The Language Abilities of Bilingual Children With Down Syndrome

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Children with Down syndrome (DS) have cognitive disabilities resulting from trisomy 21. Language-learning difficulties, especially expressive language problems, are an important component of the phenotype of this population. Many individuals with DS are born into bilingual environments. To date, however, there is almost no information available regarding the capacity of these individuals to acquire more than 1 language. The present study compared the language abilities of 8 children with DS being raised bilingually with those of 3 control groups matched on developmental level: monolingual children with DS (*n* = 14), monolingual typically developing (TD) children (*n* = 18), and bilingual TD children (*n* = 11). All children had at least 100 words in their productive vocabularies but a mean length of utterance of less than 3.5. The bilingual children spoke English and 1 other language and were either balanced bilinguals or English-dominant. English testing was completed for all children using the following: the Preschool Language Scale, Third Edition; language sampling; and the MacArthur Communicative Development Inventories (CDI). Bilingual children were also tested in the second language using a vocabulary comprehension test, the CDI, and language sampling. Results provided evidence of a similar profile of language abilities in bilingual children as has been documented for monolingual children with DS. There was no evidence of a detrimental effect of bilingualism. That is, the bilingual children with DS scored at least as well on all English tests as their monolingual DS counterparts. Nonetheless, there was considerable diversity in the second-language abilities demonstrated by these individuals with DS. Clinical implications are addressed.

Key Words: bilingualism, Down syndrome, language development, language disorders

Children with Down syndrome (DS) have cognitive and language deficits secondary to a chromosomal disorder involving trisomy of the 21st chromosome. This is the most frequent of the chromosomal disorders resulting in mental retardation. Language learning is particularly problematic for these children. Consequently, anecdotal evidence suggests that professionals often recommend that the language input to children with DS in bilingual environments be limited to a single language. This recommendation, on the surface, may seem logical.

If learning one language is difficult, by extension, learning more than one might present even more problems. However, several factors argue against recommending a single language input to children with DS in bilingual environments. Current research has highlighted the cognitive and language benefits of multilingualism (e.g., Bruck, Genesee, & Caravolas, 1997) for typically developing (TD) children. As well, there is almost no information available regarding the impact of multilingual contexts on the language-learning success or failure of children with DS. Finally, negative consequences for children and their families can result from limiting language input to a single language, in a society that is increasingly diverse. As De Houwer (1999, p. 1) has stated, "A bilingual environment is most often a necessity, not a choice."

Bilingualism

As a general principle, the more frequently and consistently one is exposed to a language, the better is one's knowledge of that language. However, the intensity of exposure to a single language varies across children (Hart & Risley, 1995) and usually varies across languages for a particular child (Bialystok, 2001). As an example, some children hear two languages with approximately equal frequency in the home. This may be the case when one parent speaks one language and the other parent speaks another language—that is, the one-parent-one-language context. Others may be exposed to a second language less frequently, or in limited contexts, as when a babysitter speaks a second language to them only when a parent is at work. The point of first exposure to a second language also varies and can affect acquisition (Bialystok, 2001).

Children can be exposed to a second language from birth or any time thereafter. In Nova Scotia, for example, English-speaking children enter French immersion programs in grade primary (kindergarten) or sixth grade, after they have acquired a considerable proficiency with their first language. In contrast, in Montreal, children may be exposed to a second language from birth in the home or somewhat later in day care or preschool. Montreal is a bilingual city with children often raised in English, French, or bilingual homes. As well, there is a large immigrant population in Montreal, leading to some children receiving significant exposure to languages other than French and English. Children in Montreal are schooled in either French or English schools, or in immersion programs, which are English schools where part of the instruction takes place in French. Children whose first language is French, as well as all immigrant children, are schooled in French.

Who speaks each language in language acquisition makes a difference as well. Primary caregivers, usually parents, have the greatest impact on language learning in their children at early ages. However, after children enter school, peers and the academic environment have an increasingly important impact in this area. Child variables such as motivation to learn, assessment of need, and perception of usefulness can also influence how proficient a child becomes with a particular language, especially as metacognitive abilities improve and a child becomes more capable of assessing such factors. Thus, a child who speaks one language in the classroom but another with friends and family may perceive little need to use the classroom language in other contexts and may therefore be less motivated to learn it. So, who speaks which language, when it is spoken and for how long, and how the child reacts to these characteristics of the input will all affect the degree to which the child is able to acquire each language in a bilingual setting (Nicoladis & Genesee, 1997a).

When bilingual individuals interact, they may interweave their languages at times. This is called language mixing. Language mixing can occur within and across utterances. The frequency of language mixing varies considerably across individuals (e.g., Nicoladis, 1995 [cited in Nicoladis & Genesee, 1997a]). Indeed, by 3 years of age, children have been shown to mix at frequencies similar to that found in the input (Nicoladis & Genesee, 1997b).

