand SMD for math computation was *g* = -0.4 SD (*SE* = 0.16, *Z* = -2.73, *p* < .005), which is a reliable difference, but not a clinically meaningful discrepancy (see Figure 2.8). Thus, for both literacy and numeracy skills (as assessed by standardized academic achievement tests), the abilities of the HFASD group seem to generally be in accordance with their NVIQ.

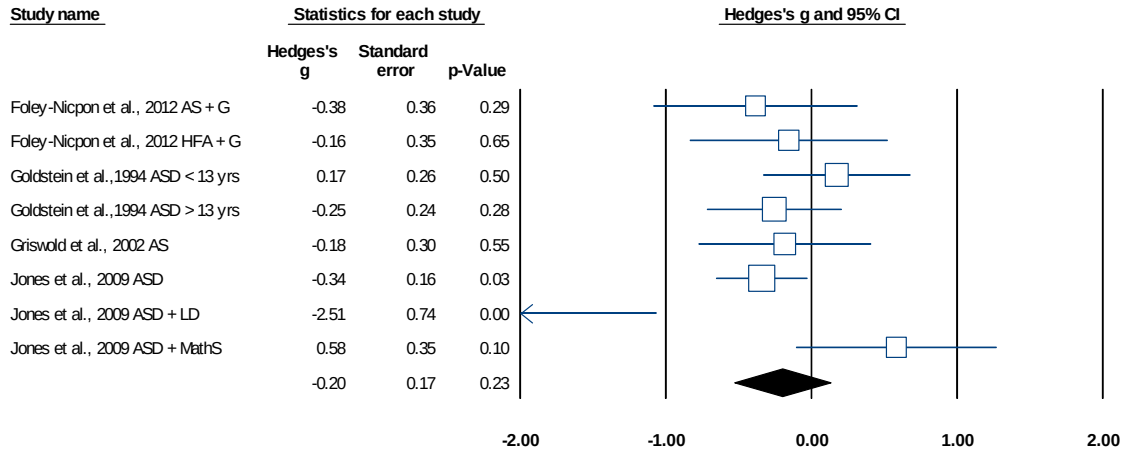

Figure 2.7.Discrepancy scores (SMDs) between math reasoning and PIQ.

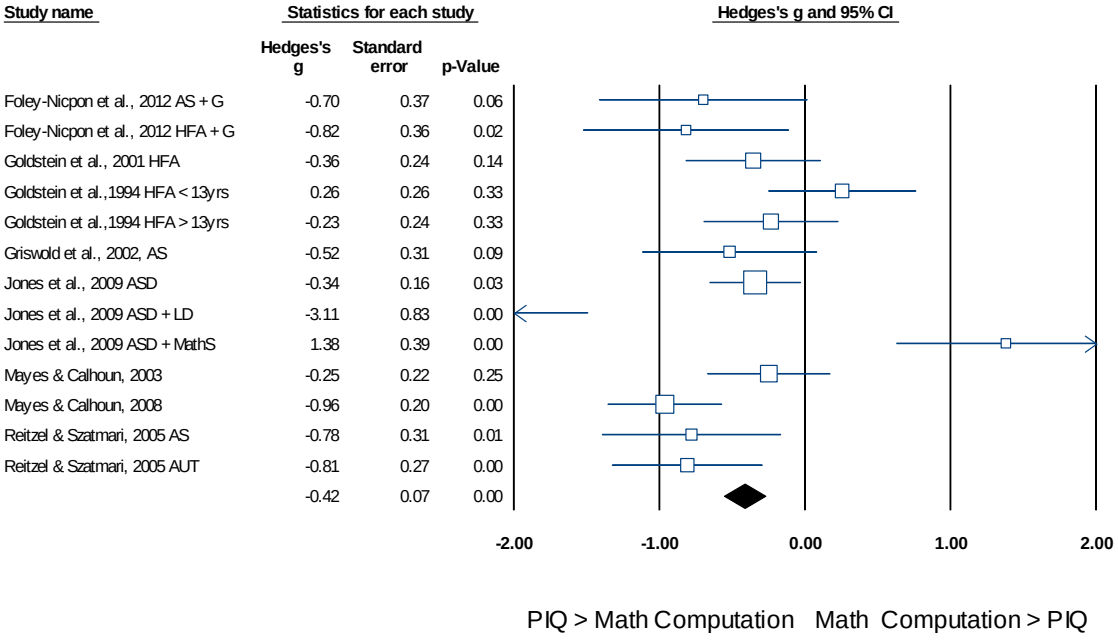

Figure 2.8 Discrepancy scores (SMDs) between math computation and PIQ.

The range of discrepancies in scores for each of math computation and math reasoning compared to PIQ were heterogeneous, $Q(12)_{MC} = 53.20$, $I^2=77.44$, $p < .001$ and $Q(7)_{MR} = 17.88$, $p = .01$. The prediction intervals were PI_{MC} = -1.4 SD to +0.5 SD for math computation and PI_{MR} = -0.9 SD to +0.5 SD for math reasoning. The prediction interval for math computation suggests that some individuals with HFASD have clinically significant discrepancies in this area. In contrast, it would seem that few samples of individuals with HFASD will have clinically significant discrepancies in math reasoning.

Publication Bias

Duval's and Tweedie's trim and fill procedure was used to assess evidence of publication bias in the meta-analysis for each academic variable (see Table 2.2). Further to this, the Fail-safe N analysis suggested that 199 studies needed to be found to nullify the SMD found in the analysis of reading comprehension (Z = -6.48, p < .0001), 64 studies for written expression (Z = -5.85, p < .0001), three studies for math reasoning (Z = -2.25, p = .02), and 103 studies for math computation (Z = -5.83, p < .0001) (Rosenthal, 1995).

Predicting Academic Achievement from Language Scores

Before discussing the results of the meta-regression of language ability on discrepancy scores for each academic area, it is important to note that while Jones et al. (2009) reported academic achievement scores compared to FSIQ for three subgroups (the non-discrepant group, the peak group and the dip group), they only reported language ability for the entire sample, rather than for each subgroup. Within the

Table 2.2.

Assessment of Bias using Duval's and Tweedie's Trim and Fill Procedure

Academic Area	Number of Studies Imputed	Direction	Original Estimate of the SMD	Unbiased Estimate of the SMD
Reading Comprehension	0	NA	g = -0.4	g = -0.4
Decoding	5	Left	g = 0.0	g = -0.2
Math Reasoning	1	Right	g = -0.2	g = -0.1
Math Computation	3	Right	g = -0.4	g = -0.3
Written Expression	0	NA	g = -0.6	g = -0.6

Note: NA = Not applicable

following meta-regressions, the Jones et al. (2009) data were entered into the analyses as one sample, rather than three. The effect of this methodological decision was to render the test for heterogeneity nonsignificant for math reasoning. Likely, this result occurred because the previous finding of significant heterogeneity in math reasoning scores was driven entirely by the large discrepancy scores for the math peak and math dip subgroups from the Jones et al. (2009) study (see Figure 2.7).

Language skill reliably predicted variance in discrepancy scores between reading comprehension and NVIQ, $Q_{model}(1) = 26.23$, $R^2 = 99.60\%$, $p < .001$, accounting for 99% of the variance, and between decoding and NVIQ, $Q_{model}(1) = 5.12$, $R^2 = 62.74\%$, $p = .02$ accounting for 63% of the variance. Unexpectedly, however, language ability was not a significant predictor of the discrepancy scores between written expression and NVIQ, $Q_{model}(1) = .466$, $R^2 = 20.93\%$, $p = .50$. Analogously, language skill also did not reliably predict discrepancy scores for math computation, $Q_{model}(1) = .813$, $R^2 = 69.70\%$, $p = .37$.

Thus, these findings demonstrate that language skill strongly predicts discrepancy scores for reading comprehension and decoding for individuals with HFASD, but not written expression or math computation.

Discussion

The results of our meta-analyses suggest that for individuals with HFASD, academic ability is generally in accordance with NVIQ (see Table 2.3). With respect to discrepancies, we found that (a) there was no reliable discrepancy between decoding skill and NVIQ; (b) the average discrepancy between math reasoning and NVIQ was only three points; and (c) while the overall discrepancies between each of reading comprehension and math computation compared to NVIQ was six points, and nine points between written expression and NVIQ, these differences would not be considered clinically meaningful discrepancies (Learning Disabilities Association of Ontario, 2003).

Table 2.3

Grand SMDs and Prediction Intervals for each Area of Academic Achievement

Academic Area	Grand SMD		Prediction Interval	
Reading Comprehension	-0.4 SD	-6 pts	-1.0 to +0.2 SD	-15 pts to +3 pts
Decoding	0	0 pts	-0.7 to +1.1 SD	-11 pts to +15 pts
Written Expression	-0.6 SD	-9 pts	-1.3 to +0.8 SD	-20 pts to +12 pts
Math Reasoning	-0.2 SD	-3 pts	-0.9 to +0.5 SD	-14 pts to +8 pts
Math Computation	-0.4 SD	-6 pts	-1.4 to +0.5 SD	-21 pts to +8 pts

Nonverbal IQ

Having a diagnosis of HFASD does not seem to predict intelligence as measured by NVIQ because the Grand standardized mean difference between the NVIQs of

individuals with HFASD and TD controls was not found to be reliably different from zero. Thus, it is not the case that having HFASD is predictive of a lower NVIQ in general and, consequently, it is not necessarily the case that a diagnosis of HFASD is the primary predictor of lower academic achievement levels within this population. Furthermore, students with HFASD tend to perform academically as we might expect, based on their NVIQ. In other words, NVIQ seems to be in accordance with academic performance on global measures of academic achievement.

Reading Comprehension and Decoding

The prediction interval represents the range within which the SMDs would fall if we had been able to test every single person diagnosed with HFASD (see Table 2.3). The prediction interval further suggests that for any given sample of individuals with HFASD, their mean discrepancy score between academic achievement and NVIQ is likely to fall within a given range. The prediction intervals between NVIQ and achievement in the areas of decoding and reading comprehension ranged within ±1 SD. This suggests that any given sample of individuals with HFASD will be unlikely to demonstrate clinically significant discrepancies in these two areas on standardized achievement tests. While our recent meta-analysis of the reading skills of individuals with HFASD similarly found that decoding ability was likely to be within approximately ±1 SD of their TD peers, the finding that the same would be true for reading comprehension is in direct contrast to our earlier results. Our previous results suggested that the reading comprehension skills of individuals with HFASD would be within -2 SD and +1 SD of their TD peers (Brown et al., 2013). These two opposing findings may have occurred due to the inclusion of only

standardized measures of reading comprehension in the current meta-analysis, whereas in the previous meta-analysis, a much wider array of reading assessments were included (see Brown et al., 2013 for a complete description). When we included many diverse types of reading assessments, we found that text type and more specifically, the amount of social information needed to understand the text, had a very large effect on the performance of individuals with HFASD to comprehend the text. In contrast, many standardized reading comprehension measures require little social understanding to complete various parts of the assessment. The relative lack of social content is perhaps most striking in the reading comprehension subtest of the *Wechsler Objective Reading Dimensions*, which asks participants to read and understand single sentence statements and expository paragraphs (Rust, Golombok, & Trickey, 1993). Thus, it may be that standardized measures of reading comprehension are not providing a complete picture of the reading comprehension difficulties of students with HFASD.

Written Expression

It is often suggested that individuals with HFASD have great difficulties with written expression. For example, in the Mayes and Calhoun (2003, 2006, 2007, 2008) series of studies, the authors reported that approximately 60% of their students with HFASD showed a discrepancy of one SD between their FSIQ scores and their writing achievement scores, and that a majority of students with HFASD had a specific learning disability in writing. However, the current meta-analysis found that there was no clinically significant discrepancy between written expression and PIQ across the seven studies of standardized writing assessments and 200 participants with HFASD.

How can these disparate findings be reconciled? The prediction interval demonstrated that any given sample of individuals with HFASD would likely have a discrepancy score between -1.3 SD and +0.8 SD. Thus, the Mayes and Calhoun (2003, 2006, 2007, 2008) sample of participants with HFASD (where the original participants were included in several of the subsequent studies) may be one instance of a sample where a majority of individuals with HFASD had significant difficulties with written expression. Future researchers need to be aware that it is also likely to sample a group of individuals with HFASD and find little discrepancy between their intelligence and standardized written expression scores as seen in Smith-Myles et al. (2003) and Griswold et al. (2002).

Math Computation and Math Reasoning

Our findings from the meta-analyses on mathematics achievement are largely consistent with the previous meta-analysis conducted by Chiang and Lin (2007). We extended the previous findings by demonstrating that the discrepancy scores between each area of math achievement (math computation and math reasoning) and PIQ were small (six points and three points, respectively) and not clinically meaningful. Furthermore, the prediction intervals suggested that the math reasoning scores would be generally within the normal range for any given sample of students with HFASD; however, given there were only four studies included in the analysis on math reasoning, the prediction interval and its implications must be interpreted with caution. In contrast, the prediction interval for math computation suggested that, like written expression, some individuals or groups of individuals with HFASD will demonstrate clinically

significant discrepancies between expected and predicted levels of achievement. This finding raises an important question: What traits or characteristics of individuals with HFASD potentially explain why some individuals on the spectrum are underachieving to such a degree in math computation and written expression?

Predicting Academic Achievement: The Predictive Ability of Language Skill

The hypothesis explored here was that language ability may predict the discrepancy between academic achievement and NVIQ. This hypothesis was supported, but only for reading comprehension and decoding ability. When reading comprehension or decoding were better than expected, in general language skill was also high. Conversely, when the discrepancy score was negative (i.e., reading comprehension or decoding was lower than predicted by NVIQ), language skill was generally low. Further to this, language ability predicted over 99% of the variance in the reading comprehension/NVIQ discrepancy scores. As well, language ability predicted over 63% of the variance in discrepancy scores for decoding. These findings are consistent with previous research. For example, Lindgren et al. (2009) also demonstrated the relationship between language skill and reading ability. These researchers divided their participants with HFASD into two groups based on language ability. They found that individuals with HFASD + normal language abilities had reading comprehension strengths of 0.5 SD above TD controls, whereas their peers with HFASD + SLI had reading comprehension deficits of -0.5 SD below controls. Taken together, these findings show that language impairment is a strong predictor of reading comprehension (and decoding) deficits in the HFASD population. As such, it is just as important to take the

language ability of the participants with HFASD into consideration as it is to control for intelligence when assessing the reading skills of individuals with HFHFASD.

Surprisingly, language ability did not reliably predict discrepancy scores in written expression. While written expression is also a language-based ability, writing is dependent on many other cognitive processes to be successful. For example, theory of mind (ToM) ability (i.e., the ability to understand mental states) has been shown to have a positive relationship with writing quality (Brown & Klein, 2011). Furthermore, many of the deficits in the writing of individuals with HFASD, such as overly literal language use, difficulty elaborating on ideas, lack of textual coherence, having a distorted sense of audience and limited ToM content have been shown to be related to ToM (Barnes, Lombardo, Wheelwright, & Baron-Cohen, 2009; Brown & Klein, 2011; Chavkin, 2004; Happé, 1991; Jurecic, 2007). These problems are theorized to be associated with impaired ToM because they may result from individuals with HFASD having limited social understanding and difficulty envisioning the perspective of their readers (Brown & Klein, 2011; Chavkin, 2004; Happé, 1991; Jurecic, 2007). Thus, other cognitive skills, such as ToM, may be stronger predictors of writing success for individuals with HFASD than language skill. Future research will need to explore this possibility further.

Language skill also did not predict discrepancy scores for math computation. However, for both written expression and math computation, the predictive power of language may have been stronger if researchers had used more comprehensive assessments of language skill. Most researchers in these studies used the *Peabody Picture Vocabulary Test* (PPVT; Dunn & Dunn, 1997) or some other measure of

vocabulary as a marker for language ability. Such measures may be limited in their ability to capture the language ability of individuals with HFHFASD for two reasons. First, these tests tend to measure number of words known (vocabulary breadth), but not how detailed understanding is for each word (vocabulary depth; Stothers & Oram Cardy, 2012). Second, individuals with HFASD + normal language skills have been shown to know a similar number of words compared to their age-matched and IQ-matched TD peers, yet their semantic representations of words tend to be less rich and of poorer quality (Volden, 2004; Stothers & Oram Cardy, 2012). As a consequence, using a vocabulary test that measures vocabulary breadth in the absence of other semantic (and syntactic) skills may overestimate the overall language ability of individuals with HFASD (Volden, 2004; Stothers & Oram Cardy, 2012).

On the other hand, it may be that arithmetic skills are independent of language ability or at least, vocabulary skill. There are conflicting views on this question. Some researchers have shown that there are partially overlapping networks within the brain that aid language comprehension and math computation (cf., Baldo & Dronkers, 2007). Yet it is acknowledged that language disorders and disorders of math computation can occur independently in individuals with traumatic brain injury, and it is believed that numerical understanding arises independently of language in children (Gelman & Butterworth, 2005). The results of this analysis suggest that language ability, in terms of vocabulary knowledge, is independent of math calculation ability, at least in the HFASD population. This, however, may not be the complete answer. For children with language impairments, associations between language and math calculation ability have been

found. For example, children with SLI are known to have problems with phonology; verbatim recall of numbers, words, and sentences; and rote retrieval of memorized material (Fazio, 1999). All of these deficits are believed to inhibit recall of math facts and math procedures, such as the steps needed to solve multi-step arithmetic problems (Fazio, 1999). Thus, it may be that language ability has a significant impact on math computation ability for a subgroup of individuals with HFASD, specifically, individuals with co-morbid SLI.

Limitations and Future Research

Although academic achievement appears to be generally in accordance with NVIQ at a group level in individuals with HFASD, standardized measures and group means may not be providing a complete picture of the range of academic skills in this population. First, as Jones et al. (2009) aptly stated, "the cognitive heterogeneity in ASD means that describing the population at the group mean level can mask subgroups of individuals whose academic achievements are not congruent with their general intellectual functioning" (p. 718). Heterogeneity is one of the most defining features of HFASD (Happé, Ronald & Plomin, 2006). Therefore, it is essential to examine academic skills across subgroups within the HFASD population, especially the differences between individuals with HFASD + normal language function and HFASD + SLI, as deficits in core language skills are a strong predictor of academic achievement (Aram, Ekelman, & Nation, 1984). In fact, one of the limitations of this study was that a subgroup analysis of the discrepancy between NVIQ and academic achievement was not possible because the subgroups included in the studies within this analysis were highly varied (e.g., HFASD +

SLI vs. HFASD + normal language; Asperger Syndrome vs. Autism; HFASD ± learning disability). As such, there were not enough data on any particular subgrouping to complete a subgroup analysis.

Second, researchers also need to use more comprehensive measures of academic achievement beyond standardized tests when examining the academic skills of individuals with HFASD. For example, Brown and Klein (2011) asked adults with HFASD and non-disabled controls to complete a non-standardized narrative and expository writing task. In the narrative condition, participants were asked to write about a time when they had a problem with someone. In the expository condition, participants were asked to write a text on the topic of problems between people. Brown and Klein (2011) analysed the texts across 18 measures of *good* writing. Overall, they found that the adults with HFASD wrote poorer quality narrative (*d* = 1.8 SD) and expository texts (*d* = 1.0 SD). In the narrative genre, the adults with HFASD had difficulty with the structure, coherence and cohesiveness of their texts; providing adequate detail; and with integrating the inner worlds of the characters with the events of the story. In comparison, the expository texts of the adults with HFASD primarily had difficulty with textual coherence and cohesiveness. Brown and Klein's (2011) study provides rich detail about the strengths and weaknesses in the written texts of their participants with HFASD. If these researchers had instead focused only on a global measure of writing competence, all of this rich detail would have been lost.

Moving beyond standardized measures of achievement is also important in order to examine the cognitive skills that are subserving each academic skill. In the area of

math achievement, Pellicano, Aagten-Murphy, Daniel and Burr (2012) examined the estimation skills of a small sample of students with HFASD, a skill not usually measured in any depth in standardized measures of math achievement. These researchers demonstrated that individuals with HFASD tended to have problems with estimation (when they were asked to map numbers on a number line), and that their math computation achievement scores were associated with their estimation skills. Further to this, Reitzel and Szatmari (2003) suggest that simple tests of academic achievement and IQ will not necessarily capture the types of difficulties students with HFASD experience at school. Thus, standardized tests of achievement may be providing an incomplete picture of the academic skills of individuals with HFASD. Future studies should include comprehensive measures of a given academic skill and move beyond standardized tests.