Given the variability of bilingual experience, it is not surprising that most children who are bilingual have better proficiency in one of their two languages. The better language can be referred to as the dominant language. Language dominance can change as significant life contexts change. In the case of many immigrant families, for example, the language of the home is often the dominant language for the child until school entry. At this point, the language of the larger society often replaces that of the home (Romaine, 1996) as the dominant language of the child.

Early Language Acquisition in a Bilingual Context

While early studies were conducted with the assumption that bilingual children would be disadvantaged in their cognitive and language development relative to monolinguals, more recent studies have refuted this contention (Bialystok, 2001; Pacheco, 1983; Payan, 1989). Indeed, research has now suggested evidence for a variety of advantages that result from bilingualism (Cromdal, 1999; Oller, 1983; Pacheco, 1983). Perhaps the most frequently reported finding is that bilingual children exhibit advanced metalinguistic skills relative to monolingual peers (Bialystok, 2001; Bruck & Genesee, 1995), although the advantage in this area is not usually identifiable in the earliest periods of language development and seems to be related to the degree of bilinguality achieved (Cromdal, 1999). Cummins (1979) has hypothesized that a threshold level of competency in a second language is necessary before the beneficial effects of bilingualism can be realized.

Nicoladis and Genesee (1997a) note in their review of the literature that there are three "logical possibilities" regarding the effect of bilingualism upon language learning: it could lead to language delay, it could lead to more rapid language development, or it could have no effect at all. These authors conclude that general milestones are reached at comparable times for monolingual and bilingual children. That is, both produce their first words, attain their first 50 words, and begin to combine words at approximately the same times when the vocabularies in both languages are considered. As well, the order and age of acquisition of various syntactic forms are comparable. However, the authors caution that the expressive lexicon size in any one language is found to be smaller for bilingual than monolingual children. They conclude that, with regard to general milestones of development, bilingual children's language abilities do not appear to be "remarkably delayed nor remarkably advanced" relative to that of monolingual children (Nicoladis & Genesee, 1997a, p. 264). Bialystok (2001), in her review of the literature, also concluded that the sequence and rate of development in bilingual children was similar to that of monolingual children.

Pearson, Fernandez, and Oller (1993) examined the early vocabulary skills of bilingual children. They reported few statistical differences between monolingual and bilingual children's expressive vocabulary skills up to 30 months of age, when the dominant language of the bilingual children was used in the comparison. Nonetheless, the expressive vocabulary skills of bilingual children looked more similar to that of monolinguals when a measure of combined knowledge in both languages was used: either a combined count of expressive vocabulary or a count that included the number of shared concepts across the two languages. Interestingly, when the vocabulary comprehension skills of these bilingual children were examined, there was evidence that they may have been more advanced than the monolingual controls.

Language of Children With DS

Language-learning difficulties in monolingual children with DS are often greater than would be predicted given their cognitive development (Chapman, 1995; Chapman, Schwartz, & Kay-Raining Bird, 1991; Chapman, Seung, Schwartz, & Kay-Raining Bird, 1998, 2000; Fowler, 1990). The gap between language production and cognition emerges in the early period of language development (Cardosa-Martins, Mervis, & Mervis, 1985; Miller, 1992; Mundy, Kasari, Sigman, & Ruskin, 1995). Although vocabulary acquisition is often a strength for these children (Chapman, 1995; Chapman, Kay-Raining Bird, & Schwartz, 1990; Chapman et al., 1991, 1998, 2000), a larger than expected gap between production and comprehension vocabulary emerges almost with the onset of first words (Chapman, 1995; Miller, 1992). Perhaps the most difficult component of language for children with DS to acquire is expressive morphosyntax (Chapman et al., 1998, 2000), although receptive morphosyntactic abilities are also delayed (Chapman et al., 1991). These children often show early delays in the onset of word combinations (Clements-Baartman & Girolametto, 1995) and increasing divergence of language and mental age (MA; Chapman, 1995). Nonetheless, there is evidence that children with DS continue to develop in morphosyntactic ability throughout adolescence (Chapman et al., 1991, 1998; Thordardottir, Chapman, & Wagner, 2002). While verb development has been studied very little in this population, there is evidence that these children have particular difficulty acquiring lexical and grammatical verbs, as well as constructing multiclausal utterances spontaneously (Hesketh & Chapman, 1998). The acquisition of language may be constrained by a variety of factors in children with DS, including auditory memory deficits (Jarrold, Baddeley, & Phillips, 2002; Kay-Raining Bird & Chapman, 1994; Seung & Chapman, 2000) and intelligibility problems (Miller, 1988).

Bilingualism and Children With Language-Learning and/or Intellectual Difficulties

There is a surprising lack of research involving bilingual or multilingual children with language-learning problems in general, and children with intellectual disabilities such as DS in particular. While it is expected that children with language-learning difficulties will experience problems learning any language, the specific manifestations of those problems will vary with the language (Crago & Allen, 1996; Nicoladis & Genesee, 1997a). Many educators have called for the development of unbiased assessment procedures for bilingual children and education or language intervention opportunities in a child's first language or a bilingual setting (Crago & Westernoff, 1997; Erickson & Walker, 1983; Holland & Forbes, 1986; Payan, 1989; Vaughn-Cooke, 1986). There is also emerging evidence that language learning in a second language is facilitated by intervention in the child's first language (Perozzi & Sanchez, 1992) or in a bilingual setting (Thordardottir, Ellis Weismer, & Smith, 1997), at least for children with normal cognitive abilities. Bruck (1982) reports that children with language impairments do as well in immersion programs as they do in monolingual programs.

Not surprisingly, bilingual children with specific language impairment (SLI) have been shown to perform more poorly than their TD age-matched peers on measures of morphology and syntax, using both group (Håkansson, Salameh, & Nettelbladt, 2003; Jacobson & Schwartz, 2002) and single participant studies (Restropo & Kruth, 2000). Research that compares the development of bilingual and monolingual children with SLI is only beginning to emerge. The first study of this type (Crutchley, Botting, & Conti-Ramsden, 1997) reported that bilingual children with SLI scored less well on a variety of language and reading measures as opposed to monolingual controls with SLI. As a result, the authors claimed that bilingualism may act as an "aggravating factor" in SLI. This interpretation, however, is premature since no information about the children's bilingualism was provided. Consequently, it is quite possible that the documented differences simply reflect performance in the nondominant language. In contrast to Crutchley et al.'s results, Paradis, Crago, Genesee, and Rice (2003) found that French-English bilingual children with SLI exhibited the same type and frequency of morphosyntactic errors as did monolingual French or English controls with SLI. Predictably, the specific surface structures that were affected differed across languages for monolingual and bilingual groups. Jordaan, Shaw-Ridley, Serfontein, Orelowitz, and Monaghan (2001) have suggested that children with different language disorders may have different bilingual capabilities. However, the 2 participants they studied differed in their exposure to two languages, suggesting that input, not disorder type, could explain the observed differences.

Clearly, we are just beginning to understand how bilingualism affects language learning in children with language impairments. The literature on individuals with intellectual disabilities is even sparser. With regards to children with DS, Woll and Grove (1996) discuss the simultaneous development of British Sign Language (BSL) and English in monozygotic twins with DS growing up with deaf parents. While their syntactic skills are delayed in both languages, these girls are acquiring each language and using them selectively in appropriate contexts (i.e., BSL with deaf interactants, English with hearing interactants). Vallar and Papagno (1993) provide a case study of a 23-year-old woman with DS who is successfully trilingual (Italian, English, and French). Interestingly, this woman presents a very different profile of language and cognitive skills: stronger verbal than nonverbal cognitive scores on the Wechsler Adult Intelligence Scale and good phonological awareness skills relative to a control group. One might wonder whether this woman's multilingualism has affected her particular skill profile. For example, are the unusually high phonological awareness skills indicative of the oft-mentioned metalinguistic advantage of bilingualism? These issues were not explored by the authors. Clearly much more work in this area is needed to understand the implications of bilingualism for children with language-learning disabilities, including children with cognitive deficits such as children with DS.

The primary objective of the current study, then, was to obtain information about how successful children with DS are in acquiring two languages. Specifically, the English language and second-language abilities of bilingual children with DS were compared with those of three groups of controls, all matched on developmental level. Children were in the early stages of language development. That is, they had more than 100 words in their productive vocabularies but a mean length of utterance (MLU) of less than 3.5.

Specifically, we asked the following questions:

1. Do the English language skills of bilingual children with DS differ from that of three control groups matched for developmental ability: monolingual children with DS, bilingual TD children, and monolingual TD children?
2. To what degree are bilingual children with DS successful in acquiring a second language and do their second-language skills differ from developmentally matched bilingual TD controls?
3. What variables correlate with language outcome measures in bilingual children with DS?

Method

Participants

A total of 51 children participated. Children were recruited for one of four participant groups: children with DS or TD children who were being raised in either a bilingual (B) or a monolingual (M) context. Group matching was achieved based on developmental level ($p = .445$): MA for the children with DS, and chronological age (CA) for the TD controls. Groups were not matched on parents' educational level (i.e., the highest level of education obtained by the mother or father; $p = .001$). For this measure, parental education was significantly higher ($p < .05$) in the TD-B group than any other group. Parental education did not differ among the other three groups (DS-M, DS-B, and TD-M). Group means and ranges for age, MA, and parental education are presented in Table 1 for each of the four groups.

All children were recruited to be in the early stages of language development, with a minimum of 100 reported words in their productive vocabularies (measured with the toddler form of the MacArthur Communicative Development Inventories (CDI; Fenson et al., 1993) and an MLU of 3.5 or less. A parental questionnaire was used to obtain information about the language environment of participants. Monolingual children (DS-M and TD-M) were recruited in Nova Scotia as part of another study. They came from English-speaking homes and received no significant exposure to other languages either in the home or at school. Bilingual children were recruited from Montreal and had received ongoing and intensive input in two languages, one being English. Table 2 shows features of bilingualism for both bilingual groups (DS and TD). Bilingual children were either English-dominant or balanced bilinguals, as determined using a comparison of standardized vocabulary comprehension tests administered in both languages and calculation of MLU in both languages. Despite this, 5 TD bilingual controls were reported by their mothers to have stronger production skills in the second language. The bilingual data were collected in Montreal; the majority of bilingual children (7/8 DS-B, 8/11 TD-B) had French as their second language.