Conclusion

In summary, none of the mean discrepancies between NVIQ and each of the five academic areas (reading comprehension, decoding, written expression, math reasoning and math computation) were clinically meaningful discrepancies. Second, it was not found that individuals with HFASD had lower NVIQs in general compared to their TD peers. Third, the prediction intervals described the range within which the discrepancy between expected achievement (NVIQ) and actual achievement would fall for any student or group of students with HFASD. Across the five academic areas, it was found that (a) the prediction intervals for the range of discrepancy scores between NVIQ and achievement in each of decoding, reading comprehension and math reasoning, all ranged within ±1SD, indicating that students with HFASD are unlikely to demonstrate

clinically meaningful discrepancies in these three areas; and (b) the discrepancy scores at the bottom end of the range for math computation and written expression were greater than -1.0 SD, suggesting that some students or groups of students with HFASD will have a clinically significant discrepancy in math computation and writing compared to NVIQ. Taken together, the results of NVIQ/achievement discrepancies and the prediction intervals suggest that for students with HFASD, clinically significant underachievement in academics relative to expectations is less common and dramatic than generally reported in the literature.

Fourth, the oral language ability of students with HFASD accounted for a great deal of the variance in the discrepancy scores for reading comprehension and decoding skill. However, oral language ability did not predict variance in the discrepancy scores for written expression and math computation. More research is needed that examines the mathematical and written expression skills of children and adolescents with HFASD, especially research that is more fine-grained and focuses on the underpinnings of academic success in each area.

In conclusion, it is essential that researchers highlight the similarities, as well as the differences, between students with HFASD and TD controls in order to ensure that we are accurately representing the abilities of students with HFASD. Solid academic performance empowers students with HFASD to attend post-secondary institutions and obtain meaningful employment (Schaefer-Whitby & Richmond-Mancil, 2009). This post-secondary training is crucial as it gives students with HFASD the opportunity to develop specialization in a field and in turn, employers will pay for their unique skills while

potentially overlooking any social deficits (Grandin, Duffy & Attwood, 2004). In fact, Temple Grandin suggests that academic performance and specialized skill development is as important as social skills training for individuals on the spectrum (Grandin, Duffy & Attwood, 2004; Schaefer-Whitby & Richmond-Mancil, 2009). Given that many students with HFASD are as capable of succeeding academically as their TD peers, it becomes essential that researchers, teachers and other professionals recognize their academic potential, which is often hidden behind behavioural and social deficits, and empower students with HFASD to achieve academic success.

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Chapter 3

Exploring the Narrative Writing Skills of Students with High-Functioning Autism Spectrum Disorder[5]

Autism spectrum disorder (ASD) is the most common neurodevelopmental disorder, and is characterized by deficits in social interaction and social communication as well as restricted, repetitive patterns of behaviour, interests or activities (American Psychiatric Association, 2013; McPartland, Reichow, & Volkmar, 2012). The ICD-10 diagnostic criteria for childhood autism report that "qualitative abnormalities in reciprocal social interaction" are a core feature of ASD (WHO, 1993). Similarly, this population tends to have limited social knowledge and difficulties envisioning the perspective of others (Colle, Baron-Cohen, Wheelwright, & van der Lely, 2008; Tager-Flusberg, 2007). That is, individuals ASD seem to have problems understanding minds, an ability termed *theory of mind* (ToM; Baron-Cohen, 1995; Tager-Flusberg, 2007).

Despite their aforementioned limitations, many children and adolescents with ASD, especially those with average or above average intelligence (henceforth referred to as high functioning autism spectrum disorder (HFASD), are educated in the general education classroom, where their academic achievement varies widely, ranging from severely impaired to exceptional (Brown, Oram Cardy, Johnson & Archibald, 2013 [Chapter2]; Griswold, Barnhill, Smith-Myles, Hagiwara & Simpson, 2002). Within academics, written expression has been proposed as one of the most challenging areas

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for students with HFASD, because "surely the self-expression of writing, and especially the writing about oneself, must put to the greatest test those social, imaginative and communicative skills thought to be crucially impaired in autism" (Happé, 1991, p. 207). Given that individuals with HFASD have weaknesses in social knowledge, social understanding and social communication, writing tasks in the narrative genre may prove to be some of the poorest examples of their writing.

Writing, telling and reading narratives is integral to the development of many psychological and social processes (McKeough, Genereux & Jeary, 2006). When we reflect upon, reason about, or describe the actions and experiences of ourselves or others, real or fictional, we are engaging in narrative thought (McKeough et al., 2006). Narrative thought makes sense of the social world, interprets human actions and intentions, and organizes everyday experiences (McKeough & Genereux, 2003). Indeed, mastery of the narrative mode, one of the primary modes of thought, is considered a central task of cognitive development for all individuals (Bruner 1986; 1990; Feldman, Bruner, Kalmar & Renderer, 1993; Genereux & McKeough, 2007; McKeough, 1992).

Further to the concept of narrative thought, and of great relevance to the HFASD population, is the concept of social knowledge. It is purported that social knowledge, like all the major domains of knowledge, has a set of central conceptual structures that underlies it (Case & McKeough, 1989; McKeough et al., 2006). When a child or student repeatedly engages in narrative thought, it leads to the gradual acquisition of these general conceptual structures (Case & McKeough, 1989). One of the first steps in understanding everyday experience begins when very young children move beyond

telling stories that are a simple sequence of physical events and states (Genereux & McKeough, 2007; McKeough, Palmer, Jarvey & Bird, 2007). As young children develop, their stories begin to demonstrate that the characters' actions are motivated by intentions, that is, goals, desires, wants, and needs (McKeough et al., 2007). This transition in children's narrative is referred to by Bruner (1986) as integrating *landscape of action* with the *landscape of consciousness* (McKeough, 1992). Beginning around age six, children's awareness of the *landscape of consciousness* begins to emerge primarily through their engagement in the narrative mode (McKeough, 1992). As children are able to create a fuller understanding of the implications of the *landscape of consciousness* for the *landscape of action*, they develop a deeper understanding of central concepts underlying social knowledge in general (McKeough, 1992). The importance of narrative to the development of social knowledge for all individuals and the documented weaknesses in social understanding in students with HFASD together suggest that understanding the development of narrative in children and adolescents with HFASD may have far reaching consequences. Namely, this understanding could ultimately inform our efforts to remediate their deficits in social cognition and increase their overall psychological functioning (Bruner & Feldman, 1993).

The importance of narrative to children's development and the ToM deficit hypothesis lead to some theories about how features of autism might negatively impact written expression in this population. In particular, students with HFASD may write poorer quality narrative texts because they may not realize the importance of making their writing comprehensible to the reader, that is, engage in perspective-taking (Brown

& Klein, 2011). As such, writers with HFASD may fail to give appropriate background information necessary for their audience to comprehend the text. They may be unaware that although the level of detail was adequate for their understanding, it was not so for their reader (Jurecic, 2007). Furthermore, the psychological aspects of their texts could be missing or atypical, in that writers with HFASD may ignore the importance of affect and emotion to their audience and/or fail to emphasize the emotional significance of events (Happé, 1991).

Surprisingly, the hypothesis that overall narrative writing skills are weaker across individuals with HFASD relative to those without has only been partially substantiated. A small body of research has demonstrated that narrative writing, and written expression skills more generally, can be an area of particular weakness in individuals with HFASD, yet their writing skills are not always impaired (Brown & Klein, 2011; Mayes & Calhoun, 2003; 2008).

Mayes and Calhoun (2003; 2008) asked students with HFASD to complete the written expression subtest of the *Wechsler Individual Achievement Test* (*WIAT;* Wechsler, 1991a), in which participants wrote a descriptive text. In both 2003 and 2008 studies, the participants with HFASD had mean FSIQ scores of approximately 100 points in comparison to mean written expression scores of 86 and 87 points, respectively. Further, the authors reported that 63% of their sample of students with HFASD in both studies had significantly lower written expression scores than FSIQ scores, and that difference averaged between *d* = -0.7 SD and -1.0 SD in size. These initial studies suggest

that written expression may be a significant educational concern for a proportion of students with HFASD.

Although Mayes and Calhoun (2003; 2008) documented that many students with HFASD have a global writing deficit, they did not describe the specific strengths and weaknesses in the written texts of their students with HFASD. Only two well-designed studies involving multiple participants have examined the written narratives of individuals with HFASD in detail. In the first, Barnes, Lombardo, Wheelwright, and Baron-Cohen (2009) compared the written narratives of adults with HFASD to controls. After participants viewed four scenes from a video containing highly emotional and mentalistic content, they were asked to write four different narratives describing what they saw. The researchers reported that the adults with HFASD wrote shorter narratives (*d* = -1.2 SD) and used fewer mental state terms (*d* = -0.8 SD) than their non-disabled peers. However, on the control task, in which participants wrote for five minutes on something that interested them, Barnes et al. (2009) reported that the groups wrote interest compositions that were similar in terms of length (as measured in words) and readability (as measured by the Flesch-Kincaide Grade Level formula, a rough metric of lexical and syntactic complexity). This study highlights that there may be some similarities as well as differences in the written texts of adults with HFASD compared to controls.

In the second, Brown and Klein (2011) asked participants with HFASD (*n* = 16) and their non-disabled peers (*n* = 16) to write a story about a time when they had encountered a problem with someone. In terms of quality, Brown and Klein (2011)

found that the narrative texts of adults with HFASD were rated much lower (*d* = -1.8 *SD*) than their non-disabled peers. Notably, the texts of the HFASD group tended to be poorly structured (*d* = -1.0 *SD*), demonstrate a simplistic understanding of the inner worlds of their characters (*d* = -1.3 *SD*), give less background information (*d* = -1.2 *SD*), and fail to fit together into a consistent whole (*d* = -0.8 *SD*). Although the adults with HFASD also wrote shorter narratives in terms of words (d = -0.8 *SD*) and sentences (*d* = -0.8 *SD*), there was no reliable differences between the groups on the mechanics of writing. As well, it was noted that there was a modest positive correlation, *r*(28) = .38, between ToM skill and overall narrative quality. Yet, despite the large differences in narrative quality between adults with HFASD and controls, it is important to note that some of the adults with HFASD in their sample were excellent narrative writers.

Taken together, these three studies suggest that some individuals with HFASD have significant difficulties in written expression. However, they also demonstrate that some individuals with HFASD are writing quite well. The reasons for this heterogeneity have yet to be investigated. One possibility is that oral language skill plays a significant role in the quality of the written narratives of students with HFASD. Writing skill is highly dependent on the more primary forms of oral language (i.e., listening and speaking), as strong connections have been found between many measures of oral and written language (Berninger, 2000; Shanahan & Shanahan, 2008). Further to this, several studies have identified language ability subgroups within the HFASD population. While problems with the pragmatics of language (i.e., the appropriate use of language in social communication) are a hallmark feature of HFASD, only a subgroup of individuals with

HFASD also struggle with the core structure of language, such as phonology, morphology, and syntax (Bennett et al., 2008). Across studies, it has been found that there is a subgroup of individuals with HFASD who have a core language impairments (LI); in contrast, there is a second subgroup of individuals with HFASD who have grammatical, phonological and vocabulary skills within the normal range (LN; language normal; Bennett et al., 2008; Kjelgaard & Tager-Flusberg, 2001; Lindgren, Folstein, Tomblin & Tager-Flusberg, 2009). In fact, it has been reported that individuals with HFASD + LN may have lexical strengths (Brown, Oram Cardy & Johnson, 2013; Lindgren et al., 2009). Thus, it is of interest to determine whether some of the large dispersion in writing scores among individuals with HFASD may have occurred in part because previous researchers did not examine their participants with HFASD + LI separately from the participants with HFASD + LN (cf., Mayes & Calhoun, 2003). Alternatively, researchers may have compared individuals with HFASD + LI and HFASD + LN to controls with normal language skills only (cf., Barnes et al., 2009; Brown & Klein, 2011). The inclusion of individuals with HFASD + LI in the HFASD group might have resulted in lower mean scores in writing skill compared to non-disabled controls due to language ability alone. Therefore, it is necessary to begin to untangle whether core oral language impairments, autism or both contribute to the writing problems of many individuals with HFASD.

No research has explored the strengths and weaknesses in the written narratives of *children and adolescents* with HFASD beyond standardized achievement tests. Given the importance of early intervention, it is critical that descriptive research studies are

conducted to identify strengths and areas for growth in the writing abilities of students with HFASD, which is necessary to provide a foundation for developing educational interventions (Foley-Nicpon, Assouline & Stinson, 2012). The aim of the current study was to describe the narrative writing of students with HFASD in comparison to their unaffected peers when both groups were balanced in language ability, i.e., both groups had similar mean language scores, had a similar range of language ability scores, and had language scores that fell in the normal range. Twenty text variables were examined across following areas of writing: Productivity, Syntactic Complexity, Lexical Complexity, Writing Conventions, Overall Narrative Clarity and Overall Narrative Form. It was hypothesized that a diagnosis of HFASD would contribute to written language strengths and weaknesses beyond what would be predicted by oral language skill alone. Specifically, it was predicted that individuals with HFASD in comparison to their typically developing (TD) peers would: (a) write poorer quality narrative texts (Overall Narrative Clarity and Overall Narrative Form), (b) show lexical strengths in their writing (Lexical Complexity); and (c) not demonstrate significant differences on text variables analyzing Text Length, Syntactic Complexity or Writing Conventions.

A second aim was to explore what variables best predicted writing quality across both groups. As previously described, it was hypothesized that language ability would play a significant role in writing success. It was also hypothesized that students with HFASD would write poorer quality narratives given the social and communicative deficits known to be associated with this disorder.

Method

Participants

Inclusion criteria. Twenty-four students with HFASD (3 females) and 22 of their TD peers (8 females) from the Southern Ontario region participated in this study. The HFASD group included more males and this difference approached significance, $\chi^2(1, N = 46) = 3.59$, $p = .058$. Inclusion criteria for both groups included participants who: (a) were aged 8 to 17 years; (b) had a PIQ of greater than or equal to 80 on the *Wechsler Abbreviated Scale of Intelligence* (*WASI*; Wechsler, 1999); (c) had a Spoken Language Composite score of greater than or equal to 80 on the *Test of Language Development: Intermediate-4 (TOLD-I:4*; Hammill & Newcomer, 2008); (d) had no known neurological disorder (e.g., epilepsy, cerebral palsy, hydrocephalus), sensory impairment (hearing impairment, uncorrected vision impairment) or major psychiatric disorder (e.g., psychosis); and (e) spoke English as their first language. Inclusion in the HFASD group further required: (a) a community diagnosis of Autistic Disorder, Asperger's Disorder or PDD-NOS; and (b) a Social Responsiveness Scale (SRS; Constantino, 2005) *T-score* of greater than or equal to 60.To be included in the control group, students must have had no reported disabilities including, but not limited to, learning disabilities and attention-deficit/hyperactivity disorder, as well as an SRS *T-score* of less than 60. Participant demographics are summarized in Table 3.1. T-tests demonstrated no significant differences between groups except on the SRS.

Table 3.1.

Participant Demographics

Demographic	HFASD (*n*= 24) *M (SD)* Range	TD (*n* = 22) *M (SD)* Range	*t*(44)	*p*	*d*
Age (years)	12.80 (2.12) 8.17-16.83	13.09 (2.50) 8.25-16.83	-0.429	.670	-0.1
Performance IQ (*WASI*)	108.46 (11.67) 84-131	109.59 (10.07) 85-128	-0.351	.727	-0.1
Language Ability (*TOLD-I:4*)	98.29 (9.91) 82-123	101.55 (8.12) 83-118	-1.211	.232	-0.4
Social Responsiveness (SRS)	86.25 (12.30) 63-113	44.00 (6.66) 35-58	14.652[a]	< .001	+4.3

[a] *t*(36.02) = 14.652

Recruitment. Participants with HFASD were invited to participate through announcements placed with local agencies that support individuals with HFASD via their websites and through email to their membership. TD children were recruited in two ways. First, parents of students who had previously participated in a longitudinal epidemiological study of school age children (Archibald, Oram Cardy, Joanisse & Ansari, 2013) received an email announcement. Second, siblings of children with HFASD were invited to participate. Finally, personal contacts were asked to distribute email or paper announcements to parents of children with or without HFASD whom they may know.

Rationale for including siblings of participants with HFHFASD. Siblings of individuals with HFASD were included in the TD group if they had PIQ and language ability scores ≥ 80, below cut-off scores on the SRS, and no reported disabilities of any kind. Although there is considerable evidence that siblings of children with HFASD have a

higher incidence of communication difficulties (Yirmiya, Shaked, & Erel, 2001), it has been shown that only a subset of these siblings have language impairments. For example, Lindgren et al. (2009) demonstrated that 89% of siblings of children with HFASD + LN had language skills in the normal range, while only 11% of the siblings had language impairments. To ensure that the siblings were not significantly different than the non-sibling controls, one-way ANOVAs were conducted on four key variables: Age, PIQ, language ability and social responsiveness (see Table 3.2). The ANOVAs demonstrated that there were no significant differences between the sibling and non-sibling control participants.

Table 3.2.

Demographics of the TD group (siblings vs. non-siblings)

Demographic	Siblings (*n*= 8) *M (SD)* Range	Non-siblings (*n* = 14) *M (SD)* Range	*t*(20)	*p*	*d*
Age (years)	13.16 (2.73) 9.75-16.83	13.05 (2.46) 8.25-16.33	0.097	.923	0.0
Performance IQ (*WASI*)	113.00 (9.47) 101-128	107.64 (10.22) 85-123	0.792	.438	+0.5
Language Ability (*TOLD-I:4*)	103.38 (7.63) 94-118	100.50 (8.48) 83-118	1.213	.239	+0.3
Social Responsiveness (SRS)	45.83 (6.30) 38-58	43.07 (6.90) 35-57	0.860	.400	+0.4

Measures

Social responsiveness. The Social Responsiveness Scale (SRS; Constantino, 2005; Constantino & Todd, 2005) was used to confirm the presence or absence of HFASD across participants. The questionnaire, which takes about 20 minutes to complete, asked parents to rate their child on 65 questions in the areas of social awareness, social information processing, capacity for reciprocal social responses, social use of language, and rigid, repetitive behaviours (Constantino et al., 2003; Constantino et al., 2004). The SRS generates a T-score that serves as an index of the severity of the child's impairment in social responsiveness (Constantino, et al., 2004; Constantino & Todd, 2005). Scores in the range of 60-80 are indicative of clinically significant (albeit mild) impairments in social responsiveness, whereas scores greater than 85 represent a more severe impairment (Constantino et al., 2004; Constantino & Todd, 2005). In the current study, four control participants were excluded because their SRS standard scores were greater than 60.

Nonverbal IQ. The *WASI* is a standardized test of cognitive ability for individuals aged 6 through 90 years (Wechsler, 1999). Participants completed the Block Design and Matrix Reasoning subtests to obtain their estimated PIQ standard score rapidly and efficiently.

Language. The *TOLD-I:4*, a standardized language assessment, was used to examine oral language skills across groups (Hammill & Newcomer, 2008). It was the most appropriate choice for this study because it used the same six subtests (Sentence Combining, Picture Vocabulary, Word Ordering, Relational Vocabulary, Morphological

Comprehension and Multiple Meanings) across the entire age range of participants, i.e., 8 to 17 years. Each participant's Spoken Language Composite standard score was computed.

Narrative writing task. First, the participant viewed the following instructions on a computer screen, which were also read aloud to the student:

> *Read this sentence: Jacob hid under the porch, staring out at the old swing set, plotting his revenge. Make up a good story to go with this sentence. Be sure to tell a complete story. Remember a story has a beginning, middle, and ending. Make sure you plan your story first and try to write as much as you can. When you are ready, please click 'Begin'.*

The participant was then given the following verbal instructions:

> *I just want you to know that Jacob is not planning revenge against the swing set. He is planning revenge against a person. He is simply staring at the swing set while he is thinking. So please write me a story about what happened to Jacob and what he going to do about it.*

After the participant clicked *begin*, the prompt: *Jacob hid under the porch, staring out at the old swing set, plotting his revenge* appeared at the top of a text box and the student would continue writing from the prompt. When the student was finished, she clicked *submit* to save the story. No spelling or grammar checking was available to the students while they wrote. Students were given unlimited time to complete the writing task, but most completed within half an hour.