Participants with DS. Parents reported that all the children with DS were diagnosed with trisomy 21 and that speech was their primary mode of communication. None of these children were reported to have a history of other health problems that could affect development (e.g., autism, meningitis), and no hearing problems were reported. Fourteen monolingual (DS-M) and 8 bilingual (DS-B) children with DS participated (see Table 1). Ages ranged from 31 to 101 months for the DS-M group and 55 to 137 months for the DS-B group. Mean MAs were 31.4 and 35 months for the DS-M and DS-B groups, respectively, measured using either the Mental scale of the Bayley Scales of Infant Development, Second Edition (BSID–II; Bayley, 1993) or the mean age-equivalent score of the Bead Memory and Pattern Analysis subtests of the Stanford–Binet Intelligence Scale, Fourth Edition (SB4; Thorndike, Hagan, & Sattler, 1986). While the groups with DS did not differ significantly on MA or CA, it should be noted that the means for both measures were somewhat higher in the DS-B group.

TD participants. TD status was established via parent questionnaire. None of the children were reported to have any history of difficulties in the areas of hearing, speech, language, reading, or general learning. As well, all children scored no more than 1 *SD* below the mean on all administered standardized tests. Eighteen monolingual

TABLE 1. Characteristics of the four participant groups.

		Age in months		Mental age in months		Parental education in years	
Group	*n*	*M*	Range	*M*	Range	*M*	Range
DS-M	14	73.9	31–101	31.4	23–45.5	13.1	12–16
TD-M	18	30.5	24–36	30.8	24–38	15.6	12–22
DS-B	8	85.5	55–137	35.0	20–47	15.3	12–22
TD-B	11	33.5	26–45	37.0	26–51	18.8	16–24

Note. Mental age is measured using the mean age-equivalent scores from the Bead Memory and Pattern Analysis subtests of the Stanford–Binet Intelligence Scale, Fourth Edition (Thorndike et al., 1986) or the Mental scale of the Bayley Scales of Infant Development, Second Edition (Bayley, 1993). Parental education is the level of education achieved by either the mother or father, whichever is higher. DS = Down syndrome; TD = typical development; M = monolingual; B = bilingual.

(TD-M) and 11 bilingual (TD-B) children participated (see Table 1). Ages ranged from 24 to 45 months.

Procedure

Children and their mothers participated in two sessions in a laboratory setting, each lasting up to 2 hr. The protocols for the monolingual and bilingual children are presented in Table 3. Those tests and tasks relevant to the present study will be discussed further. Monolingual and bilingual children received similar but not completely overlapping testing protocols, first because the monolingual data were collected for a separate study and used as control data for the present study, and second because the bilingual children required testing in their second language. On shared procedures, the testing protocol of the bilingual children was designed to be identical to that of the monolingual children.

For bilingual children, testing in English and the second language occurred on different days, the order being counterbalanced across participants within participant groups. Two bilingual examiners worked with each family. When an examiner administered tests and/or collected language samples in a given language, the examiner spoke only that language in the presence of the child in order to minimize the likelihood of code switching in the bilingual children. Within a session, tests and tasks were presented in an individually randomized order.

Procedures common to monolingual and bilingual groups. Measures of cognition and English language ability were collected for all of the children. Depending on their age or developmental level, either the Mental scale of the BSID–II (Bayley, 1993) or the Bead Memory and Pattern Analysis subtests of the SB4 (Thorndike et al., 1986) were used to measure cognitive ability. It is acknowledged that the inclusion of language items in the BSID–II reduces the equivalency of these two measures; however, current limitations on cognitive testing at younger ages require such a compromise. Language measures included the collection of two language samples and several standardized language tests. Language sampling involved collection of two 20-min samples during free-play with two different toy sets. One toy set was designed to elicit talk about animals and their babies (i.e., the "noun task") using 28 plastic animals, troughs, fences, trees, and a large wooden structure. The other, the "verb" task, used 14 activity boxes each specially crafted to be colorful and interesting and to elicit talk about a single action such as "feed." The Preschool Language Scale, Third Edition (PLS–3; Zimmerman, Steiner, & Pond, 1992) provided an overall measure of English language ability as well as measures of receptive and expressive language skill. The CDI (Fenson et al., 1993), an inventory of the English vocabulary of the child using a parent report format, yielded a measure of the number of words that a child "says" in English. Because children with DS are often taught sign language in the early stages of development, the English CDI was modified by asking parents to report the number of signed as well as spoken words that the child could produce.

Procedures exclusive to the bilingual groups. A parent questionnaire was used to determine the children's exposure to each of their languages (see the Appendix). To this end, parents were asked to document who has interacted with their child, in what language, for how long, and where the exposure has taken place (e.g., home, day care). Parents were also asked which language they felt their child could understand or produce better.