Coding reliability. The textual analysis was completed by H.M.B. and R.E.S. and two research assistants. Each text had all identifying information removed to ensure that all four of the coders were blind to the group membership of any given participant's

text. The research assistants were also naïve to the experimental hypotheses. All variables were independently coded in their entirety either by the first or third author. Each variable was then scored a second time by either R.E.S. or a research assistant on at least 20% of the texts. Intraclass correlations between the two raters were computed for each variable. If any given variable did not receive at inter-rater reliability score of 0.7 or higher, then the coders were retrained and the variable was recoded.

Analysis

In the current study, we evaluated both lower order (text microstructure) and higher order (text macrostructure) features of the texts using *good* writing measures. *Good* writing measures are those that have been shown to capture developmental changes in writing skill and measure that are able to differentiate between typical and atypical performance (Wolf Nelson & Van Meter, 2007).

Lower order text variables. Four categories of lower order variables were assessed: (a) Productivity (number of words, clauses and t-units); (b) Syntactic Complexity (mean length of t-unit; MLTU, clausal density, and frequency of t-units without grammar errors); (c) Lexical Diversity (Type Token Ratio; TTR, as well as frequency of multi-syllable words, big words and rare words; and (d) Writing Conventions (frequency of errors in punctuation, spelling and capitalization). In order to control the experiment-wise risk of false rejections of the null hypothesis due to the large number of textual variables, multivariate analysis of covariance (MANCOVA) was used to assess whether there were differences in the written narratives between the two groups across each family of lower order variables (Hummel & Sligo, 1971). Hummel

and Sligo (1971) suggest that a significant multivariate effect "protects" the F-ratios of subsequent univariate calculations from inflation of the Type I error rate when performing multiple comparisons, and so no corrections were made to univariate ANOVAs that were carried out when parsing significant multivariate effects. Age was entered as a covariate because it was the strongest predictor of writing skill across all writing measures. Thus, when the data were analyzed using only a multivariate analysis of variance (MANOVA), the large within-group variability in writing scores due to age weakened the power of the test to detect between-group variation. Detailed descriptions of these variables are found in Table 3.3.

Higher order text variables. Before assessing the texts on measures of narrative quality, all texts were corrected for spelling, capitalization and punctuation. The goal was to reduce rater bias because such errors have been shown to influence quality ratings (Olinghouse, 2008). The narrative texts were then assessed for quality across two higher order composites. The first, *Overall Narrative Clarity*, included variables related to overall understandability of content for the reader. Narrative Clarity included the following variables: cohesive reference, frequency of connectives, as well as a holistic measure of cohesiveness and background information. The second aspect, *Overall Narrative Form*, was comprised of variables that reflected overall use of narrative elements and form. These variables included rubric ratings of narrative organization and structure, character development, and balance between landscapes (of action and consciousness) (see Appendix A). The scores were later adjusted so that the minimum score was 0 and the maximum score was 10. For the two frequency variables, cohesive

Table 3.3.

Lower Order Text Variables

Composite	Variable	Definition	ICC
Productivity	Total Words	The number of words in the text	-
	Total T-units	The number of t-units. One t-unit is one independent clause and any clauses dependent upon it	0.99
	Total Clauses	The total number of clauses in the texts (whether dependent, independent or embedded)	0.99
Syntactic Complexity	Mean Length of T-unit (MLTU)	The total number of words in the text divided by the total number of t-units	-
	Clause Density	The total number of clauses in the text divided by the total number of t-units	-
	Frequency of T-units without Grammar Errors	The total number of t-units that were free of the two most common grammatical errors (sentence fragments and run-on sentences) divided by the total number of t-units	0.87
Lexical Complexity	Type Token Ratio (TTR) [a]	A ratio of the number of different words in the text over the total number of words	-
	Frequency of Multi-Syllable Words [a]	The total number of words containing three or more syllables divided by the total number of words	-
	Frequency of Big Words [a]	The total number of words with seven or more letters divided by the total number of words	-
	Frequency of Rare Words [b]	The total number of words that were considered very rare according to the Corpus of Contemporary American English (COCA), i.e., words that had a frequency rating of greater than 3000, divided by the total number of words	-

Writing Conventions	Frequency of Punctuation Errors	The total number of clauses with one or more punctuation errors divided by the total number of clauses	0.98
	Frequency of Spelling Errors	The total number of clauses with one or more spelling errors divided by the total number of clauses	0.99
	Frequency of Capitalization Errors	The total number of clauses with one or more capitalization errors divided by the total number of clauses	0.96

Note. Dashes indicate the variable was computed electronically. [a] This variable was scored using the following online text analyzer: http://www.usingenglish.com/resources/text-statistics.php [b] Rare words were scored using this online text analyzer: http://www.wordandphrase.info/analyzeText.asp

reference and frequency of connectives, these scores were originally a percentage, but they were also converted so that the scores on these two variables ranged from 0 to 10. Then the scores for each composite were created by averaging across the individual variables. The Overall Narrative Clarity and Overall Narrative Form composites were each assessed with a one-way analysis of covariance, ANCOVA, which controlled for the effects of age as described above. Detailed descriptions of these variables are found in Table 3.4.

Regardless of the outcome of the multivariate tests for both lower order and higher order text variables, post hoc comparisons on all of the individual text variables were completed using one-way ANCOVAs and the means, SDs, and estimates of standardized mean differences (SMD) between groups were reported. These follow-up comparisons were also evaluated with a Sidak correction, which adjusted the

Table 3.4.

Higher Order Text Variables

Composite	Variable	Definition	ICC
Overall Narrative Clarity	Cohesive Reference	The number of t-units that made reference to the subject or predicate of the previous t-unit divided by the total number of t-units and multiplied by 10.	0.97
	Frequency of Connectives	The number of clauses that included a connective word divided by total clauses and multiplied by 10.	0.99
	Cohesiveness	A holistic judgment of the degree to which: (a) ideas were connected; (b) topic changes were smooth; (c) the student included off-topic or tangential information; and (d) the text was understandable.	0.98
	Background Information	A holistic judgment of the degree to which the student provided background information through description of setting, characters and events.	0.84
Overall Narrative Form	Organization and Structure	A holistic measure of the degree to which the narrative: (a) contained the elements of a basic story including: beginning, initiating event, reaction, goal, attempt, outcome, conclusion (Genereux & McKeough, 2007); (b) proceeded in a logical order; (c) focused on the inner worlds of characters; and (d) used paragraphing	0.85
	Character Development	A holistic measure of the degree to which the characters were developed in terms of physical description, cognition, affect, motivation, intentions, change and growth. Also evaluated the student's choice of narrative point of view: third person objective, third person limited omniscient or third person omniscient.	0.80
	Balance Between Landscapes	A holistic measure of the degree to which (a) the text content focused primarily on the landscape of action (low score) versus appropriately balanced the landscape of action and consciousness (high score); and (b) the text included intentional and interpretative mental states.	0.81

Note: Across all measures, individual scores ranged from 0 to 10.

significance level of each test relative to the total number of tests in the set. These comparisons were completed regardless of the multivariate test results because the information gained by exploring the differences between the groups across all twenty individual text variables was invaluable, in that it provided a thorough and detailed description of the similarities and differences in the texts of students with HFASD compared to their TD peers.

Finally, a forward multiple regression was used to examine the impact of age, language ability and social responsiveness on overall writing quality across both groups. This would help to evaluate the question of whether it was language ability, features of autism or both that contribute to writing strengths and weaknesses across both groups.

Results

Lower Order Text Variables

The results of the omnibus MANCOVAs for the lower order text variables are reported in Table 3.5. Overall, there were significant differences between the writing of students with HFASD and their TD peers on measures of lexical complexity within their narratives. In contrast, there were no significant differences between the two groups across measures of productivity, syntactic complexity and use of writing conventions.

On measures of productivity and syntactic complexity, the HFASD group performed similarly to their peers (see Table 3.6). Although the means of the students with HFASD were lower across all three measures of productivity (with an SMD of -0.3 SD between groups on each of number of words, clauses and t-units), none of these differences were reliable and there was tremendous variability in text length across both

Table 3.5.

Results of the Omnibus MANCOVAs for each Family of Lower Order Text Variables

Lower Order Text Variables	Wilks' λ	*F*	*p*	Power
Productivity	0.968	0.458	.713	0.134
Syntactic Complexity	0.977	0.315	.814	0.106
Lexical Complexity*	0.753	3.286	.020	0.790
Writing Conventions	0.988	0.162	.921	0.077

* Significant at $p < .05$

Table 3.6.

Comparison between Groups on Measures of Productivity and Syntactic Complexity

Text Variable	HFASD	Control	*F*(1,43)	*p*	*d*
	M (SD) Range	*M (SD)* Range			
Productivity					
Total Number of Words	237.29 (168.79) 46-660	289.14 (220.76) 95-956	0.615	.437	-0.3
Total Number of Clauses	33.67 (24.55) 6-110	42.64 (33.34) 14-138	0.892	.350	-0.3
Total Number of T-units	20.50 (15.81) 5-75	25.45 (21.64) 8-108	0.597	.444	-0.3
Syntactic Complexity					
Mean Length of T-unit	11.60 (2.59) 7.5-18.0	11.75 (2.30) 8.4-18.1	0.003	.957	-0.1
Clauses per T-unit	1.66 (0.272) 1.7-2.2	1.71 (0.230) 1.4-2.2	0.390	.535	-0.2
Frequency of T-units without Grammar Errors	84.36 (15.22) 54-100	87.66 (11.49) 61-100	0.533	.469	-0.2

groups. In addition, students with HFASD tended to write narratives of similar syntactic complexity and with similar rates of grammatical errors as their peers as the differences between groups on these measures were very small (*d* = -0.1 to -0.2 SD) and negligible. Finally, there were also no significant differences between the two groups on their use of writing conventions. Both groups had similar rates of errors in punctuation, spelling and capitalization.

In contrast to the findings reported above, lexical diversity did reliably differentiate between the two groups on the omnibus MANCOVA (see Table 3.7). Examination of the individual means shows that this disparity was primarily the result of the higher mean score by the HFHFASD group on Type Token Ratio. Individuals with HFHFASD tended to use a greater number of unique words (*d* = +0.9 SD) in narrative texts compared to their TD peers. In other words, they showed more variety in their vocabulary usage than controls.

Higher Order Text Variables

The results of the one way ANCOVAs (controlling for age) on the two higher order text variables are reported in Table 3.8. These results show that on overall narrative form, the HFASD group scored significantly lower than their peers (*d* = -0.7 SD). In contrast to the results for narrative form, there was no significant difference between the two groups on overall narrative clarity despite this difference being modestly sized (*d* = -0.5 SD). Similarly, after using a Sidak correction, the two groups were not reliably different on any of the individual measures within family of quality variables, despite the

Table 3.7.

Differences between Groups on Measures of Lexical Diversity and Writing Conventions

Text Variable	HFASD	Control	$F(1,43)$	p	d
	M (SD) Range	*M (SD)* Range			
Lexical Diversity					
Type Token Ratio [a]	60.34 (11.97) 35-81	49.94 (10.39) 31-66	12.57	.001	+0.9
Frequency of Multi-Syllable Words	4.82 (2.19) 2-9	4.89 (2.29) 2-10	0.010	.921	0.0
Frequency of Big Words	15.40 (5.82) 2-27	16.34 (5.39) 9-26	0.158	.963	-0.2
Frequency of Rare Words	5.27 (3.83) 1-10[b]	5.01 (2.45) 2-11	0.229	.635	+0.1
Writing Conventions [c]					
Frequency of Punctuation Errors	0.745 (0.518) 0-1.7	0.658 (0.313) 0.1-1.3	0.301	.586	+0.2
Frequency of Spelling Errors	0.593 (0.482) 0-1.6	0.534 (0.511) 0-1.7	0.053	.819	+0.1
Frequency of Capitalization Errors	0.443 (0.552) 0-1.9	0.332 (0.424) 0-1.4	0.401	.530	+0.2

Notes. [a] Significant using a Sidak correction of $p < .013$; [b] There was one outlier in the HFASD group whose text contained 18% rare words. The range reported above has this outlier removed; [c] Higher scores represent larger error rates

Table 3.8.

Differences between Groups on the Higher Order Text Variables

	HFASD	Control	*F*(1,43)	*p*	*d*
	M (SD)	*M (SD)*			
Overall Narrative Clarity	**5.63 (1.10)**	**6.19 (1.20)**	**2.685**	**.109**	**-0.5**
Cohesive Reference	8.41 (1.19)	8.75 (0.94)	1.353	.251	-0.3
Frequency of Connectives	2.24 (0.91)	2.42 (0.81)	0.589	.447	-0.2
Cohesiveness	5.83 (2.29)	7.05 (2.36)	6.263	.078	-0.5
Background Information	6.04 (2.60)	6.53 (2.70)	0.215	.645	-0.2
Overall Narrative Form*	**3.65 (2.27)**	**5.35 (2.90)**	**6.418**	**.015**	**-0.7**
Organization and Structure	4.58 (2.24)	6.14 (2.90)	4.854	.033	-0.6
Character Development	3.08 (2.18)	4.68 (2.95)	5.604	.022	-0.6
Balance between Landscapes	3.28 (2.68)	5.23 (3.49)	5.402	.025	-0.6

* Significant at $p < .05$

fact that the following variables showed modestly-sized discrepancies: organization and structure (*d* = -0.6 SD); character development (*d* = -0.6 SD); balance between landscapes (*d* = -0.6 SD); and cohesiveness (*d* = -0.5 SD).

Predicting Narrative Quality

Across both groups, social responsiveness was negatively correlated (Pearson's r) with narrative form, but not with narrative clarity (see Table 3.9). In contrast, age and language ability were both positively associated with narrative form and clarity.

To investigate these relationships further, age, language ability, and social responsiveness were entered into two forward multiple regressions as predictors of overall narrative form and clarity. For narrative quality, the resulting model predicted

Table 3.9.

Pearson Product-Moment Correlations with Narrative Text Quality

Predictor	Form		Clarity	
	r	*p*	*r*	*p*
Age (years)	0.485	.008	0.523	< .001
Performance IQ (WASI-II)	0.214	.157	-0.062	.341
Language Ability (*TOLD-I:4*)	0.346	.049	0.346	.009
Social Responsiveness (SRS)	-0.247	.122	-0.268	.036

55.7% of the variance in narrative form, $F(3,42) = 61.156$, $R^2 = .557$, $p < .001$, with all three variables being significant predictors: age ($\beta = .549$, $p < .001$); language ability ($\beta = .254$, $p = .025$); and social responsiveness ($\beta = -.243$, $p = .028$). For narrative clarity, all predictors except for age ($\beta = .523$, $p = .007$) were dropped from the model and age significantly predicted only 27.3% of the variance in writing clarity, $F(1,44) = 16.58$, $R^2 = 0.273$, $p < 0.001$.

Discussion

This was the first study to conduct a detailed investigation of the narrative writing skills of children and adolescents with HFASD. Several lower order and higher order text features were examined. Overall, the narrative texts of students with HFASD and their TD peers were often similar. There were no reliable differences between the two groups on measures of productivity, syntactic complexity, use of writing conventions and overall narrative clarity. The narrative texts of the two groups did differ in terms of lexical complexity, primarily because students with HFASD tended to use more unique words ($d = +0.9$ SD, $p = .001$) in their texts than their peers. As well, the

narratives of the HFASD group were rated more poorly on measures of narrative form (*d* = -0.7 SD, *p* = .015) compared to controls.

Overall narrative form was comprised of three main components: organization and structure, character development, and balance between landscapes (of action and consciousness). While none of these three areas reached statistical significance between the two groups on their own, taken together these areas differentiated the narrative texts of the HFASD and their peers. As such, the narratives of the HFASD group were less likely to: (a) be well structured, particularly with regard to containing the elements of the basic story grammar, i.e., beginning, initiating event, reaction, goal, attempt, outcome, and conclusion (*d* = -0.6 SD, *n.s.*); (b) have well developed characters in terms of physical description, cognition, affect, motivation and intention (*d* = -0.6 SD, *n.s.*); and (c) maintain an adequate focus on explaining the essential meaning behind the actions of human characters, along with interpreting the significance of those actions (*d* = -0.6 SD, *n.s.*). The results should not be taken as conclusive, however, due to their lack of significance, the relatively small sample size and the large number of variables. The small sample and large number of tests have reduced the power of statistical tests so that only moderate or large differences are significant.

The examination of the three predictors of narrative form and clarity demonstrated the self-evident finding that older students write better than younger students, and that age is a very strong predictor of writing quality. However, in terms of narrative measures that focused on the form and content of the narrative genre, students who scored as more socially responsive and students who had stronger

language skills tended to also score higher on overall narrative form. Furthermore, although language ability and social responsiveness were dropped from the model examining the predictors of narrative clarity, both of these variables were nevertheless significantly related to narrative clarity according to the Pearson product-moment correlation coefficients. Thus, it may be that both language ability and a diagnosis of HFASD (at least in terms of impairment in social responsiveness) contribute to impairments in higher order measures of narrative quality. However, future research should re-examine these predictors of narrative skill with a larger sample to increase the power to detect significant findings.

The results of the current study are somewhat in line with the findings of Brown and Klein's (2011) study examining the narrative writing of adults with HFASD. Like the narratives of adults with HFASD, we found the texts of children and adolescents with HFASD to be rated more poorly on overall narrative quality. However, in contrast to Brown and Klein's (2011) findings, our differences between groups on overall narrative quality (*d* = -0.5 SD to -0.7 SD) were not as large as the previous findings (*d* = -1.8 SD), nor did our participants with HFASD write texts that were shorter in length. The discrepancies between the two studies may have been due to the presence of adults with HFASD who also had core language impairments in the Brown and Klein (2011) sample. The present study rigorously matched the students with HFASD and their TD peers on language ability using a comprehensive standardized language assessment (i.e., *TOLD-I:4*). Doing so seems to have diminished group differences on several key variables,

a phenomenon that has been identified previously by other researchers (cf. Tager-Flusberg & Sullivan, 1995).

Tager-Flusberg and Sullivan (1995) rigorously matched their sample of participants with ASD[6] to participants with intellectual disabilities on language skill using the *Peabody Picture Vocabulary Test - Revised* (Dunn and Dunn, 1981) and on the Sentence Structure and Formulated Sentences subtests of the *Clinical Evaluation of Language Fundamentals – Revised* (Semel, Wiig, & Secord, 1987). They then asked their participants to narrate the story of a wordless picture book. Follow-up analyses on several measures of narrative ability revealed almost no differences between the two groups. Like the current study, Tager-Flusberg and Sullivan's (1995) research found that individuals with ASD did not produce shorter narratives nor did their narratives include fewer connectives than controls. Further, both groups used similarly complex connectives as well as similar rates of mental state terms in their oral narratives (Tager-Flusberg & Sullivan, 1995).

Thus, it would seem that it is of critical importance to balance the language abilities of individuals with HFASD and the control group in order to accurately assess the specific impact of autism on narrative ability. Further, it is essential that future research compare the writing of children and adolescents with HFASD + LI to students + LI without HFASD, that is, children who fail to develop language at the usual rate, despite having normal intelligence, hearing and vision as well as typical environmental

[6] The ASD group had mean FSIQ scores of 68.4 (*SD* = 14.9). In comparison, the mean FSIQ scores for the control group was 76.8 (*SD* = 12.8).

exposure to language (Alloway, Rajendran & Archibald, 2009). Only by comparing the narrative texts of students with HFASD + LI and HFASD + LN to students + LI (without HFASD) and TD controls will we be able to more clearly untangle the impact of autism and language impairments on a student's ability to write narratives.

In the current study, both groups had oral language abilities in the normal range, yet the texts of the children and adolescents with HFASD were still found to have poorer narrative form than controls. This finding may link back directly to one of the core impairments of autism, i.e., social responsiveness. Deficits in social responsiveness are evident within the first year of life as the infant with HFASD tends to show decreased inclination to orient to human sounds, failures to engage in joint attention or social smiling, and difficulties with anticipating another's aim (Meyer & Minshew, 2002; Mitchell, Oram Cardy & Zwaigenbaum, 2011; Lord, 1995). Further to this, very young children with HFASD show deficits in responding to adult facial expressions and their own name, following an adult's eye gaze to infer an intended referent, learning through imitation, engaging in joint actions with others, and engaging in pretend play (Backer van Ommeren, Begeer, Scheeren & Koot, 2012; Bruner & Feldman, 1993; Klin, Jones, Schultz & Volkmar, 2003; Meyer & Minshew, 2002; Mitchell et al., 2011). Thus, the child with HFASD tends not to engage in the caretaker-child interactions necessary for the development of narrative thought, which in turn is believed to be necessary for the child to build the central conceptual structures of how the social world works (Bruner & Feldman, 1993; Case & McKeough, 1989). Furthermore, adolescents and adults with HFASD may have gone through much of their life without transforming their experiences

into the requisite conventional narrative form (Bruner & Feldman, 1993). In other words, they may spend less time encoding, representing, interpreting and constructing their experiences into a story form. As a result, individuals with HFASD may have underdeveloped narrative concepts and structures, which became evident in this study when they wrote impoverished narratives in terms of: (a) including all the elements of a narrative; (b) developing rich and dynamic characters; and (c) integrating *landscape of action* with the *landscape of consciousness*. This failure to engage in narrative thought may also be an underlying cause of one of the core features of autism, that is "qualitative abnormalities in reciprocal social interaction" (WHO, 1993).

Narrative thought is believed to be the "primary cultural tool for encoding, organizing, and constructing everyday experience" (McKeough et al., 2006, pg. 203). Yet, if a reduction in the ability to engage in narrative thought may be one cause of decreased social responsiveness among individuals with HFASD, then it also suggests a possible solution. Providing repeated opportunities for youth with HFASD to engage in narrative thought, such as through the creation of written narratives, could help students with HFASD to better understand or make sense of human acts and events (Bruner & Feldman, 1993; McKeough et al., 2006) and, perhaps, ultimately allow them to develop more successful peer relationships. In fact, previous research with TD children has shown training children to compose developmentally more advanced stories led to concomitant advances on a broad range of social tasks (Case & McKeough, 1989; McKeough, 1992; 1995). While much more research is needed in this area, we need to begin with a better understanding of the development of narrative in

population of individuals with HFASD and in turn develop interventions where their abilities may need support. Potentially, these interventions aimed at helping students with HFASD engage in narrative thought may have far-reaching consequences, and may be a critical element in the remediation of social deficits in HFASD.

Appendix

Narrative Rubrics: Higher Level Text Features

	Narrative Overall Content (Quality and Quantity)	**Cohesiveness**	**Balance between Landscapes**
0	• No elaboration of events, characters or setting – physical events only • Writing bound by context (you have to be there to understand the text) • No background information	• Scarce connections between ideas • The text is simply a list of ideas, statements, or thoughts • The text may be very repetitive • There is likely much off topic or tangential information • Text may not make sense	• Few or no intentional states (2 max) • Landscape of action primary/only landscape
2	• Minimal/limited description – may begin to describe setting, character and/or events • Inadequate background information	• Rare connections between ideas • There may be much off topic or tangential information • May still have a list-like feel • Text may be only somewhat understandable	• Simple intentional states only • Narrative extensively focuses on landscape of action • Limited reference to landscape of consciousness
4	• Simple / Some description of characters, events and/or setting (minimum 2/3 categories) • Some background information given	• Includes some connections between ideas • There may be some off topic or tangential information • Topic changes beginning to be smooth • May read as “choppy“ • The text is generally understandable	• beginning to include complex intentional states • Narrative consistently focuses on landscape of action • Some reference to landscape of consciousness

6	• Regular/ clear description of setting, characters and events • Consistent background information given	• Regularly connects ideas • May have some off topic or tangential information • Topic changes are often smooth • Reads as a relatively smooth text (not list-like) • The text is understandable	• Many intentional states; including both simple and complex states • A variety of mental states • Narrative approaches sound balance between landscapes
8	• Elaborate/thorough description of setting, characters and events • Extensive background information given	• Most ideas are connected • Topic changes are smooth • Contains many linked ideas • Reads as a smooth text • Text is understandable • Text may be insightful	• Extensive and explicit intentional states • Wide range of mental states • Masterful balance between landscapes
	Narrative Organization and Structure	**Narrative Character Development**	
0	• Story is only a few sentences long: 6 max. • Few or none of the Basic Story Structure elements present (0-2) • Physical events and states linked in simple sequence • Story may be a series of isolated events	• One or two flat static characters • Little relationship between characters OR Familial relationship between characters • Objective Point of View: story just gives facts; Reader is never allowed into any of the characters' minds, nor given any of their feelings or emotions.	
2	• Story is only one paragraph long • Some elements of the Basic Story Structure may be present (1-3) • Story mostly an action based sequence of events • Story does not seem to follow a logical order	• Beginning rounding in cognition/affect; often through explicit statements – she was sad • Relationships between characters are often action-driven • May move to third person limited point of view = reader can only access the thoughts and feelings of one character	

4	• Story may be more than one paragraph long • Many of the elements of the Basic Story Structure are present (3-5) • Story is not just an action based sequence of events but is beginning to also focus on the emotions/intentions of the characters • Beginning to proceed in a logical order	• Continued rounding in cognition/affect; may include physical description • Evidence that motivations/intentions drive actions of characters • third person limited point of view = disembodied narrator who's telling the story; reader has access to one person's head at a time • there may be some evidence of change but no evidence of growth
6	• Story is 1+ paragraph long • Most of the elements of the Basic Story Structure are present (4-6) • Story focuses on emotions/intentions of characters but may have a weak connection between the two landscapes • Story proceeds in a mostly logical order	• at least one character further developed through cognitive and affective states; may include physical description • Beginning evidence that motivations/intentions drive feelings and actions of characters • Third person limited point of view = reader can only access the thoughts and feelings of one character • Beginning features of change and growth
10	• Story is 3+ paragraphs long • All of the elements of the Basic Story Structure are present (7) • Story focuses on emotions/intentions of characters • Story proceeds in a logical order	• Round dynamic major characters through rich description of affect, intention and motivation • Growth occurs as a result of complex interactions between characters • Most characters contribute to the development of the narrative • Omniscient point of view

Basic Story Structure	
Beginning	Uses the prompt effectively
Initiating Event	First stimuli in the story that triggers the conflict in the plot of a story line
Simple Reaction	Protagonist's emotional or cognitive reaction
Goal	Protagonist's intentions in terms of dealing with the initiating even; cannot be implied
Attempt	Protagonist's attempt to achieve the goal
Outcome	Result of attempt
Conclusion	Story Ending

Note: These rubrics were developed based on the work of Brown & Klein, 2011; McKeough, Genereux, Jeary, 2006; McKeough, Palmer, Jarvey & Bird, 2007; Midgette, Haria & MacArthur, 2008; and Wolf & Gearheart, 1994.

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Chapter 4

Exploring the Persuasive Writing Skills of Students with High-Functioning Autism Spectrum Disorders[7]

Individuals with high functioning autism spectrum disorder (HFASD) tend to have deficits in social interaction and social communication as well as restricted, repetitive patterns of behaviour, interests or activities (American Psychiatric Association, 2013) despite the fact that they have average to above average intelligence. It is currently estimated that only 34-47% of adults with HFASD hold steady jobs and, of those who do, most would be considered under-employed (Howlin, 2003; Howlin, Goode, Hulton & Ruiter, 2004). Indeed, it has been reported that the annual societal cost due to lost productivity averages $33,000 per adult with HFASD between the ages of 23-32 (Ganz, 2007). This substantial cost could be reduced if individuals with HFASD had access to appropriate training and resources that enabled them to experience academic success. Solid academic performance empowers individuals with HFASD to attend post-secondary institutions and obtain meaningful employment (Schaefer-Whitby & Richmond-Mancil, 2009). This training is crucial as it gives adults with HFASD the opportunity to develop specialization in a field. In turn, employers will pay for their unique skills, while potentially overlooking any social deficits (Grandin, Duffy & Attwood, 2004). Consequently, Temple Grandin suggests that academic performance and

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specialized skill development is as important as social skills training for individuals with HFASD (Grandin, Duffy & Attwood, 2004; Schaefer-Whitby & Richmond-Mancil, 2009).

Before we can implement training and resources to address where students with HFASD need support, we first need to better understand their academic strengths and weakness in comparison to their typical developing (TD) peers. Such an examination in the area of written expression is critical as effective writing skills are necessary to succeed academically, professionally and in day-to-day life (Delano, 2007; Magnifico, 2010). Persuasive (or argumentative) writing, in particular, is important to adaptive functioning in work and society, because the "the literate, educated person is expected to be able to articulate a position on important matters so as to persuade colleagues, fellow citizens, governments, and bureaucrats" (Crowhurst, 1990, p. 349). Despite the critical importance of writing skills, only a small body of literature exists that investigates the written expression of individuals with HFASD in any genre, much less the persuasive genre. Nonetheless, this small body of research has demonstrated that writing can be an area of particular weakness in students with HFASD, but that writing skill is not always weak in this population (Brown, Oram Cardy, Johnson & Archibald, 2013 [Chapter2]; Brown, Oram Cardy, Smyth & Johnson, 2013 [Chapter 3]).

Foley-Nicpon, Assouline and Stinson (2012) recently examined the standardized academic achievement scores of a sample of students HFASD (*N* = 26) who were considered gifted, i.e., a standard score on a measure of intelligence or achievement ≥ 120 (93rd percentile). In this study, students with HFASD completed the writing samples subtest of the *Woodcock Johnson Tests of Achievement* (*WJ-III*; Woodcock,

McGrew, & Mather, 2001), in which they wrote two or three sentences in response to a picture or verbal cue. Their sentences were then scored on quality of expression at the single sentence level. These researchers found that individuals with HFASD generally had high mean scores on the writing samples subtest. However, score dispersion was quite large ranging from *Borderline* (Standard Score = 70) to *Very Superior* (Standard Score = 162).

In one of the few studies to date to examine expository writing, Mayes and Calhoun (2003) asked forty-two students with HFASD to complete a descriptive writing task from the written expression subtest of the *Wechsler Individual Achievement Test* (*WIAT*; Wechsler, 1991). These researchers reported that 63% of their sample of students with HFASD had written expression scores on the *WIAT* that were at least one standard deviation lower than their FSIQ scores. However, it is noteworthy that the written expression scores of their sample of individuals with HFASD ranged from *Extremely Low* (Standard Score = 65) to *High Average* (Standard Score = 113). Mayes and Calhoun (2003) summarized their findings by stating that a majority of their participants with HFASD had a specific learning disability in writing.

In a second study, the expository writing of adults with HFASD was examined in more detail using a non-standardized writing task. Brown and Klein (2011) asked participants with HFASD (n = 16) and their non-disabled peers (n = 16) to write an essay on the topic of *problems between people*. After evaluating the written texts across 18 indicators of *good* writing, results revealed that the essays of the adults with HFASD were rated lower on overall quality (d = -1.0). The primary area of difficulty in their

expository texts was that they tended to have difficulty staying on topic (*d* = -0.9) and included abrupt transitions between ideas (*d* = -1.0). In other words, the texts were weak in textual coherence and cohesion. Additionally, there was a tendency for the expository texts of the adults with HFASD to have lower clausal density (*d* = -0.5 SD), contain shorter words (*d* = -0.6 SD) and have more frequent spelling errors (*d* = -0.7 SD), but these modest differences were not significant.

Taken together, these three studies suggest that some students with HFASD have significant difficulties with written expression, especially in the expository genre. However, they also demonstrate that other students with HFASD are writing quite well. The reasons for this heterogeneity have yet to be explored. Furthermore, much of the research on the writing skills of individuals with HFASD has documented global writing deficits on standardized tests of writing achievement. New research is necessary that describes the specific strengths and weaknesses in the written texts of students with HFASD, as descriptive studies are an important first step to garnering evidence of a group's unique characteristics (Assouline, Nicpon & Dockery, 2011). To date, no research has examined the persuasive writing skills of individuals with HFASD. It is essential that we increase our understanding of the writing strengths and weaknesses of students with HFASD in the persuasive genre because competency in this area is necessary for success in secondary and post-secondary education as well as in the workplace (Crowhurt, 1990).

In persuasive writing, the writer adopts a particular point of view and tries to convince the reader to accept his position (Nippold, Warn-Lonergan, & Fanning, 2005).

To be successful, the writer must state his position, support it with emotional and/or logical appeals, anticipate counterarguments and reply to opposing points of view, all without alienating the reader he hopes to persuade (Crowhurst, 1990; Kroll, 1984; Nippold & Warn-Lonergan, 2010). Equally important, the author must create an integrated framework of ideas to help the reader comprehend the text and to allow the reader to integrate new information into memory stores (Kroll, 1984). Thus, persuasive writing is a challenging communication task that requires the writer to have sufficient knowledge of the topic, perspective-taking skills, the ability to weigh both sides of an issue, and written language competence, especially complex syntax (Nippold & Warn-Lonergan, 2010). It follows then that good persuasive writing is heavily dependent on writing for the reader, in that writers must not just express thoughts, but transform thoughts to meet the needs of readers (Flower, 1979). Writing that does not to meet the needs of the audience has been termed *writer-based prose* (Flower, 1979).

In function, writer-based prose is the writer's thoughts written to himself and for himself (Flower, 1979). In form, it can be the associative path of the author's thoughts on a topic. From Flower's (1979) list of characteristics of writer-based prose, we have identified two overarching features of this writing style. The first is *problems with integration of details into higher order concepts*. Such texts may read like a list of data and details, where the information is recorded in the exact form in which it was stored. Ideas are expressed with inadequate development or proof, and details tend not to be placed into larger, integrated frameworks (Flower, 1979). In writer-based prose, it seems as if writers assume their audience will "do the work of abstracting the essential

features, building a conceptual hierarchy and transforming the whole discussion into a functional network of ideas" (Flower, 1979, p. 28). The second feature of writer-based prose is that there is a *decreased clarity of expression*. The language in these texts is often unclear or vague. The text may contain ambiguous referents and expressions that convey only a general sense to the reader (Flower, 1979). In essence, then, poor persuasive writing often resembles writer-based prose in that it has problems with the integration of ideas into higher order concepts and its language can be unclear.

The writing problems of individuals with HFASD described in three case study reports (Chavkin, 2004; Happé, 1991; Jurecic, 2007) are characteristic of the two main features of writer-based prose defined above. First, the writers with HFASD described in these case studies struggled to create transitions, had a tendency to roam from one subject to another, and had difficulty filtering out irrelevant information; all of these are examples of difficulties with Flower's (1979) notion of creating large integrated frameworks. Second, the language of the texts was often unclear. Frequently, the writers failed to give appropriate background information and used undefined personal terms. Jurecic (2007) concluded that the writing of her undergraduate male with HFASD seemed to have a distorted sense of audience and, more specifically, that he seemed to use writer-based prose. The present study examined the question of whether the persuasive writing of adolescents with HFASD can be categorized as writer-based prose to a greater degree than their TD peers.

If the writing of people with HFASD does resemble writer-based prose, it raises the question of how features of autism would lead to this style of writing. The theory

explored here is drawn from Frith's (1989) original conception of *weak central coherence (WCC)*, which theorized that persons with autism had impaired global processing skills, and that they experienced a relative failure to extract the gist or see the big picture in many situations. The present study focused on one aspect of WCC, specifically, integrative processing, which is the ability to combine disparate parts into a unified whole. Research has suggested that this integrative aspect of WCC is necessary in order to create coherence in language-based tasks. Notably, Jolliffe and Baron-Cohen (2000) asked adults with HFASD and non-disabled controls to complete the Global Integration Test. In this test, the participants arranged five sentences to tell a coherent story based on a theme, except that some of the stories included temporal cues, whereas others did not. In the absence of temporal cues, adults with HFASD were less accurate and took more time to complete the task compared to control participants and these differences were quite large, ranging from d = -0.8 SD to -1.5 SD for accuracy and from d = -4.6 SD to -8.5 SD for response time. The large discrepancy between the two groups at achieving textual coherence based on thematic cues provides evidence for the hypothesis that individuals with HFASD struggle with integrative processing. Indeed, Jolliffe and Baron-Cohen (1999; 2000) noted that, overall, adults with HFASD were less accurate than their non-disabled peers at integrating words and sentences into meaningful wholes, and that they had the most difficulty with items that placed the greatest demands on integration to achieve higher order meaning.

It follows then that if individuals with HFASD have difficulty integrating information into hierarchical forms, their writing may resemble writer-based prose to a

greater extent than their TD peers, because one of the core features of writer-based prose is problems with *integration of details into higher order concepts*. Should it be true that their writing resembles writer-based prose, then we might expect that the persuasive texts of individuals with HFASD would show weaknesses in higher order measures of structure/organization and cohesiveness, and in lower order measures such as complex syntax. Consequently, the present study explored whether students with HFASD had difficulties with integrative processing relative to their TD peers and whether integrative processing was related to persuasive text quality.

Oral language skill was also an important factor for consideration in this study because written expression skill is highly dependent on the more primary forms of oral language (i.e., listening and speaking). Strong connections have been found between oral and written language on measures of wordiness, sophistication of grammar/syntax and textual coherence (Berninger, 2000; Hunt, 1965; Pappas, 1985; Shanahan & Shanahan, 2008). Further to this, several studies have identified language ability subgroups within the HFASD population. While problems with the pragmatics of language (i.e., the appropriate use of language in social communication) are a hallmark feature of HFASD, only a subgroup of individuals with HFASD also struggle with the core structure of language, namely, phonology, morphology, syntax and semantics (Bennett et al., 2008). Across studies, it has been found that a subgroup of individuals with HFASD has a core language impairments (LI) and a second subgroup has grammatical, phonological and vocabulary skills within the normal range (LN – Language normal) (Bennett et al., 2008; Kjelgaard & Tager-Flusberg, 2001; Lindgren, Folstein, Tomblin &

Tager-Flusberg, 2009). In addition, it has been suggested that individuals with HFASD + LN may in fact have lexical strengths relative to their TD peers (Brown, Oram Cardy & Johnson, 2013). Thus, it is of interest to determine whether some of the large dispersion in writing scores among individuals with HFASD may be related to collapsing participants with HFASD + LI and HFASD + LN into a single group (cf., Brown & Klein, 2011; Mayes & Calhoun, 2003). It is possible that the inclusion of individuals with HFASD + LI in the HFASD group may have resulted in lower mean scores in writing skill compared to non-disabled controls due to language ability alone. For this reason, it is important to untangle whether it is core oral language impairments, autism, or both that contribute to writing problems of students with HFASD.

The aim of the current study was to determine whether or not students with HFASD have difficulties across multiple indicators of *good* writing relative to TD students in their writing of persuasive texts. Of particular interest was whether the writing of students with HFASD resembled writer-based prose to a greater degree than their peers, even though both groups were balanced in language ability (in that they had language scores that fell within the normal range, and had similar group means and ranges of language scores). Eighteen text variables were examined across the following areas of writing: Productivity, Syntactic Complexity, Lexical Complexity, Use of Writing Conventions, and Overall Persuasive Quality. It was hypothesized that a diagnosis of HFASD would contribute to written language strengths and weaknesses beyond what would be predicted by oral language skill alone. Specifically, it was predicted that the texts of individuals with HFASD in comparison to controls would:

(a) resemble writer-based prose by demonstrating difficulty with the integration of details into higher order frameworks (i.e., problems with structure/ organization, cohesiveness and syntactic complexity) as well as with clarity of language use;

(b) not significantly differ on text variables related to text length or writing conventions, although these variables were also investigated.

A second aim of the study was to explore the predictive power of several key variables on persuasive writing quality. As previously described, it was hypothesized that language ability would play a significant role in writing success. Integrative processing ability was also investigated as a possible predictor of persuasive writing quality.

Method

Participants

Inclusion Criteria. This study included 25 students with HFASD (3 females) and 22 of their TD peers (8 females) from the Southern Ontario region. There were significantly more males in the HFASD group $\chi^2(1, N = 47) = 3.88$, $p = .049$. These same students also completed a narrative writing task, which is described in a separate paper (Brown, Oram Cardy, Smyth & Johnson, 2013 [Chapter 3]). There were five inclusion criteria shared across both groups. Each participant:

(a) was 8 to 17 years of age;

(b) had a PIQ score greater than or equal to 80 on the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999);

(c) had a Spoken Language Composite score greater than or equal to 80 on the Test of Language Development: Intermediate 4 (*TOLD-I:4*; Hammill & Newcomer, 2008);

(d) had no known neurological disorder, sensory impairment or major psychiatric disorder; and

(e) was a native English speaker.