Testing was administered to assess the bilingual children's abilities in their second language. Some English tasks were added to the protocol to allow comparison of

TABLE 2. Features of bilingualism.

Features	DS-B (*n* = 8)	TD-B (*n* = 11)
Second language	7 French 1 Cree	8 French 1 Lebanese 1 Portuguese 1 Italian
Input		
1 parent, 1 language	3	3
2 languages at home	7	9
2 languages outside home	8	9
No. of months exposure/chronological age		
English (*M, SD*)	0.87, 0.24	0.91, 0.20
Second language (*M, SD*)	0.84, 0.24	1.00, 0
English dominant or balanced		
Standardized testing	8	11
Parent report, production	8	6

TABLE 3. Testing protocol.

Groups	Tests and tasks
Monolingual only (English)[a]	
Language samples	Joint book reading with mother
Probes	Comprehension and production probes of target words
Monolingual and bilingual (English)	
Cognitive test	BSID–II Mental scale or SB4 Bead Memory and Pattern Analysis subtests
Language tests	PLS–3; CDI, toddler form
Language samples	1 noun, 1 verb, toy play with parent or examiner
Parent questionnaire	To establish that children met inclusion criteria
Bilingual only (English and second language)	
Language tests	PPVT–R, Form L; EVIP, Form A; CDI, Quebec French version, or modified English for another second language
Language samples	1 noun, 1 verb, toy play in second language with parent or examiner
Parent questionnaire	Language input information

Note. BSID–II = Bayley Scales of Infant Development, Second Edition; SB4 = Stanford–Binet Intelligence Scale, Fourth Edition; PLS–3 = Preschool Language Scale, Third Edition; CDI = MacArthur Communicative Development Inventories; PPVT–R = Peabody Picture Vocabulary Test—Revised; EVIP = *Echelle de vocabulaire en images Peabody.*

[a]Not relevant to the present study.

equivalent measures in two languages. For children whose second language was French, a version of the CDI that was adapted and validated for French-speaking children in Quebec (Trudeau, Frank, & Poulin-Dubois, 1999) was used. This provided a parent report measure of French vocabulary production to compare with the English CDI. Two language samples (noun and verb) were also collected in the second language, using the same toy sets and following identical sampling procedures as in English, providing for equivalence in language sample measures. To compare receptive vocabulary abilities, two tests were administered, one in English and one in the second language, using the Peabody Picture Vocabulary Test—Revised (PPVT–R; Dunn & Dunn, 1981) and its equivalent Canadian-French version, *Echelle de vocabulaire en images Peabody* (EVIP; Dunn, Theriault-Whelan, & Dunn, 1993). If the child's second language was not French, an adult who was a fluent speaker of the language and was very familiar with the child's capacity in the second language and usually spoke that language to the child (often a parent) was asked to assist in completing the CDI and the PPVT–R. For the CDI, the adult was asked to consider each word in the English CDI form and report whether the child was able to produce the listed English word in the second language. For the PPVT–R, the adult was asked to translate relevant English words in the PPVT–R and administer the test to the child, under the supervision of the examiners. When a listed word was not directly translatable into the second language in either the CDI or the PPVT–R, it was skipped. The two language samples were collected in a manner identical to that described above.

For all forms of the CDI administered, the person most knowledgeable about the child's abilities in the language being considered was asked to complete the form. Language sampling was conducted with an adult. This was usually a parent but could also be another accompanying individual who typically spoke to the child in the language under consideration (number of parent samples: DS, English = 6; DS, second language = 5; TD, English = 5; TD, second language = 7; number of other familiar adult: TD, English = 1). For English and French samples, the examiner collected the language sample if the accompanying person did not typically speak the language in question with the child. In all cases, the person collecting the sample was asked to use the toy sets to play with the child as naturally as possible.

Data analysis. All standardized tests were scored as designated in their respective manuals. Raw, standard, and age-equivalent scores were obtained. For each form of the CDI, the number of reported words was counted, yielding scores for English, signs, and the second language. All translation equivalents, 381 in total, were identified (i.e., words included in the lists of both French and English forms of the CDI). For this set of translation equivalents, the number of words reported to be produced in both English and French (shared words) and the number of words reported to be produced uniquely in each language (English, sign, second language) were tallied. The sum of the shared words plus the words unique to each language was then calculated to provide an estimate of total vocabulary size that would be comparable across the four groups. The noun and verb samples in each language were combined into a single sample, starting with the noun interaction. For each language, all the talk produced in the toy play tasks was then orthographically transcribed onto computers following the Systematic Analysis of Language Transcripts conventions (Miller & Chapman, 1993). Measures of vocabulary development (total number of words [TW], number of different words [NDW]) and morphosyntax (MLU in words and morphemes) were computed for 50- and 100-utterance samples, respectively, starting from the beginning of the noun sample. These language sample measures (TW, NDW, and MLU) were computed with language mixing (i.e., use of one language while speaking another) excluded from the calculation. Language mixing was not a frequent occurrence for either group. On average, in 100 English utterances, the DS-B group exhibited language mixing in 3.3 utterances for a mean total of 4.8 mixed words, in contrast to 4.5 utterances for a mean total of 6.7 mixed words in the TD-B group. In 100 second-language utterances, the DS-B group averaged 7.7 mixed utterances for a total of 15.9 mixed words, while TD-B children average 4.5 mixed utterances for a total of 7.7 mixed words.

For the English measures shared by all four groups, one-way analyses of variance (ANOVAs) were conducted with group (4) as the independent variable. Significant effects were further explored using Tukey pairwise comparisons. For analogous measures collected in both languages, two-way Group (2) × Language (English, second language) ANOVAs were conducted. For all analyses, significance was set at $p < .05$, and all tests were two-tailed.

Results

Analyses Involving All Four Groups

Dependent measures for the one-way ANOVAs comprised the following: raw scores from the PLS–3, the number of reported words produced in English on the CDI, the total reported productive vocabulary (unique signs plus unique English words plus shared words plus unique second-language words, the latter two present for the bilingual children only), and three English language sample measures (TW, NDW, and MLU in morphemes). Descriptive statistics for these measures are presented in Table 4.

PLS–3. Scores for the Expressive and Receptive subtests and the total PLS–3 score were submitted to separate analyses (Table 4). Four participants in the TD-B group did not have scores available for the Expressive subtest and, therefore, the total test of the PLS–3. A significant effect of group was obtained for the Expressive subtest only, $F(3, 43) = 7.12$, $p = .001$. Post hoc Tukey tests revealed that the TD-B group scored significantly higher on this test ($p < .05$) than any of the other groups. Effect size using Cohen's d was calculated to be $d = 1.93$ for TD-B versus DS-M, $d = 1.27$ for TD-B versus TD-M, and $d = 1.26$ for TD-B versus DS-B. (Cohen's d is considered a small effect for values at or below 0.25, a medium-size effect at 0.50, and a large effect above 0.75.) Note that the four children in the TD-B group who did not complete the Expressive subtest had Receptive subtest scores in the midrange for the group. Therefore, their absence did not seem to account for the significant finding on this test.

CDI. The number of English words reported to be produced in the CDI (Table 4) did not differ significantly across the four groups ($p = .698$). Since English vocabulary was only a part of the vocabulary knowledge of bilingual children, the total productive vocabulary of each child was computed by adding the number of reported-to-be-produced words that were unique to English, sign, and the second language, and the shared words (produced in more than one language), using only the subset of translation equivalents included in both the English and French versions of the CDI (Table 5). These values did not differ significantly across the four groups either ($p = .479$), although the variability for the DS-B group was higher than for any of the others. Three children with DS were reported to use signs (1 DS-M, 2 DS-B). Unique signs constituted approximately one third of the reported productive vocabulary of the DS-M child (52 of 147 words), while only two and three unique signs were reported to be produced by the 2 DS-B children.

Language sample: TW, NDW, MLU in morphemes. All three language sample measures (Table 4) yielded significant group effects: MLU in morphemes, $F(3, 47) = 8.24$, $p < .001$; TW, $F(3, 47) = 8.19$, $p < .001$; and NDW, $F(3, 47) = 4.04$, $p = .012$. Post hoc Tukey tests revealed that the DS-M group performed significantly lower than either TD group on all three measures. For MLU, Cohen's d was calculated to be $d = 1.64$ for the DS-M versus TD-M comparison and $d = 1.48$ for the DS-M versus TD-B comparison. For NDW, Cohen's d was calculated to be $d = 1.18$ for the DS-M versus TD-M comparison and $d = 1.09$ for the DS-M versus TD-B comparison. For TW, Cohen's d was calculated to be $d = 1.56$ for the DS-M versus TD-M comparison and $d = 1.76$ for the DS-M versus TD-B comparison. As well, the DS-B group produced significantly fewer total words in 50 utterances than did the TD-M group ($d = 1.02$).

Analyses Involving the Bilingual Groups Only

Two-way ANOVAs compared performance in English and the second language for the two bilingual groups (DS-B, TD-B). Dependent measures were raw scores from the two standardized receptive vocabulary tests, the number of words reported to be produced on the CDI, and the three language sample measures—TW, NDW, and MLU in words. Recall that translated versions of the PPVT–R were used for children whose second language was other than French, and the EVIP was used with children who spoke French as a second language. Descriptive statistics for these measures are presented in Table 6.

Receptive vocabulary. Data for both receptive vocabulary tests were not available for 1 TD-B child. The two-way ANOVA of the raw scores for these tests (Table 6) revealed that only the main effect for language was significant, $F(1, 16) = 4.82$, $p = .043$, $\eta^2 = .23$. For both groups, the raw scores on the vocabulary test were significantly higher in English than they were in the second language (English: $M = 22.0$, $SD = 15.8$; second language: $M = 16.9$, $SD = 13.9$), confirming that as a group these children were English dominant.