For inclusion in the in the HFASD group, participants were required to have a community diagnosis of Autistic Disorder, Asperger's Disorder or PDD-NOS, as well as a *Social Responsiveness Scale* (*SRS*; Constantino, 2005) *T-score* of greater than or equal to 60. The TD students were required to have no reported disabilities and an SRS *T-score* of less than 60. Table 4.1 reports participant demographics. T-tests demonstrated that there no significant differences between the groups except on social responsiveness.

Table 4.1

Participant Demographics

Demographic	HFASD (*n* = 25) *M (SD)* Range	TD (*n* = 22) *M (SD)* Range	*t*	*p*	*d*
Age (years)	12.91 (2.15) 8.17-16.83	13.09 (2.50) 8.25-16.83	-0.267	.670	-0.1
Performance IQ (*WASI*)	108.04 (11.61) 84-131	109.59 (10.07) 85-128	0.630	.727	-0.1
Language Ability (*TOLD-I:4*)	98.32 (9.70) 82-123	101.55 (8.12) 83-118	0.227	.232	-0.4
Social Responsiveness (SRS)	85.44 (12.70) 63-113	44.00 (6.66) 35-58	14.242	< .001	+4.3

Recruitment. Several strategies for recruitment were used for this study. Personal contacts were asked to distribute email or paper announcements to parents of students with/without HFASD whom they may know. In addition, participants with HFASD were invited to participate through announcements placed with local agencies that support individuals with HFASD via their websites and through email to their membership. TD children were recruited in two additional ways. First, students who had previously participated in a longitudinal, epidemiological study of school-age children (Archibald, Oram Cardy, Joanisse & Ansari, 2013) received an email invitation. Second, siblings of children with HFASD were invited to participate if they had PIQ and language scores in the normal range, below cut-off scores on the SRS and no reported disabilities of any kind. Thus, siblings were included as long as there was no evidence that the siblings were any different from the other TD children. A more detailed explanation of our reasoning along with a complete description of the siblings can be found in Brown, Oram Cardy, Johnson and Smyth (2013 [Chapter 3]).

Measures

Social responsiveness. The *SRS* (Constantino, 2005; Constantino & Todd, 2005) was used to assess HFASD symptomology. The questionnaire asked parents to rate their child on 65 scaled questions in the areas of social reciprocity, social communication, and rigid, repetitive behaviours. The SRS generates a *T-score* with higher scores suggestive of greater impairments in social responsiveness. *T-scores* greater than 60 were used to confirm the presence of a diagnosis of HFASD (Constantino et al., 2004; Constantino &

Todd, 2005). In the current study, four control participants were excluded because their SRS scores were greater than 60.

Nonverbal IQ. PIQ was assessed using the Block Design and Matrix Reasoning subtests of the *WASI* (Wechsler, 1999). This nonverbal IQ score is primarily a measure of visual-spatial reasoning abilities. The measure was chosen because it allowed us to obtain an estimate of each participant's PIQ rapidly and efficiently. It is normed for participants aged 6 through 90 years.

Language ability. A comprehensive standardized language assessment, the *TOLD-I:4* (Hammill & Newcomer, 2008) was use to examine oral language skills across groups. It was the most appropriate choice for this study because it used the same six subtests across the entire age range of participants, i.e., 8 to 17 years. The six subtests included: (a) Sentence Combining, (b) Picture Vocabulary, (c) Word Ordering, (d) Relational Vocabulary, (e) Morphological Comprehension, and (f) Multiple Meanings. The six subtests were converted to scaled scores, which were then combined to calculate a standardized Spoken Language Composite score (Hammill & Newcomer, 2008).

Integrative processing ability. In the Global Integration Test, participants were asked to rearrange sentences according to contextual cues to make a coherent story (Jolliffe & Baron-Cohen, 2000). In total, participants completed 22 stories. Nine of the stories had only thematic cues, whereas the remaining 13 had both thematic and temporal cues. Each story consisted of five sentences, which were presented to the participant on a computer screen. During the trial story, the participant was shown how

to use the mouse to create a coherent story by dragging and dropping the sentences until they were in their proper sequence. When the participant felt that the story was in the proper order, she clicked *Done*. After completing the Global Integration Test, the participant read a short paragraph aloud to the experimenter. The time taken for each participant to read this paragraph aloud was used as a measure of reading speed. Accuracy and response times for each story were recorded by the computer program.

Persuasive writing task. First, the student viewed the following instructions on a computer screen, which were also read aloud to him:

> *Some parents want to limit:*
> - *the type of computer/video games their kids play*
> - *the type of internet and webpages (like Facebook, YouTube, iTunes) their kids are allowed to use*
> - *how long their kids are allowed to be on the computer*
>
> *Do you think your parents should limit what you use the computer for and how much time you spent on it?*

The student was then prompted to click *yes* or *no*. On the subsequent screen, the student would see and be read the following instructions:

> *Pretend that your parents are thinking about limiting what you use the computer for and how much time you spend on it (e.g., games, webpages, screen time). Write an essay to convince your parents to agree with your point of view on limiting your computer use. Make sure you plan your essay, include all elements of an opinion essay, and write as much as you can. My parents SHOULD (or SHOULD NOT) be able to limit what I use the computer for and/or how much time I spend on it! Explain why…*

The student would then write his text in a text box that had no spelling or grammar checking available. Students were given unlimited time to complete the writing task, but most completed within half an hour.

Analysis

We evaluated both lower order (text microstructure) and higher order (text macrostructure) text features. Tables 4.2 and 4.3 provide detailed descriptions of these variables.

Lower order text variables. In this study, four categories of lower order variables were assessed (Productivity, Syntactic Complexity, Lexical Diversity and Writing Conventions) and each category contained the following individual variables:

(a) Productivity: number of words, clauses and t-units;

(b) Syntactic Complexity: mean length of t-unit (MLTU), clausal density, and frequency of t-units without grammar errors;

(c) Lexical Diversity: Type Token Ratio (TTR), as well as frequency of multi-syllable words, big words and rare words; and

(d) Writing Conventions: frequency of errors in punctuation, spelling and capitalization.

Higher order text variables. Before assessing the texts on higher-order writing variables, all texts were corrected for spelling, capitalization and punctuation. The goal was to reduce rater bias because such errors have been shown to influence quality ratings (Olinghouse, 2008). Overall persuasive quality was evaluated using five text variables relating to the ability of the participants to organize ideas into higher order

Table 4.2

Lower Order Text Variables

Composite	Variable	Definition	ICC
Productivity	Total Words	The number of words in the text	-
	Total T-units	The number of t-units. One t-unit is one independent clause and any clauses dependent upon it	0.99
	Total Clauses	The total number of clauses in the texts (whether dependent, independent or embedded)	0.93
Syntactic Complexity	Mean Length of T-unit (MLTU)	The total number of words in the text divided by the total number of t-units	-
	Clausal Density	The total number of clauses in the text divided by the total number of t-units	-
	Frequency of T-units Without Grammar Errors[a]	The total number of t-units that were free of the two most common grammar errors (sentence fragments and run-on sentences) divided by the total number of t-units	0.88
Lexical Complexity	Type Token Ratio (TTR)[a]	A count of the number of different words in the text divided by the total number of words	-
	Frequency of Multi-Syllable Words[a]	A count of the number of words containing three or more syllables divided by the total number of words	-
	Frequency of Big Words[a]	A count of the number of words with seven or more letters divided by the total number of words	-

	Frequency of Rare Words[a]	A count of the number of words that are considered very rare according to the Corpus of Contemporary American English (COCA), i.e., words that had a frequency rating of greater than 3000 divided by the total number of words	-
Writing Conventions[a]	Frequency of Punctuation Errors	A count of the number of clauses with one or more punctuation errors divided by the total number of clauses	0.95
	Frequency of Spelling Errors	A count of the number of clauses with one or more spelling errors divided by the total number of clauses	0.98
	Frequency of Capitalization Errors	A count of the number of clauses with one or more capitalization errors divided by the total number of clauses	0.99

Note. Dashes indicate the variable was scored electronically. [a] This variable was scored using the following online text analyzer: http://www.usingenglish.com/resources/text-statistics.php [b] Rare words were scored using this online text analyzer: http://www.wordandphrase.info/analyzeText.asp

Table 4.3

Higher Order Text Variables

Composite	Variable	Definition	ICC
Overall Persuasive Quality	Frequency of Connectives	The number of clauses that included a connective word divided by total clauses and multiplied by 10.	0.92
	Cohesiveness	A holistic judgment of the degree to which: (a) ideas were connected, (b) topic changes were smooth, (c) the student included toff-topic or tangential information, and (d) the text was understandable.	0.89
	Background Information	A holistic judgment of the degree to which the student provided appropriate background information through the inclusion of multiple arguments that were well-developed through supporting reasons	0.92
	Organization and Structure	A holistic measure of the degree to which the narrative: (a) contains the elements of the five paragraph essay structure (i.e., introduction, position statement, three body paragraphs and a conclusion); (b) contains several distinct arguments; and (c) uses paragraphing .	0.85
	Tone	A holistic measure of the degree to which the writer used (a) a respectful and appropriate tone; (b) mature arguments; and (c) softeners (e.g., hedges) to indicate narrator uncertainty and, thus, multiple possible interpretations or perspectives	0.80

Note: Across all measures, individual scores ranged from 0 to 10.

frameworks and to communicate their ideas clearly. As such, overall persuasive quality contained the following variables: frequency of connective use, as well as rubric scores of structure and organization, cohesiveness, background information, and tone. (See Appendix). Further, all higher order scores were adjusted so that the minimum score was 0 and the maximum score was 10. The mean across all the individual variables was taken as the overall composite score, i.e., overall persuasive text quality.

Integrative processing. After each trial of the Global Integration Test, the computer program automatically provided accuracy and response time information for each participant. The accuracy scores on the two conditions were converted to be on a scale from 0 to 10, so that the two conditions could be compared more easily. Additionally, the response time data for each question that the participant answered incorrectly was deleted. The remaining response times for correctly answered trials were averaged to form a response time composite score for both the temporal and thematic conditions.

Reliability. Tables 4.2 and 4.3 include the inter-rater reliabilities for each variable. The coding of the textual variables was undertaken by H.M.B. and R.E.S. and two research assistants. To eliminate rater bias, all coders were blind to the diagnosis of each participant. In addition, the research assistants were intentionally uniformed as to the experimental hypotheses. H.M.B. or R.E.S. independently coded each variable in its entirety. Then, each variable was scored a second time by a research assistant or R.E.S. for at least 20% of the texts. This process allowed us to compute intraclass correlations between the two raters for each variable. In instances where a given variable did not

receive an inter-rater reliability score of 0.7 or higher, the coders were retrained and the variable was recoded.

Statistical analysis. With regard to the persuasive texts, multivariate analysis of covariance (MANCOVA) controlling for age was used to assess whether there were differences in the written texts between the two groups across each family of lower order variables. This was done in order to control the experiment-wise risk of false rejections of the null hypothesis due to the large number of textual variables (Hummel & Sligo, 1971). Hummel and Sligo (1971) suggest that a significant multivariate effect "protects" the F-ratios of subsequent univariate calculations from inflation of the Type I error rate when performing multiple comparisons, and so no corrections were made to univariate ANOVAs that were carried out when parsing significant multivariate effects. However, the large within group variability in writing scores due to age weakened the power of the multivariate analysis of variance (MANOVA) to detect between group variation. Therefore, age was used as a covariate in all analyses. A one-way analysis of covariance (ANCOVA) also controlling for the effects of age was used to test for differences between groups on the higher order composite score.

Post hoc comparisons on all the individual text variables were run using one-way ANCOVAs, regardless of the outcome of the multivariate tests for both lower order and higher order text variables. To adjust the significance level of each test relative to the total number of tests in the set, post hoc comparisons were evaluated with a Sidak correction. Further to this, the means, *SD*s, and estimates of standardized mean differences between groups (Cohen's *d*) were reported. These comparisons were

completed regardless of the multivariate test results because the information gained by exploring the differences between the groups across all eighteen individual text variables was invaluable. This information was necessary to provide a systematic and detailed description of the similarities and differences in the text of students with HFASD compared to their TD peers.

With regard to the Global Integration Test, a MANCOVA controlling for age was run on the accuracy data. The response time composites were also analyzed using MANCOVA, but these analyses controlled for both age and reading speed. As above, the size of the differences between groups for each variable was quantified using effect sizes.

Finally, Pearson's product-moment correlations were run between overall persuasive quality and the following predictors: age, language ability, social responsiveness, and accuracy on the temporal and thematic conditions of the Global Integration Test. Only those variables that were significantly related to persuasive quality were then used as predictors in a forward multiple regression. The regression was conducted to help answer the question of whether language ability, the symptoms of autism or both contribute to writing strengths and/or weaknesses across both groups.

Results

Lower Order Text Variables

In Table 4.4, the results of the omnibus MANCOVAs for the lower order text variables are reported. There were significant differences between the writing of students with HFASD and their TD peers across measures of productivity, syntactic

complexity and lexical complexity. There were no significant differences between the two groups on use of writing conventions.

Table 4.4.

Results of the Omnibus MANCOVAs for each Family of Lower Order Text Variables

Lower Order Text Variables	Wilks' λ	*F*	*p*	η^2
Productivity*	0.815	3.171	.034	0.19
Syntactic Complexity*	0.702	5.929	.002	0.30
Lexical Complexity*	0.777	2.949	.031	0.22
Writing Conventions	0.979	0.297	.827	0.02

Note. * Significant at $p < .05$

Productivity and syntactic complexity. Whereas the multivariate test suggested that the length of the persuasive texts of the HFASD group tended to be shorter than the persuasive texts of their peers, none of the three individual measures of productivity were reliably different between groups (see Table 4.5). The multivariate test across all measures of syntactic complexity was also shown to discriminate between the two groups. However, in this case, the two groups differed on two of the individual syntax variables. Students with HFASD tended to write t-units that were shorter (*d* = -1.0 SD) and less complex (*d* = -1.0 SD) than those of their peers. Further, the size of these mean differences suggest that they may be clinically meaningful in that students with HFASD would likely be viewed by various professionals as having weaknesses in syntactic complexity.

The reported differences between the two groups in terms of productivity and syntactic complexity, prompted a closer examination of each group's oral language

Table 4.5.

Differences between Groups on Measures of Productivity and Syntactic Complexity

Text Variable	HFASD	Control	$F(1,44)$	p	d
	M (SD) Range	*M (SD)* Range			
Productivity					
Total number of words	183.48 (178.23) 35 - 722	271.72 (235.10) 60 - 926	2.869	.097	-0.4
Total number of clauses	22.28 (18.79) 5 - 75	31.95 (24.99) 6 - 105	2.791	.102	-0.4
Total number of T-units	12.64 (10.44) 4 – 40	14.95 (11.45) 4 - 42	0.487	.489	-0.2
Syntactic Complexity					
Mean Length of T-unit *	13.62 (3.65) 7.0 - 20.6	17.43 (4.02) 9.1 - 26.9	15.824	< .001	-1.0
Clausal Density*	1.74 (0.421) 1.0 - 2.4	2.13 (0.159) 1.5 - 3.1	10.023	.003	-1.0
Frequency of T-units without Grammar Errors	83.35 (21.34) 25 – 100	90.05 (12.28) 57 - 100	1.640	.207	-0.4

Note. *Significant using a Sidak correction of $p < .017$

scores as measured by the *TOLD-I:4*. In addition to an overall language score, the *TOLD-I:4* also provides a grammar composite score based on participants' oral syntactic and morphology skills. As shown in Figure 4.1, there was no significant difference in grammatical ability between the HFASD group (M = 97.76, SD = 10.30) and the control

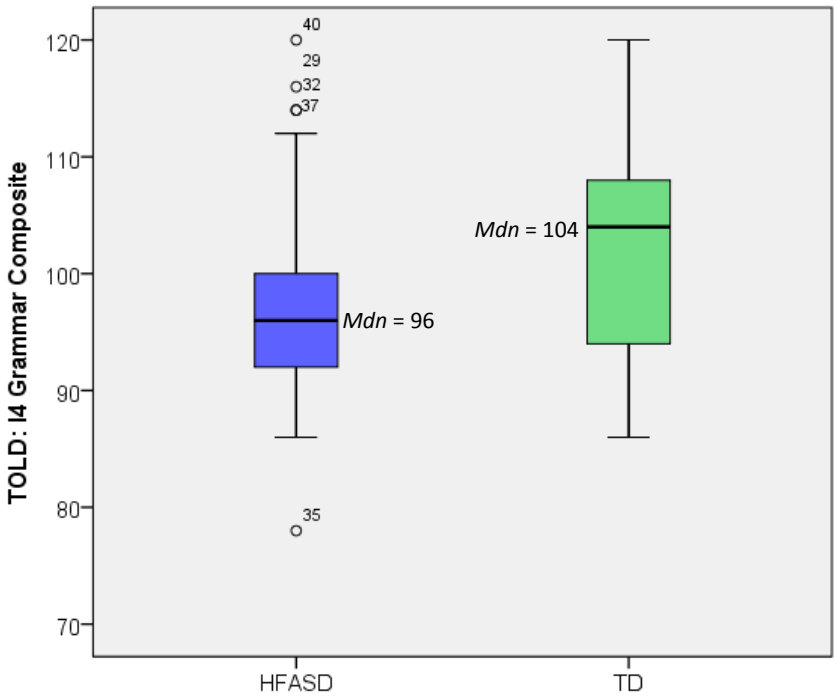

Figure 4.1. Grammar composite scores from the *TOLD-I:4.*

group (*M* = 102.00, *SD* = 8.99), *F*(1,45) = 2.23, *d* = -0.4, *p* = .142. An independent samples median test indicated a slight trend for the median of the HFASD group between the *TOLD-I:4* grammar composite and each of: (a) MLTU (*r* = .258, *p* = .083); and (b) Clausal density (*r* = 0.083, *p* = .584). These correlations demonstrated that there was no relationship between oral grammar ability and syntactic complexity across the two groups.

Although the use of complex syntactical structures in the persuasive writing task was not likely related to oral grammar skills, complex syntax may have been related to the ability of participants to integrate details into higher order frameworks, in this case, hierarchical syntactic structures. Pearson correlation coefficients between the Global Integration Task (Temporal and Thematic accuracy) and MLTU and Clausal Density are

reported in Table 4.6. The modest correlations found between integrative processing and syntactic complexity indicate that the lower syntactic complexity scores were partially related to the participants' weaknesses in integrative processing.

Table 4.6

Correlations between Measures of Integrative Processing and Syntactic Complexity

	Thematic Accuracy Score	Temporal Accuracy Score
MLTU	r = .420, p = .003	r = .467, p = .001
Clausal Density	r = .298, p = .042	r = .256, p = .082

Lexical complexity and writing conventions. Overall, lexical complexity differentiated between students with HFHFASD and controls. Examination of the individual means revealed that this disparity was primarily the result of higher mean scores for the HFASD group on Type Token Ratio and Frequency of Rare Words (see Table 4.7). In particular, Individuals with HFASD tended to use a greater number of unique words (d = +0.8 SD) in their persuasive texts along with words that occur less frequently in the English language (d = +0.8 SD) compared to their TD peers. In contrast to the findings for lexical complexity, there were no reliable differences between the two groups on their use of writing conventions. Both groups had similar rates of punctuation, spelling and capitalization errors.