Language sample: TW, NDW, and MLU in words. Data from 1 child in each bilingual group were not available for these 3 two-way ANOVAs (Table 6). There was a significant effect of language for both the analysis of TW, $F(1, 15) = 11.2$, $p = .004$, $\eta^2 = .43$, and the analysis of NDW, $F(1, 15) = 8.59$, $p = .010$, $\eta^2 = .36$. In both cases, groups exhibited higher vocabulary abilities in English than in the second language (English: TW, $M = 106.1$, $SD = 31.8$; NDW, $M = 48.8$, $SD = 15.8$; second language: TW, $M = 82.3$, $SD = 28.9$; NDW, $M = 37.5$, $SD = 14.7$). For MLU in words, significant main effects were obtained for language, $F(1, 15) = 12.28$, $p = .003$, $\eta^2 = .40$, and group,

TABLE 4. Descriptive statistics for the English PLS–3, CDI, and language sample measures for the four participant groups.

	DS-M (n = 14)		TD-M (n = 18)			DS-B (n = 8)			TD-B (n = 11)		
Measure	*M*	*SD*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
PLS–3, raw											
Receptive	23.7	6.1	27.3	5.7		25.0	6.3		26.6	7.9	
Expressive	21.7	2.3	24.7	3.9		22.6	5.8		31.7	8.6	7
Total score	45.4	7.8	51.9	9.3		47.6	11.8		58.1	17.7	7
PLS–3, age-equivalent											
Receptive	28.8	7.6	33.1	7.1		30.1	7.9		32.5	10.7	
Expressive	28.4	3.7	32.4	5.2		29.8	7.9		42.9	13.1	7
Total score	29.1	5.3	33.2	5.9		30.5	7.8		45.7	21.4	7
CDI, no. of English words produced	369	165	444	131		408	244	7	401	210	10
CDI, total vocabulary produced[a]	262.1	72.4	291.2	52.2	17	265.0	121.7	7	305.7	69.1	9
Language sample measures											
Total no. of words	73.4	13.6	117.1	35.4		84.5	21.9		115.6	32.8	
No. of different words	35.6	10.4	49.6	12.9		41.1	11.2		51.1	18.0	
MLU-morphemes	1.57	0.32	2.44	0.65		1.81	0.48		2.55	0.94	

Note. n = number of participants contributing data if different from number of participants in group; MLU = mean length of utterance.

[a]Total reported vocabulary (taken from the subset of translation equivalents in English and French versions of the CDI) = unique signs + unique English words + shared words + unique second-language words, the latter two present for the bilingual children only.

$F(1, 15) = 5.40$, $p = .035$, $\eta^2 = .27$. Again, for both groups, MLU in words was higher in English than in the second language (English: $M = 2.17$, $SD = 0.74$; second language: $M = 1.66$, $SD = 0.55$). As well, the TD-B group used longer MLUs in both languages than did the DS-B group (DS-B: English, $M = 1.78$; second language, $M = 1.35$; TD-B: English, $M = 2.46$; second language, $M = 1.87$). No other main effects or interactions reached significance.

CDI. The reported productive vocabularies from the French and English CDIs were analyzed using a two-way Group (DS-B, TD-B) × Language (shared plus unique to English, shared plus unique to second language) multivariate ANOVA. Again, to ensure comparability across languages, only the subset of translation equivalents included in both French and English versions of the CDI were included in this analysis (Table 5). Data were missing for 1 child in the DS-B and 2 children in the TD-B group. The main effect of language, $F(1, 14) = 7.44$, $p < .016$, $\eta^2 = .35$, and the interaction, $F(1, 14) = 6.46$, $p < .023$, $\eta^2 = .32$, were significant. The main effect for group did not reach significance. Post hoc paired comparisons were used to examine the interaction further. For the DS-B group only, significantly more words were reported to be produced in English than in the second language, $t(6) = 2.89$, $p = .028$, $d = 0.66$. The groups did not significantly differ in the number of reported words in either language. Descriptive statistics are displayed in Table 5, along with the mean number of reported words that were shared across the two languages or unique to a single language.

Individual Variability

Individual language data were examined. They indicated that the DS-B child with the highest MA (47 months) was also the child who had the highest scores on the PLS–3 Expressive and Receptive subtests (45 months and 43 months, respectively), the highest PPVT–R (54 months), and the highest MLU in English (2.41). This same child had the highest scores on several second-language measures as well—the EVIP (64 months) and MLU in the second language (1.65)—and had the highest proportion of her total vocabulary that was second-language words (.95), either shared or unique. She had been exposed to both languages consistently from birth. In contrast, the DS-B child with the highest CA (144 months) and the lowest MA (20 months), and therefore the lowest IQ, scored lowest on the PPVT–R (25 months) and the PLS–3 Expressive (19 months) and Receptive (19 months) subtests, and had the second lowest MLU in English (1.43). Surprisingly, this child was not the lowest scorer on any measure of second-language ability. Indeed, the proportion of his total vocabulary that was second-language words was .56, which can be compared with the low of .07 in the DS-B group. He also had been exposed to both languages from birth.