Table 4.7

Differences between Groups on Measures of Productivity and Syntactic Complexity

Text Variable	HFHFASD	Control	*F*(1,43)	*p*	*d*
	M (SD) Range	*M (SD)* Range			
Lexical Diversity					
Type Token Ratio[a]	57.32 (10.70) 40.4-87.0	49.97 (7.02) 35.1-63.9	8.301	.006	+0.8
Frequency of Multi-Syllable Words	2.92 (1.95) 0.0-8.8	2.72 (1.52) 0.0-5.44	0.235	.630	+0.1
Frequency of Big Words	12.67 (5.62) 4.1-25.6	11.24 (3.45) 5.0-16.8	1.148	.290	+0.3
Frequency of Rare Words	9.42 (4.03) 4.4-17.4	6.51 (3.47) 2.1-13.1	6.770	.013	+0.8
Writing Conventions[c]					
Frequency of Punctuation Errors	74.83 (72.97) 0-300	81.83 (61.32) 0-230	0.248	.621	-0.1
Frequency of Spelling Errors	61.10 (45.53) 0-180	76.84 (73.31) 8-316	0.887	.351	-0.3
Frequency of Capitalization Errors	67.96 (68.64) 0-283	67.12 (72.12) 0-225	.016	.899	0.0

Note. [a] Significant using a Sidak correction of $p < .013$; [b] There was one outlier in the HFHFASD group whose text contained 18% rare words. The range reported above has this outlier removed; [c] Higher scores represent larger error rates

Higher Order Text Variables

Table 4.8 reports the results of the one-way ANCOVA (controlling for age) on Overall Persuasive Quality as well as the follow-up comparisons between the two groups on the individual text variables. The texts of individuals with HFASD were generally rated more poorly on overall quality (d = -0.6 SD); however, these differences in persuasive quality might be perceived as subtle by the general educator or clinician. An examination of the five variables within Overall Persuasive Quality showed that the differences were of modest size (d = -0.4 to -0.6 SD), yet none were significant after using a Sidak correction for running multiple tests. Although these findings cannot be taken as conclusive, the results indicate that the persuasive texts of the students with HFASD tend to be rated more poorly across measures of quality that tap text clarity, cohesiveness, organization and tone.

Integrative Processing

Across the temporal and thematic conditions of the Global Integration Task, the omnibus MANCOVA examining accuracy while controlling for age, Wilks' $\lambda = 0.949$, $F(2,42) = 1.153$, $p = .325$, $\eta^2 = 0.051$, as well as the MANCOVA for reaction time controlling for age and reading speed, Wilks' $\lambda = 0.915$, $F(2,42) = 1.95$, $p = .155$, $\eta^2 = 0.085$, both demonstrated that there were no reliable differences between groups on the Global Integration Task (see Table 4.9). Inspection of the individual group means in the thematic condition shows a slight trend where the HFASD group seem somewhat less accurate (*d* = -0.4 SD) than controls; however they appear to have also completed correct trials slightly faster (*d* = 0.4 SD) than their TD peers.

Table 4.8.

Differences Between Groups on the Higher Order Text Variables

	HFHFASD	Control	*F*(1,44)	*p*	*d*
	M (SD)	M (SD)			
Overall Persuasive Quality	**3.76 (1.96)**	**5.00 (2.05)**	**7.721**	**.008***	**-0.6**
Frequency of Connectives	2.22 (1.13)	2.76 (1.46)	2.490	.122	-0.4
Cohesiveness	4.35 (3.21)	5.85 (2.87)	5.928	.046	-0.6
Background Information	3.75 (3.00)	5.40 (3.44)	4.199	.019	-0.5
Organization and Structure	4.65 (3.34)	5.91 (2.94)	3.034	.089	-0.4
Tone	3.85 (2.60)	5.11 (2.86)	2.404	.128	-0.4

Note. * Significant at p < .05

Table 4.9.

Differences between Groups on the Global Integration Test

Variable	HFASD M (SD) Range	Control M (SD) Range	F(1,43)	p	d
Temporal Condition					
Accuracy	6.09 (1.66) 3.1-10.0	6.22 (2.08) 2.3-9.2	0.015	.903	-0.1
Reaction Time	44.33 (16.22) 26.9-97.7	48.96 (20.12) 25.5-101.8	1.80	.187	-0.2
Thematic Condition					
Accuracy	6.40 (1.91) 1.1-8.9	7.12 (1.36) 4.4-8.9	2.36	.132	-0.4
Reaction Time	42.74 (13.01) 22.6-80.4	50.06 (22.17) 21.2-108.0	3.82	.057	-0.4

Predicting Overall Persuasive Quality

Across both groups, there was a fairly substantial positive correlation (Pearson's r) between overall persuasive quality and each of age (r = .704, p < .001), language ability (r = -0.569, p < .001), and accuracy on the thematic (r = .629, p < .001) and temporal (r =.508, p < .001) conditions of the Global Integration Test. Furthermore, there was a significant negative relationship between social responsiveness and text quality (r = -0.453, p < .001).

Age, language ability, social responsiveness, and accuracy on the thematic and temporal conditions of the Global Integration Test were entered into a forward multiple regression to further investigate the relationship between these predictors and text quality. The resultant model predicted 77% of the variance in persuasive writing quality, $F(4,42) = 35.12$, $R^2 = 0.770$, p < .001, and four variables were included: age (β = .490, p < .001); language ability (β = .336, p < .001); social responsiveness (β = -.230, p = .008); and accuracy in the thematic condition of the Global Integration Test (β = .205, p = .033). In contrast, accuracy on the temporal condition of the Global Integration Test was dropped from the model.

Discussion

This was the first study to conduct a detailed investigation of the persuasive writing skills of children and adolescents with HFASD compared to their TD peers. We found that the persuasive writing of students with HFASD was reliably different across overall measures of productivity, syntactic complexity, lexical complexity and persuasive

quality. In contrast, there were no significant differences between the two groups on overall use of writing conventions.

It was unexpected that individuals with HFASD would write shorter and less syntactically complex persuasive texts than their peers given that both groups were rigorously matched on oral language ability. Nevertheless, the results suggest that individuals with HFASD tended to write fewer words and clauses (*d* = - 0.4 SD, *n.s.*) and to use shorter and simpler sentences in terms of both shorter t-units (*d* = -1.0 SD, *p* < .001) and fewer clauses per t-unit (*d* = -1.0 SD, *p* = .003). Similarly, Brown and Klein's (2011) examination of the expository writing of adults with HFASD found modest (d = -0.4 SD, *n.s.*), but non-significant differences between groups across productivity measures (e.g., t-units, clauses, words) and on one measure of syntactic complexity, clausal density (*d* = -0.5 SD, *n.s.*). However, a few of the adults in the Brown and Klein (2011) study likely had core oral language impairments. These difficulties with syntax found by Brown and Klein (2011) might be expected given that syntactic weaknesses of individuals with LI are often characterized by short, simple sentences with limited subordination (Nippold, Mansfield, Billow, & Tomblin, 2008). Yet, these same findings in the current study of individuals with HFASD + LN prompted a closer examination of the oral language scores as measured by the *TOLD-I:4* grammar composite score, which provides an estimate of oral syntactic and morphological skills.

Although there was no significant differences in oral grammatical ability between the HFASD group and controls, there was a slight trend for the median grammar scores of the HFASD group to be lower than the control group (*p* = 0.061) and this difference

was modestly sized (*d* = -0.6 SD). Although it may be reasonable to suppose that the lower syntactic complexity scores of the HFASD group resulted from weaker oral grammar skills, this prediction was not supported. There was no relationship between the oral grammar composite scores and any measure of syntactic complexity in the persuasive texts. In contrast, a modest relationship was found between the two measures of complex syntax and integrative processing (as measured by the Global Integration Test).

In light of these findings, the shorter text length and simpler syntax of the HFASD group might be better understood through the lens of writer-based prose. Flower's (1979) notion of writer-based prose included difficulties creating large integrated frameworks and decreased clarity of expression. More specifically, elements found in writer-based prose tend to include: (a) inadequate development of ideas; (b) decreased cohesiveness; (c) vague or unclear statements; and (d) a tendency for details to not be placed into cohesive, hierarchical structures (Flower, 1979). As described in Table 4.10, the results of the current study do not establish, but do suggest, that individuals with HFASD tend to write using writer-based prose to a greater degree than their TD peers. While these findings cannot be taken as conclusive, the current study provides preliminary support for the notion that the persuasive writing of children and adolescents with HFASD may be characterized as writer-based prose. Although this style is not ideal, writer-based prose may be an important step in the writing process for writers with HFASD. Writer-based prose reflects the author's thoughts about the material and it represents a practical strategy for managing large amounts of

Table 4.10.

Evidence from the Current Study Supporting the Hypothesis that Individuals with HFASD Tend to Write Using Writing-Based Prose

Characteristics of Writer-Based Prose	Evidence from the current study
Vague or unclear statements	The texts of the HFASD group were rated more poorly on overall quality, tended to give less background information[b], and tended to use more rare words. All of which may have impacted the clarity of their writing[a].
Ideas are expressed with inadequate development	The texts of the HFASD group tended to give less background information[b], and were shorter in length[a]. Their texts may have also had some problems with organization and structure[c]. These findings suggest that the ideas expresses in the texts of students with HFASD may have been inadequately developed.
Decreased cohesiveness	The HFASD group tended to use fewer connectives[b], used less repetition of content words[a], and had lower cohesiveness scores[c] than controls. As such, these findings suggest that the persuasive texts of students with HFASD were less cohesive.
Ideas not integrated into overarching frameworks	The syntax used by students with HFASD tended to be less complex[a] and less dense (i.e., fewer t-units tended to contain multiple clauses[a]) compared to their peers. The HFASD group also seemed to struggle with the organization and structure of their persuasive texts[c]. Together, this suggests that the ideas expressed in the texts of the HFASD group may not have been well-organized into hierarchical frameworks.

Note. [a] Significant difference; [b] Non-significant difference after correcting for multiple tests; [c] Non-significant difference.

information (Flower, 1979). Transforming writer-based prose into reader-based prose breaks down the writing process into manageable parts and is a practical way to deal with overload on working memory. In creating writer-based prose, the writer is able to create a draft that covers the breadth of their knowledge on the topic and drops the burden of making the writing accessible to the reader. It often represents a rich compilation of thoughts that cohere for the writer, but the writing has not yet fully articulated the connections for the reader (Flower, 1979). Teaching writers with HFASD to recognize their writer-based prose and to view it as a positive first step in the writing process may give the writer with HFASD the confidence to continue onto the revising and editing stage. Further, teaching writer-based prose defines writing as a multi-stage process and gives a good rationale for the necessity of editing and reworking written drafts (Flower, 1979). Thus, transforming writer-based prose into reader-based prose should be explored as a possible teaching strategy when working with students with HFASD.

It is nonetheless important to emphasize that the differences in the persuasive texts between groups tended to be subtle (-0.4 SD to -0.6 SD) and not necessarily significant. Further research in this area is needed with a larger cohort of participants in order to increase the power of the analyses to find statistical significance in the modestly-sized differences between the HFASD group and TD controls. This finding of modest differences between groups was likely due to the fact that the two groups were rigorously matched on oral language skill, given that previous research has shown that doing so can reduce or eliminate group differences (c.f., Tager-Flusberg & Sullivan,

1995). This may be especially important in the study of persuasive writing skills of individuals with HFASD given the current study's finding that oral language ability was a strong predictor of overall persuasive quality (β = .336, p < .001), as was HFASD symptomology (β = -.230, p = .008). Therefore, it is critical that future research examine the persuasive writing of individuals with HFASD + LI compared to students with LI, i.e., children who fail to develop language at the usual rate, despite having typical environmental exposure to language as well as normal intelligence and sensory abilities (Alloway, Rajendran & Archibald, 2009). Only by examining the persuasive texts of four different groups: students with HFASD + LI, HFASD + LN, LI without HFASD and TD controls will we be better able to understand the impact of autism (in the presence and absence of core language impairments) on a student's ability to write persuasively.

Historically, writing has been a central facet of western education (Crowhurst, 1990). In our increasingly digital age, writing has become even more essential in the workplace, the education system and our day-to-day personal lives (Magnifico, 2010). Having a job that requires the individual to regularly produce written reports has become "a marker of high-skill, high-wage, professional work" (College Entrance Examination Board, 2004). Yet, most individuals with HFASD are unemployed or underemployed despite their average to above average intelligence. This is a huge loss to both the individual with HFASD and to society as a whole. In order for students with HFASD to obtain appropriate employment, we must provide training and resources to improve their written expression skills. Individuals with HFASD need access to appropriate writing education to prepare them for later employment, which will in turn

help them to achieve economic independence and allow them to contribute meaningfully to society.

Appendix

Persuasive Rubrics: Higher Level Text Features

	Persuasive Structure and Organization	**Background Information (Quality and Quantity)**
0	• 5-6 simple sentences (i.e., one t-unit) • No position statement • Arguments are merely listed • No conclusion	• No background information • A list of reasons all or most of which do not answer the question/relate to the topic • No arguments
2	• 5-6 simple sentences (may have some complex sentences) • Position statement present, but is only one sentence long • May use exact position statement that they were given: "My parents SHOULD (NOT) be able to limit what I use the computer for and/or how much time I spend on it!" • Arguments are merely listed • No conclusion	• Inadequate background information • A list of related reasons • No arguments
4	• Text is one paragraph long • A variety of sentence types • Position statement present but may be only one sentence long • The conclusion statement may be a terminating remark not appropriate to the text or is only one sentence long • All the arguments may be clumped together in one paragraph	• Some background information given • at least one argument has been stated • Argument shows limited development through supporting reasons
6	• Text is two paragraphs long • Introduction, position statement and conclusion are present, but each may be only about one sentence long • Beginning to resemble the five paragraph essay structure	• Consistent background information given • One or more arguments have been stated • At least one argument shows good development through supporting reasons

8	• Text is three or more paragraphs long • Each paragraph contains a distinct argument • Introduction and conclusion must be more than one sentence • Text generally follows the five paragraph essay structure	• Excellent background information given • Two or more arguments have been stated • At least two arguments show good development through supporting reasons

	Overall Textual Cohesiveness	**Overall Tone**
0	• Scarce connections between ideas • The text is simply a list of ideas, statements, or thoughts • The text may be very repetitive • There is likely much off topic or tangential information • Text may not make sense	• Tone is rude, angry, harsh, narrow-minded or disrespectful • Didn't take topic seriously • Includes obvious immature arguments • includes black and white statements , generalizations and/or sweeping statements • Uses colloquial language • Does not consider more than one point of view
2	• Rare connections between ideas • There may be much off topic or tangential information • May still have a list-like feel • Text may be only somewhat understandable	• Tone is off-putting, arrogant, whiney, lifeless or mechanical • Commitment to topic may be present but writer needed to take the topic more seriously • Includes many immature arguments • Includes many black and white statements , generalizations and/or sweeping statements • Frequently chooses inappropriate words • Does not consider more than one point of view
4	• Includes some connections between ideas • There may be some off topic or tangential information • Topic changes beginning to be smooth • May read as "choppy" • The text is generally understandable	• Tone is neutral • Writer shows interest and commitment to the topic • Includes some immature arguments • Includes some black and white statements , generalizations and/or sweeping statements but some may be softened by polite forms • Sometimes chooses inappropriate words • Likely does not consider more than one point of view

6	• Regularly connects ideas • May have some off topic or tangential information • Topic changes are often smooth • Reads as a relatively smooth text (not list-like) • The text is understandable	• Tone is respectful and appropriate • Considers the topic seriously • Has mature arguments • Uses generalized statements but are softened by polite forms • Generally chooses appropriate words • May consider the opposite point of view in the argument
8	• Most ideas are connected • Topic changes are generally smooth • Contains many linked ideas • Reads as a smooth text • The text is understandable • Text may be insightful	• Tone is inviting and engaging • Considers the opposite point of view in the argument • Softens tone of argument by “hedges” (indicate narrator uncertainty and, thus, multiple possible interpretations or perspectives) • Exhibits skill in word choice

Based on Berman & Nir-Sagiv, 2007; Brown & Klein, 2011; Midgette, Haria & MacArthur, 2008; Scott, 2009; Westby & Clauser, 1999

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Chapter 5

Discussion

Adolescents and young adults with autism are some of our most vulnerable and poorly served citizens. Programs and services that continue beyond adolescence are scarce and, in some cases, non-existent, yet demand is increasing (Autism Ontario, 2008). It is estimated that currently 70,000 people in Ontario have some form of autism spectrum disorder (ASD), including 50,000 adults (Autism and Developmental Disabilities Monitoring Network Surveillance [ADDMNS], 2007; Autism Ontario, 2008). Over the last ten years, the number of students identified with ASD in publicly funded school systems has more than doubled (Ontario Ministry of Education, 2007). At the same time, the movement towards full inclusion has resulted in more students with high functioning autism spectrum disorder (HFASD), that is students with ASD as well as average to above average intellectual functioning, being integrated in general education classrooms. As a result, teachers may find themselves ill-equipped to meet the complex needs of these learners. Understanding the nature of academic difficulties of students with HFASD is critical to allow educators and clinicians to develop more individualized, focused and effective interventions for these students. This in turn will facilitate the removal of barriers to their successful participation in the workforce and higher education upon graduation. To this end, this integrated article dissertation explored the academic skills of individuals with HFASD in general, and their narrative and persuasive writing skills in particular. Specific aims were to:

1. To examine how well students with HFASD, as a group, perform on standardized academic achievement tests compared to their expected performance as indicated by their IQ. This question was explored across five academic areas: written expression, reading comprehension, decoding, math computation, and math reasoning.
2. To examine the narrative and persuasive writing of children and adolescents with HFASD in depth across multiple measures of writing in order to create a picture of the writing strengths and weaknesses of students with HFASD.
    i. To examine whether the persuasive writing of students with HFASD can be categorized as writer-based prose to a greater degree than their TD peers;
    ii. To examine the relationship between the quality of the written texts and several predictors of narrative and persuasive writing competence.

The following general discussion considers and integrates the results across the three studies. This includes a discussion of key findings regarding the general academic abilities of individuals with HFASD and, in particular, their strengths and weaknesses in written expression. Limitations of the studies and directions for future research are considered, then the contribution of this work and its implications are discussed.

Global Writing Scores in HFASD

According to Brown, Oram Cardy, Johnson and Archibald (2013 [Chapter 2]), individuals with HFASD were generally performing 0.6 SD below their expected performance (as measured by their nonverbal IQ; NVIQ) across seven studies examining overall written expression skill. Further to this, the meta-analysis predicted that for any

given sample of individuals with HFASD, the range of discrepancies between written language performance and NVIQ would fall between -1.3 SD to +0.8 SD. In comparison, Brown, Oram Cardy, Smyth and Johnson (2013 [Chapter 3]) found that students with HFASD wrote narratives that scored, on average, 0.2 SD below their TD peers[8]. Similarly, students with HFASD wrote persuasive texts that scored 0.4 SD lower than their TD peers on the global measure of persuasive writing (Brown, Johnson, Smyth & Oram Cardy, 2013 [Chapter 4]).

Although it is not possible to directly compare these three overall effect sizes because they were formed from different measures, they nevertheless highlight that on global measures of written expression, students with HFASD are performing quite similarly to their TD peers. Furthermore, the prediction interval from the meta-analysis confirms that it should be possible to collect a sample of individuals with HFASD who have mild weaknesses (or even moderate strengths) in written expression. Indeed, a sample of students with HFASD falling within this very prediction interval was found in the two studies described in Chapters 3 and 4.

Since the students with HFASD recruited for this dissertation had very similar language profiles compared to the control group, it was perhaps unsurprising that, overall, the writing scores of the students with HFHFASD were only 0.2 to 0.4 SD lower than controls across both the narrative and persuasive writing studies. As mentioned in Brown, Oram Cardy, Smyth and Johnson (2013 [Chapter 3]), prior studies have shown

[8] This effect size was determined by computing the average difference in effect sizes across of all twenty measures of narrative writing performance used in the study.

that equating groups of individuals with HFASD and controls on language skill can diminish or alter group differences (cf. Tager-Flusberg & Sullivan, 1995). It is essential that future research on the writing skills of individuals with HFASD continue to consider language ability across groups, either by equating the groups on language ability (as done here) or by exploring how the written texts of individuals with HFASD with LI compare to the texts written by both individuals with HFASD, but without LI, and to individuals with LI, but without HFASD. To date, no research has compared the written language skills of these groups.

The comparisons of overall writing skill across the three studies also demonstrate the problems of using a global writing score to measure strengths and weaknesses in written expression skills of individuals with HFASD. While the global score demonstrated very small to modest differences between the two groups, the written texts of the HFASD group did show moderate and large weaknesses on some writing variables compared to the controls. Needless to say, the global writing score did not capture these differences. Consequently, as cautioned by Reitzel and Szatmari (2003), researchers must be wary of relying on broad measures of written expression, such as those measured by standardized tests, when evaluating the writing skills of this population. Broad writing measures will not necessarily capture the types of weaknesses that individuals with HFASD can show in their writing.

Lower and Higher Order Variables Across Genres

In this section, I compare and contrast the differences in the written texts of students with HFASD and controls across the two genres studied. Tables 5.1 and 5.2

Table 5.1

Standardized Mean Differences between Groups on the Lower Order Text Variables

Variable Name	Narrative		Expository	
	d_{AVE}	*d*	d_{AVE}	*d*
Productivity	-0.3		-0.3	
Total words		-0.3		-0.4
Total clauses		-0.3		-0.4
Total t-units		-0.3		-0.2
Syntactic Complexity	-0.2		-0.8	
MLTU		-0.1		-1.0
Clauses per t-unit		-0.2		-1.0
T-units without grammar errors		-0.2		-0.4
Lexical Diversity	+0.2		+0.5	
Type-token ratio		+0.9		+0.8
Use of multi-syllable words		0.0		+0.1
Use of big words		-0.2		+0.3
Use of rare words		+0.1		+0.8
Writing Conventions	+0.2		-0.1	
Punctuation errors		+0.2		-0.1
Spelling errors		+0.1		-0.3
Capitalization errors		+0.2		0.0

Note. A negative value for *d* indicates that the HFASD group performed worse than their TD peers. A positive value for *d* indicates that the HFASD group performed better than their TD peers; d_{AVE} = the average effect size across each family of variables; MLTU = Mean Length of T-unit.

Table 5.2.

Standardized Mean Differences between Groups on the Higher Order Text Variables

Variable Name	Narrative		Expository		
	d_{AVE}	*d*	d_{AVE}	*d*	
Quality	d_{AVE} = -0.4		d_{comp} = -0.6[c] d_{AVE} = -0.4		
Overall Narrative Clarity Composite	d_{comp} = -0.5[a]				
Cohesive reference		-0.3		Ø	
Frequency of connectives		-0.2		-0.4	Overall Persuasive Quality Composite
Cohesiveness		-0.5		-0.6	
Background information		-0.2		-0.5	
Overall Narrative Form Composite	d_{comp} = -0.7[b]				
Organization and structure		-0.6		-0.4	
Character development		-0.6		Ø	
Balance between landscapes		-0.6		Ø	
Tone		Ø		-0.4	

Notes: A negative score indicates that the HFASD group performed worse than their TD peers. Ø indicates this variable was not scored; [a] Effect size reported for the Narrative Clarity Composite; [b] Effect size reported for the Narrative Quality Composite; [c] Effect size reported from the Persuasive Quality Composite Score; d_{AVE} = the average effect size across each variable included as a measure of text quality; d_{comp} = the size of the difference between the two groups on each composite.

summarize the standardized mean differences (as measured by Cohen's *d*) between the two groups on each individual writing variable as well as across each family of variables.

Productivity. The multivariate test on persuasive text length demonstrated that across the three productivity measures, the persuasive texts of the HFASD group were shorter than the texts of their TD peers. Conversely, the narrative multivariate test found no significant differences between the two groups on narrative length. Similarly, follow up analyses on the individual variables within each productivity family (i.e., number of words, clauses and t-units) found that none of the individual variables differed between groups across both text types. Equally important, the size of the differences between the two groups on the length measures across genres were quite small ranging from *d* = -0.2 SD to *d* = -0.4 SD (See Table 5.1).

It is often cited in case studies (cf., Chavkin, 2004) as well as in multi-participant studies (cf., Brown & Klein, 2011; Smith-Myles et al., 2003) that individuals with HFASD have difficulty generating content and thus tend to write shorter texts than their peers. In comparison, Brown, Oram Cardy, Smyth and Johnson (2013 [Chapter 3]) found that the length of the written narratives of the HFASD group were not significantly different (*d* = -0.3 SD) than the control group, whereas Brown and Klein (2011) reported that the HFASD group narrative texts were much shorter (*d* = -0.8 SD) than controls when the participants were asked to write a personal narrative about a time when they had a problem with someone. On the other hand, both Brown, Johnson, Smyth and Oram Cardy (2013 [Chapter 4]) as well as the Brown and Klein (2011) study found a slight difference in length between the two groups in the persuasive genre (*d* = -0.4 SD) and

the expository genre (*d* = -0.4 SD), respectively; however, these differences were not significant.

Across the aforementioned studies, individuals with HFASD tended to have only mild weaknesses in productivity compared to controls on a variety of writing tasks, except in the task where they were asked to write a personal narrative (Brown & Klein, 2011). The disparate findings may be in part due to the fact that the personal narrative was a relatively unstructured task and similar to a diary entry. Previous research suggests that individuals with HFASD struggle on unstructured tasks (Capps, Kehres, & Sigman, 1998; Losh & Capps, 2003). Furthermore, we and others have theorized that individuals with HFASD may be less likely to encode their experiences in narrative form, which may lead to decreased narrative writing skill as well as decreased social knowledge (Brown, Oram Cardy, Smyth & Johnson, 2013 [Chapter 3]); Bruner & Feldman, 1993). Thus, evidence for this hypothesis may be seen most clearly in their personal narratives where adults with HFASD tended to have difficulty generating content about stories from their past. However, additional research is needed to explore this hypothesis in more depth.

Syntactic complexity. The persuasive texts of the students with HFASD differed quite significantly from controls in terms of syntactic complexity. The HFASD group used less hierarchical language forms in that their t-units tended to be shorter (*d* = -1.0 SD) and contained fewer clauses (*d* = -1.0 SD). Conversely, the narrative texts of individuals with HFASD were of similar syntactic complexity in terms of both MLTU (*d* = -0.1 SD) and clausal density (*d* = -0.2 SD).

The significant impairments found in the use of complex syntax of the HFASD group in their persuasive texts is somewhat surprising given that HFASD group and the TD controls were closely matched on standardized measures of spoken language from the *TOLD-I:4*, including the Spoken Language Composite and Grammar Composite (Brown, Oram Cardy, Smyth & Johnson, 2013 [Chapter 3]; Brown, Johnson, Smyth & Oram Cardy, 2013 [Chapter 4]). However, an independent sample median test on the Grammar Composite tentatively suggested that the participants with HFASD may have had modest impairments in syntactic ability compared to controls (d = -0.6 SD, p = .061) (Brown, Johnson, Smyth & Oram Cardy, 2013 [Chapter 4]). This finding is in line with some previous research. As highlighted in a review by Stothers and Oram Cardy (2012), some studies found participants with HFASD to have mild impairments in syntactic abilities (c.f., Koning & Magill Evans, 2001; Riches, Loucas, Baird, Charman & Simonoff, 2010), yet other research has found that individuals with HFASD have typical syntactic abilities (cf., Groen, Zwiers, van der Gaag & Buitelaar, 2008; Kelley, Paul, Fein & Naigles, 2006). However, the question of whether or not individuals with HFASD have impairments on oral measures of grammar and syntax may be a moot point for the purpose of this discussion as Brown, Johnson, Smyth and Oram Cardy (2013 [Chapter 4]) found that syntactic complexity in the persuasive texts was not related to oral grammar, but rather integrative ability.

Understanding the relation between syntactic complexity in persuasive texts and integrative processing can be supported by considering differences between the persuasive and narrative genres. Previous research has found that growth in syntactic

abilities throughout adolescence is subtle (Nippold, 2000). Indeed, developmental changes in syntax are often best captured in students' persuasive writing, which is more cognitively and linguistically demanding than the chronological order of the typical narrative (Crowhurst, 1987; Rubin & Piche, 1979; Nippold, 2000). Persuasive writing is considered more demanding in part because it is dependent on the writers' ability to identify the essential ideas of their argument, combine their ideas into a conceptual hierarchy and create a text containing an integrated network of ideas (Flower, 1979). Given that individuals with HFASD tend to have deficits in integrative processing (cf., Jolliffe and Baron-Cohen, 2000), the simpler syntax used by the HFASD group may be a result of their difficulty integrating details into higher order frameworks. This hypothesis was supported by the modest positive correlations (r = 0.3 to 0.5) found between measures of integrative processing and syntactic complexity (Brown, Johnson, Smyth & Oram Cardy, 2013 [Chapter 4]). Thus, the decreased syntactic complexity shown by the HFASD group in their persuasive texts, but not in their narrative texts, may have occurred because of their difficulties with integrative processing.

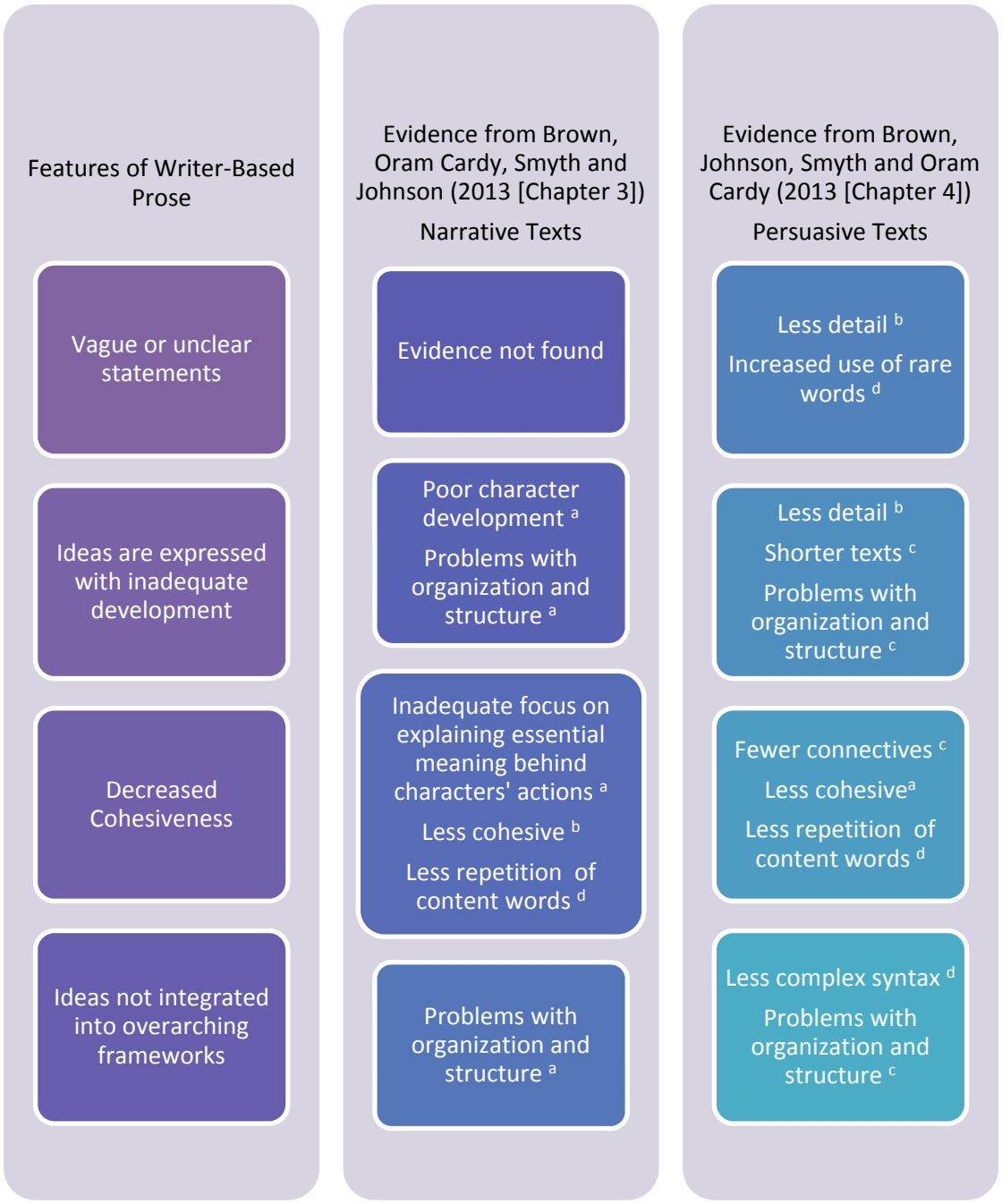
Lexical complexity. Across both text types, students with HFASD and their TD peers differed across measures of lexical complexity. In particular, the students with HFASD used more unique words (across both genres) and, in their persuasive texts only, used more rare words (i.e., words that occurred less often in the English language) than their TD peers. These differences in lexical use tended to be large (d = +0.8 to +0.9 SD) and clinically meaningful, in that the language of individuals with HFASD would appear noticeably different than that of their TD peers.

The question of whether the impact of these differences in language use improved or detracted from their written texts warrants further consideration. On the one hand, using more sophisticated vocabulary, especially in the persuasive genre, should lead to concise and varied language use and lead to better quality overall (Scott, 2009). However, if the HFASD group is using more unique words because they are using less repetition of content words, then this may threaten the textual coherence of their texts and ultimately text quality (Scott, 2009). Another possibility suggested in the literature by Happé (1991), is that writers with HFHFASD are using more unique or rare words because they are using idiosyncratic language, i.e., language that had rich meaning for them, but that meaning may not have been available to the reader. A final hypothesis is that their language choices were odd because they did not fully understand the meaning of the words they have chosen to use (Stothers & Oram Cardy, 2012).

To explore the latter hypothesis further, correlations were run between narrative and persuasive unique words, persuasive rare words, persuasive quality, narrative clarity and narrative form. These correlations demonstrated that using a greater number of unique words detracted from narrative form (r = -0.431, p = .003), narrative clarity (r = -0.399, p = .006) and persuasive quality (r = -0.565, p < .001). However, using more rare words in the persuasive texts was not related to persuasive text quality. Thus, contrary to research findings with TD children (c.f., Scott, 2009), use of more unique words tended to detract from overall quality, instead of enhancing it in the present studies.

Text Quality. Across both persuasive and narrative genres, students with HFASD wrote poorer quality texts. However, these differences were modest (*d* = -0.5 SD to -0.7 SD) and suggest that the differences in text quality between the two groups were generally subtle. In the narrative genre, individuals with HFASD had the most difficulty with their use of narrative elements and form, i.e., narrative structure and organization (*d* = -0.6 SD), character development (*d* = -0.6 SD) and integrating the inner worlds of their characters with the events in the story (*d* = -0.6 SD). As well, their narratives tended to be less cohesive (*d* = -0.5 SD), but this modest difference did not reach significance. In comparison, the persuasive texts of the students with HFASD tended to be less cohesive (*d* = -0.6 SD) and less detailed (*d* = -0.5 SD) compared to their TD peers.

One of the questions asked in Brown, Johnson, Smyth and Oram Cardy (2013 [Chapter 4]) was whether the persuasive writing of individuals with HFASD resembled writer-based prose to a greater degree than their TD peers. Flower (1979) defines writer-based prose as the associative path of the writer's thoughts on a topic. Generally, texts considered to be writer-based prose are characterized by problems with organization (since they often have difficulties creating an integrated framework of ideas) as well as by decreased clarity of language use. More specifically, elements found in writer-based prose tend to include: (a) inadequate development of ideas; (b) decreased cohesiveness; (c) vague or unclear statements; and (d) tendency for details to not be placed into cohesive, hierarchical structures (Flower, 1979). As described in Figure 5.1, the results of the persuasive and narrative studies provide some initial support for the hypothesis that individuals with HFASD tend to write using writer-based



Note: [a] *d* = -0.6 SD, *n.s.*; [b] *d* = -0.5 SD, *n.s.*; [c] *d* = -0.4 SD, *n.s.*; [d] *d* = +0.8 SD or +0.9 SD, $p < .05$

Figure 5.1. Evidence supporting the hypothesis that individuals with HFASD tend to write using writer-based prose: A comparison across genres.

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prose across both narrative and persuasive genres (Brown, Johnson, Smyth & Oram Cardy, 2013 [Chapter 4]); Brown, Oram Cardy, Smyth & Johnson, 2013 [Chapter 3]). While these findings cannot be taken as conclusive, this research tentatively suggests that the narrative and persuasive texts of individuals with HFASD demonstrate poor *integration of ideas into higher order frameworks* and *decreased clarity of expression* more so than the texts of their TD peers, and as such might be considered writer-based prose.

Predictors of Writing Quality Across Genres

Several predictors of writing quality were investigated across the persuasive and narrative writing studies. Across both genres, age, language ability and social responsiveness predicted overall text quality. As such, students who were older and those who had stronger oral language skills tended to write higher quality texts. As well, students who scored lower on the SRS scale, and thus demonstrated lower HFASD symptomology, were generally better writers.

One of the original aims of this integrated article dissertation was to examine how features of autism might lead to writing strengths and weaknesses. In particular, I wanted to examine two theories that attempted to explain why individuals with HFASD have problems communicating and interacting in the social world: the Theory of Mind (ToM) deficit hypothesis and the Weak Central Coherence (WCC) hypothesis. Brown, Johnson, Smyth and Oram Cardy (2013 [Chapter 4]) found some evidence that integrative processing, part of WCC, did impact overall persuasive text quality. In

contrast, my efforts to measure ToM for the purposes of comparing it with writing ability were not successful.

Theory of Mind. ToM is the ability to represent mental states such as beliefs and desires, both for oneself and for others (Baron-Cohen, 1995). When applied to writing, a deficit in ToM might mean that individuals with HFASD do not realize the importance of making their writing comprehensible to the reader. Researchers have suggested that ToM deficits may also impact the writer's ability to take the perspective of the reader, leading to a lack of background information or context, and a lack of explicit connections to lead the reader through the text (Colle, Baron-Cohen, Wheelwright, & van der Lely, 2008; Loveland, et al., 1990). As well, Brown and Klein (2011) found that ToM was modestly related to narrative and expository text quality in the writing of adults with HFASD.

During data collection for this dissertation, the *Social Attribution Task* (SAT; Klin, 2000) was given to all participants as a measure of ToM skill. This task assesses the ability of participants to spontaneously attribute social meaning to ambiguous visual stimuli. The SAT was originally developed by Heider and Simmel (1944) and adapted by Klin (2000). It has been shown to discriminate the ToM skills of adults with HFASD compared to individuals without disabilities (Klin, 2000; Klin & Jones, 2006). Additionally, Brown and Klein (2011) used this task in their writing study and found that their composite SAT score discriminated between the adults with HFASD and controls, and that it was modestly correlated with text quality.

The SAT involved watching a sixty second video of two triangles and a circle moving within and around a large rectangle. After the participant watched the video twice, she was asked to describe what happened in the video. The participant then watched the video again, but it was stopped six times. After each segment, the participant was asked to explain "What happened here?" The participant was then explicitly told to pretend that the shapes were people (if she had not done so spontaneously). The participant was then asked three questions: "What kind of person is Big triangle/ Small Triangle/ Small Circle?" Finally, the participant watched the video again in five segments and was asked to explicitly name objects, events and interactions as if they were people interacting with each other (Klin, 2000).

The SAT was recorded and then transcribed. The oral SAT narratives were scored by two research assistants, both of whom were naïve to the experimental hypotheses and blind to the group membership of participants, on six indices: Pertinent Index, ToM Index, Salience Index, Person Index, Animation Index, and the Problem Solving Index.

Repeated measures and correlational analyses of the SAT indices revealed that the SAT did not differentiate between the ToM skills of the two groups, nor was it related to text quality as had been found previously by Brown and Klein (2011). This finding is somewhat surprising given that the SAT required the participants to narrate a story about the shapes in the video, which seems conceptually similar to writing a written narrative. One hypothesis was that task performance was related to age, language ability or intelligence. However, correlations between each of the SAT indices and each of age and oral language ability demonstrated no significant relationships. As

such, it is unclear what the SAT was actually measuring. To conclude, the SAT task did not prove to be a good measure of ToM for children and adolescents in this research, therefore it was subsequently dropped from the papers comprising Chapters 3 and 4. Consequently, it was not possible to directly test if ToM was related to writing quality in this dissertation.

In future work, it will be important to consider using a different ToM task, such as the Strange Stories test developed by Happé (1994). These stories are a set of vignettes about everyday situations where characters say things that they do not literally mean (Happé, 1994). Each story was constructed so that TD individuals would generally interpret the meaning behind the nonliteral utterance in one way. Kaland et al. (2005) replicated the original findings of Happé (1994) with a group of relatively able children and adolescents with Asperger Syndrome (AS). Kaland and colleagues (2005) found that their participants with AS tended to have difficulty interpreting the nonliteral utterances correctly compared to their TD peers. However, it should be noted that the TD participants scored significantly higher on the tests of intelligence compared to the participants with AS.

A second possibility might be the attribution task developed by Abell, Happé and Frith (2000). This task asks participants to watch shapes in a video clip similar to the *Social Attribution Task*. However, in this version, the shapes interact in either random sequences, goal-directed sequences or ToM sequences (i.e., an interaction where one shape reacts to another's mental states). In the original study, children with autism were matched to children with general intellectual impairments and typically developing 8-

year-olds whose verbal mental age matched that of the two clinical groups. Abell et al. (2000) found that children with ASD were more likely to give inappropriate mental state explanations. This task was then further developed by White, Coniston, Rogers and Frith (2011). In the updated task, the experimenters used an objective scoring method for detecting ToM deficits, and the tasks were quicker and easier to administer. When the new methodology was used with adults with HFASD and non-disabled controls, the task was still found to be a sensitive measure of ToM deficits in the adults with HFASD (White et al., 2011).

Although these advanced ToM tasks have shown differences between HFASD groups and controls, it is important to note that many of these studies have confounded language ability and autism on ToM performance. Previous research has shown that ToM is related to both lower order and higher order language skills (Capps, Kehrs & Sigman, 1998; Losh & Capps, 2003; Tager-Flusberg, 1999; Tager-Flusberg, 2007; Tager-Flusberg & Joseph, 2003; Tager-Flusberg & Sullivan, 1994). Despite this ubiquitous finding, ToM research has generally failed to compare the ToM skills of individuals with HFASD + LI separately from individuals with HFASD + LN. Additionally, most previous work examining advanced ToM tasks has failed to rigorously control oral language skills across clinical and control groups. It is crucial that future researchers consider the impact of autism separately from language skill on the ability of students with HFASD to successfully complete advanced tests of ToM.

Integrative processing. The second predictor of writing quality that I chose to investigate in this dissertation was drawn from Frith's (1989) original conception of

WCC. Frith (1989) theorized that persons with autism had impaired global processing skills, and that they experienced a relative failure to extract the gist or see the big picture in many situations. One aspect of WCC, integrative processing, was the focus in the present study. Integrative processing is the ability to combine disparate parts into a unified whole. Joliffe and Baron-Cohen (1999; 2000) reported that adults with HFASD were less accurate than their non-disabled peers at integrating words and sentences into meaningful wholes, and that they had the most difficulty with items that placed the greatest demands on integration to achieve higher order meaning.

Brown, Johnson, Smyth and Oram Cardy (2013, [Chapter 4]) had some success at using the Global Integration Test from Jolliffe and Baron-Cohen (2000) to predict persuasive writing quality. In this task, participants had to arrange five sentences using contextual information to form a coherent story. For example,

> *the sentence 'It was not long before Charlotte was able to pat and stroke the horse's mane', suggests the protagonist has a greater familiarity with the horse than the sentence 'The horse would gallop away every time Charlotte would walk towards him' (Jolliffe & Baron-Cohen, 2000, p. 1175).*

Using context cues, one can discern that the second sentence should come before the first. As such, this task requires participants to be constantly comparing the relationships between information in each of the five sentences (Jolliffe & Baron-Cohen, 2000). Although only contextual cues are available in the thematic condition, in the temporal condition, participants use both the theme of the story as well as temporal cues to arrange the sentences. As a result, Jolliffe and Baron-Cohen (2000) suggested that the narratives in the temporal condition were easier to arrange because the individual could

rely on semantic knowledge, such as *got up early*, *after lunch*, *by mid-afternoon* and *evening*, to organize the five sentences coherently.

Jolliffe and Baron-Cohen (2000) originally gave this task to 34 adults with HFASD and 17 non-disabled controls between the ages of 18 and 49. In terms of accuracy, the researchers found that adults with HFASD were less accurate in the thematic condition than controls, yet there was no difference in between groups on the temporal condition. In terms of response time, adults with HFASD had much slower response times in the thematic condition, but they were actually faster than controls in the temporal condition.

Brown, Johnson, Smyth and Oram Cardy (2013, [Chapter 4]) did not find that the groups differed in accuracy on the thematic or temporal conditions, nor did we find differences between groups in response times. In other words, the Global Integration Test failed to differentiate between the HFASD group and the control group. This finding was quite unexpected given the integrative processing weaknesses theorized to exist in the HFASD population. However, there was some evidence that the Global Attribution Test was a valid measure of integrative processing as accuracy on the thematic condition, but not the temporal condition, predicted unique variance in persuasive writing quality above and beyond age, language ability and social responsiveness. Interestingly, integrative processing was not related to, or a significant predictor of, overall narrative form or clarity. The finding that integrative processing was related to persuasive text quality, but not narrative quality, is in accordance with the previous research that suggests that quality of persuasive writing is heavily dependent upon the

integration of ideas into higher order frameworks, whereas narratives tend to be organized sequentially or chronologically (Crowhurst, 1990; Genereux & McKeough, 2007; Westby & Clauser, 1999).

Executive functioning. There are additional features of autism that may related to writing strengths and weaknesses in the written texts of students with HFASD that should be explored in future research. For example, individuals with HFASD tend to have deficits in executive functioning, such as difficulties with planning and organization, as well as problems with perseveration, attention and initiation (Ozonoff, Pennington & Rogers, 1991). Although no studies have directly tested whether executive functioning deficits predict writing quality in the HFASD population, executive functioning has shown to be an important predictor of writing achievement in studies involving TD students (cf., Vanderberg & Swanson, 2006). Furthermore, several single subject intervention studies involving students with HFASD have used *Self-Regulated Strategy Development* (Graham & Harris, 1993; 1998), a writing intervention that focuses on the remediation of deficits in executive functioning, especially self-regulation, to improve writing skill. These intervention studies have all demonstrated that after students with HFASD have participated in Self-Regulated Strategy Development, they show improvements in both their narrative and persuasive writing in terms of including more story and essay elements in their texts as well as improvements in overall quality (Asaro-Saddler & Bak, 2012; 2013; Asaro-Saddler & Saddler, 2010; Delano, 2007a). As a result, these studies give some indirect support for the premise that executive functioning deficits may

impact the written expression skills of students with HFASD, but this hypothesis needs to be explored directly in future research.

Limitations

One of the main limitations across all three studies in this dissertation was an inability to investigate the differences between students with HFASD + LN and students with HFASD + LI in the areas of academic functioning in general, and written expression in particular. Brown, Oram Cardy, Johnson and Archibald, 2013 [Chapter 2]) were unable to run this comparison in the meta-analyses because much of the research that exists on the academic skills of individuals with HFASD have tended to include individuals with HFASD + LN and those with HFASD + LI in the same group. As such, a subgroup analysis based on language ability was not possible.

With regards to Brown, Oram Cardy, Smyth and Johnson (2013 [Chapter 3]) and Brown, Johnson, Smyth and Oram Cardy (2013 [Chapter 4]), the original aim was to have four groups of students in these studies: HFASD + LI, HFASD without LI, LI without HFASD, and TD controls. It was originally predicted that the group with HFASD + LI would have the most striking and pervasive impairments in their written expression, which will be related to weaknesses in oral language, ToM and integrative processing. A second prediction was that individuals with HFASD + LN would show impairments in higher order text features, but not lower order; whereas students + LI would show the reverse: impairments in lower order text features, but not higher order. Unfortunately, only four individuals with HFASD + LI volunteered to be a part of the studies, so the aforementioned comparison was not possible.

A second set of limitations in Brown, Oram Cardy, Smyth and Johnson (2013 [Chapter 3]), and Brown, Johnson, Smyth and Oram Cardy (2013 [Chapter 4]) involved the sample size and the number of dependent variables. First, a relatively small sample was obtained due to the difficulty of recruiting participants with HFASD and time restrictions. This limited the power of the statistical tests, so that only group differences and correlations that were medium to large in size attained statistical significance. A second limitation was due to the number of comparisons drawn. The large number of textual variables and statistical tests increased the likelihood of false rejections of the null hypothesis, but this was theoretically offset by running multivariate tests. However, in order to fully describe the strengths and weaknesses in the writing of students with HFASD, post-hoc analyses were run even when the multivariate test showed no significant difference between groups. Although a Sidak correction was used to evaluate significance within each family of variables in order to offset the study-wise probability of false rejections of the null hypothesis, readers should interpret the results concerning individual text variables with caution.

Educational Implications

There is currently a small, but growing body of research that looks at improving the writing skills of students with HFASD. Several researchers have used single-case, multiple baseline/probe designs to examine writing interventions in both the persuasive and narrative genres. It is important to note, however, that only students with HFASD who had considerable deficits in written expression were chosen to participate in these studies. Nevertheless, in a recent review of this literature, Pennington and Delano

(2012) reported that across several studies, *Self-Regulated Strategy Development* (SRSD; Graham & Harris, 1993; 1998) was shown to be successful at improving the writing skills of students with HFASD (Asaro & Saddler, 2009; Asaro-Saddler & Saddler, 2010; Delano, 2007a; Delano, 2007b; Mason, Kubina, Valasa, & Cramer, 2005). To date, two more publications have also supported the finding that SRSD seems to be a successful writing intervention for students with HFASD (Asaro-Saddler & Bak, 2012; 2013).

SRSD is a writing model that explicitly and systematically teaches cognitive and self-regulation strategies for accomplishing specific writing tasks (Graham, Harris & Mason, 2005). Teachers learn to facilitate the writing intervention in a series of six instructional stages: develop preskills, discuss it, model it, memorize it, guided practice and independent practice. The instruction is scaffolded in that it gradually shifts responsibility for strategy use and self-regulation from teacher to student. Goal setting, self-monitoring, self-instructions, and self-reinforcement are all important parts of SRSD. As well, SRSD uses a number of mnemonics to help students remember key ideas. For example, POW (Pick my ideas, Organize my notes, Write and say more) refers to the steps involved in any writing activity. Alternatively, TREE is a mnemonic to help students remember the basic elements of persuasive texts (Topic sentence, Reasons – 3 or more, Explain, Ending) (Graham et al., 2005). In sum, SRSD is a model that promotes writing independence by teaching the form and elements of narrative and persuasive texts as well as self-regulation skills, i.e., areas and abilities that tend to be weak across the population of individuals with HFASD. However, more research is needed examining the effectiveness of SRSD for students with HFASD as the current body of research is not yet

sufficient to consider SRSD an evidence-based practice for the HFASD population (Pennington & Delano, 2012).

While SRSD may be an important practice for improving the writing skills of students with HFASD, the findings of Brown, Oram Cardy, Smyth and Johnson (2013 [Chapter 3]) and Brown, Johnson, Smyth and Oram Cardy (2013 [Chapter 4]) suggest some additional implications and possible directions for instructional research. Because this was causal comparative research, and not an instructional intervention study, implications for instruction must be considered with caution.

First, the results of the narrative and persuasive studies suggest that students with HFASD generally show subtle impairments in their written texts compared to their TD peers. One area of primary concern was that students with HFASD had difficulties with narrative elements and form that are unique to narrative text construction such as: (a) including all of the elements of the basic story grammar in their narratives; (b) creating rich characters who grow and change through the events of the story; and (c) adequately explaining the essential meaning behind the actions of characters, along with interpreting the significance of those actions. We and others have theorized that individuals with HFASD may have underdeveloped narrative concepts and structures, and that they may engage in narrative thought less often (Bruner & Feldman, 1993). Consequently, increasing the amount of time individuals with HFASD spend reading, writing and telling narratives may significantly increase their understanding of the narrative genre and their social knowledge more generally. Further to this, individuals with HFASD should be explicitly taught how to create more advanced stories as this

practice as shown to be effective with TD students (Case & McKeough, 1989; McKeough, 1992; 1995).

Second, as mentioned previously, the narrative and persuasive texts of individuals with HFASD may be characterized as writer-based prose to a greater extent than their TD peers. Teachers can place a strong positive value on the writer-based prose of their students with HFASD as it is an important first step in the multi-stage process of written expression (Flower, 1979). Students who have created a writer-based draft have a text that covers the breadth of their knowledge on the topic, while dropping added burden on working memory of making their writing accessible to the reader. Thus, students need to understand that writer-based prose is a practical strategy for managing large amounts of information and breaking down the writing process into manageable parts (Flower, 1979). Moreover, using writer-based prose as an intermediary step may help students create texts that have *large integrated frameworks of ideas* and use *clear language* more manageable by setting these tasks apart from other facets of the writing process. As well, understanding writer-based prose as a practical strategy may provide a logical rationale for the necessity of editing and reworking written drafts while, at the same time, giving writers with HFASD the confidence and motivation to move onto the revising and editing stage (Flower, 1979). Thus, learning to recognize and transform writer-based prose should be explored as a possible teaching strategy when working with students with HFASD.

An Excellent Narrative Text

It is important to note that some of the narrative and persuasive texts written by the students with HFASD in this dissertation research were very well done. For example, the following narrative text was written by a 12-year-old male with HFASD (PIQ = 109; *TOLD-I:4* Spoken Language Composite = 123) in response to the prompt: *Jacob hid under the porch, staring out at the old swing set, plotting his revenge*.

> Why did the high council have to exile him to live with this pathetic family in the guise of a mere child? What had he ever done to them? How was he to know that they wouldn't like it if he spread conspiracy theories about the council around the galaxy, causing massive uprisings against them? Plus, the rumors weren't entirely untrue. Councillor dfrrfsahfrHFASDa the eighty-fourth did have an odd habit of spouting random facts about the ninety-seventh xerinionien civil war during important meetings.
>
> Oh, and did I mention that not only was he forced to live disguised as a child, but also as a human child? Yes, human. You know, that miserable species living on an even more miserable planet orbiting a star that is a depressing shade of yellow. And I might add that most of this planet is covered in an extremely boring liquid substance that, when drank, gives a painfully disgusting aftertaste that reeks of what humans call oxygen.
>
> Luckily for Jason, however, the council did not know when they sent him to this planet that it also contained the most dangerous weapon in the known universe. It is called the pencil.
>
> Unfortunately for Jason, the council soon learned about this weapon, and they sent a fleet of ships out to destroy the planet it and Jason were on. It did not take long for the council's mortal enemies over in the Andromeda galaxy, which happens to be rather close to the galaxy containing this detestable little blue planet, learned about the high council's plans. As mortal enemies generally do, they jumped at the chance to attack their foes, and both fleets arrived at the planet at the same time.
>
> Unfortunately for everyone involved (except Jason, that is) Jason was not especially fond of the Andromeda's either, so he decided

> to set off a pencil (which he had retrieved from a rather cruel form of human prison known as a school for the purpose of exacting his revenge) right there and then. I won't detail the results, but let's just say that, with the discovery of this weapon's powers, the universe was never quite the same again.

This narrative is enjoyable to read, highly creative and quite entertaining. It is also well organized, contains much descriptive detail and flows nicely. Nevertheless, it also contains some uniquely HFASD-like characteristics. For example, the writer with HFASD uses very advanced vocabulary for his age and even makes up unpronounceable names for some the places and characters in his story. Additionally, although the writer spends much time describing the setting and the events in his story, the reader only gets a few brief glimpses into the minds of the characters. Third, the writer did not create a story about what happened to Jacob and how Jacob was going to get revenge. Instead, he mistakenly changes the protagonist's name to Jason and his story is not so much about Jason's revenge, but rather about Jason's banishment and his consequent survival. Teachers should be aware that students with HFASD may fail to meet the teacher's expectations on a given assignment as *difficulty interpreting what the teacher wants* seems to be a common problem for students with HFASD, at least anecdotally (c.f., Chavkin, 2004). Although it is valuable to help students with HFASD learn to create texts that conform to teacher expectations, it is equally important that we celebrate the strengths and creativity in the written work that students with HFASD craft in their own unique way.

Conclusion

In conclusion, the differences in academic achievement between individuals with HFASD and their TD peers seem to be subtle, especially when the oral language skills of the HFASD group and controls are well-balanced. In future work, researchers need to be weary of examining global measures of academic achievement as these global measures may mask strengths and weaknesses in the academic performance of students with HFASD. Further, given that one of the most defining features of HFASD is variability, both across the spectrum and within each individual (Towgood, Meuwese, Gilbert, Turner, & Burgess, 2009), researchers must strive to highlight both the similarities as well as the differences in the academic performance of subgroups of individuals with HFASD in order to ensure that we are accurately representing their abilities.

Solid academic performance empowers students with HFASD to attend post-secondary institutions and obtain meaningful employment (Schaefer-Whitby & Richmond-Mancil, 2009). Further, having a job that requires the individual to regularly produce written reports has become “a marker of high-skill, high-wage, professional work” (College Entrance Examination Board, 2004). Yet, most adults with HFASD are unemployed or underemployed despite their average to above average intelligence (Autism Ontario, 2008). Given that many students with HFASD are as capable of succeeding academically as their TD peers, it becomes essential that researchers, teachers and other professionals recognize their academic potential, which is often hidden behind behavioural and social deficits, and empower students with HFASD to achieve academic success.

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Research Western

Use of Human Participants - Ethics Approval Notice

Principal Investigator: Dr. Janis Cardy
Review Number:18665E
Review Level: Delegated
Approved Local Adult Participants:0
Approved Local Minor Participants:52
Protocol Title: Persuasive Writing of Children and Adolescents on the Autism Spectrum
Department & Institution: Health Sciences\Communication Sciences & Disorders,University of Western Ontario
Sponsor:
Ethics Approval Date: April 09, 2012 **Expiry Date:**August 31, 2013
Documents Reviewed & Approved & Documents Received for Information:

Document Name	Comments	Version Date
Revised Western University Protocol	A third writing task has been added.	
Advertisement		
Assent	Revised - Adolescent	2012/03/15
Assent	Revised - Children	2012/03/15
Revised Letter of Information & Consent		2012/03/15

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced revision(s) or amendment(s) on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the University of Western Ontario Updated Approval Request Form.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

The Chair of the HSREB is Dr. Joseph Gilbert. The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

The **University *of* Western Ontario**
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VITA

Name	Heather M. Brown
Post-secondary Education and Degrees	**Doctor of Philosophy in Health and Rehabilitation Sciences** *Speech and Language Sciences* The University of Western Ontario, London 2009-2013 **Master of Education** *Educational Psychology, Special Education* The University of Western Ontario, London 2007-2009 **Bachelor of Education** The University of Western Ontario, London 2004-2005 **Bachelor of Arts** *Psychology* The University of Waterloo, Waterloo 1996-2001
Honours and Awards	2013 IMFAR Diversity Travel Award 2012 Social Services and Humanities Research Council (SSHRC) Doctoral Award 2011 Autism Research Training Program Scholarship CIHR 2010 G.M. Dunlop Thesis Award for the *most outstanding Master's Thesis in Educational Psychology in Canada* from the Canadian Association for Educational Psychology 2010 Ontario Graduate Scholarship (OGS) 2010 Kay Sampson Scholarship from the Ontario Association on Developmental Disabilities (OADD) 2009 RSIG Student Award for Excellence in Research OADD 2009 Jessica Campbell Coulson Award 2009 Centre for Inclusive Education Research Award 2008 Joseph-Armand Bombardier Canada Graduate Master's Scholarship (SSHRC) 2005 Centre for Communicative and Cognitive Disabilities 1996 Marion Roberts Memorial Scholarship
Research Grants	2013 PhD Research, Graduate Thesis Research Award Fund 2012 PhD Research, Graduate Thesis Research Award Fund 2008 Master's Research, UWO Autism Centre of Excellence Research Grant

Publications

1. **Brown, H. M.**, Oram Cardy, J., & Johnson, A. (2013). A meta-analysis on the reading comprehension skills of individuals with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 43*, 932-955. doi: 10.1007/s10803-012-1638-1
2. **Brown, H. M.** & Klein, P. D. (2011). Writing, Asperger Syndrome and Theory of Mind. *Journal of Autism and Developmental Disorders, 41*, 1464-1474. doi: 10.1007/s10803-010-1168-7
3. King, G., Specht, J., Bartlett, D., Servais, M., Petersen, P., **Brown, H**., …Stewart, S. (2010). A Qualitative Study of Workplace Factors Influencing Expertise in the Delivery of Children's Education and Mental Health Services. *Journal of Research in Interprofessional Practice and Education*, 1(3). Retrieved from http://www.jripe.org

Related Work Experience

Graduate Research Assistantships, 2008-2013
Graduate Teaching Assistantships, 2007-2010
The University of Western Ontario