To further identify factors that were related to bilingual ability, Pearson product–moment correlations were computed. The degree of relationship between MA, CA, parental education, English language measures (PPVT–R, PLS–3 Expressive and Receptive, MLU), duration of exposure to each language, and measures of second-language ability (EVIP, NDW, MLU, and proportion of shared words in total vocabulary) was analyzed for each bilingual group. For the DS-B group, the EVIP was highly and significantly correlated with the PPVT–R ($r = .842$) and MLU in the second language ($r = .768$). MLU in the second language was highly and significantly correlated with MA ($r = .817$), CA ($r = .879$), and the EVIP. (Note that MA, CA, and the EVIP were all moderately but not significantly correlated with each other: $r_{MA,CA} = .582$,

TABLE 5. Means and standard deviations for number of shared words, number of unique English words, and number of unique second-language words reported to be produced by the two bilingual groups (DS-B, TD-B) in the subset of translation equivalents used in the English and French versions of the CDI.

	DS-B		TD-B	
	M	*SD*	*M*	*SD*
Shared + unique English	254.86	124.30	264.00	98.75
Shared + unique second language	162.86	145.66	260.78	72.51
Shared words	153.1	144.7	219.1	99.0
Unique English	101.7	78.2	44.9	37.6
Unique second language	9.9	9.9	41.7	35.0

Note. Only those words with translation equivalents in both the French and English CDIs were included. Signed words are not included in these data.

$r_{MA,EVIP} = .364$, $r_{CA,EVIP} = .562$.) Duration of exposure was not significantly correlated with any second-language measure in the DS-B group. For the TD-B group, NDW was significantly related to MA ($r = .840$). The EVIP was significantly correlated with the PPVT–R ($r = .842$) and MLU in the second language ($r = .768$). MLU in the second language was also significantly correlated with MA ($r = .817$), CA ($r = .879$), the PLS–3 Expressive ($r = .851$) and Receptive ($r = .885$) subtests, the PPVT–R ($r = .949$), MLU in English ($r = .748$), and the proportion of shared words ($r = .713$). This latter measure was also significantly correlated with the duration of English exposure ($r = .674$). All other correlations did not reach significance.

Discussion

This study was designed to examine the language abilities of children with DS who were being raised in bilingual environments. Bilingualism was defined as intensive, ongoing, and prolonged exposure to two languages. All of the children had English as one of their languages. In addition, all children tested either with better English than second-language skills or with equal English and second-language skills. Therefore, here, second language simply refers to the "non-English" language and does not directly imply relative strength. Specifically, this study compared the English language abilities of bilingual children with DS to those of monolingual (TD and DS) and bilingual (TD) controls matched for developmental level. In addition, the second-language abilities of bilingual children with DS were compared with their TD counterparts, also matched on developmental age. Finally, factors that were correlated with second-language abilities in the DS-B and TD-B groups were explored.

Evidence for an effect of diagnosis was found in English. Previous research has provided robust evidence for a usual profile of language abilities in children with DS (e.g., Chapman, 1995; Chapman et al., 1991, 1998, 2000). This profile reveals receptive vocabulary strengths and expressive language weaknesses, especially morphosyntax. Generally consistent with such a profile, the TD-B group performed significantly better on the PLS–3 Expressive subtest than either the DS-B or the DS-M group. As well, both TD groups performed significantly better than the DS-M group on all three English language sample measures (TW, NDW, and MLU), while the TD-M group performed significantly better on the TW measure than did the DS-B group. It would appear, then, that the general profile of language abilities documented in the literature for monolingual children with DS has been replicated in this study. More importantly, this finding has been extended to the dominant language, in this case English, of *bilingual* children with DS, who also evidenced an expressive language impairment relative to TD controls.

TABLE 6. Means and standard deviations for comparable measures in English and the second language for both bilingual groups (DS-B, TD-B).

	DS-B (*n* = 8)		TD-B (*n* = 11)	
Measure	*M*	*SD*	*M*	*SD*
PPVT–R (raw)	21.1	14.4	22.7	17.6
EVIP (raw)	16.1	17.6	17.5	11.2
TW, English	88.1	20.9	118.7	32.8
TW, second language	75.4	23.5	87.1	32.5
NDW, English	42.9	10.9	52.9	17.8
NDW, second language	33.6	15.9	40.2	14.1
MLU-words, English	1.78	0.36	2.46	0.82
MLU-words, second language	1.35	0.23	1.87	0.62

Note. TW = total number of words; NDW = number of different words.

Expressive morphosyntactic difficulties were evident in the second language of bilingual children with DS, as well as in English. Specifically, the second-language MLU of DS-B children was significantly lower than that of their TD-B counterparts. In her review of the literature on language development in monolingual children with DS, Chapman (1995) argues that expressive morphosyntactic skills are particularly impaired in individuals with DS. The present study extends this finding to the weaker language of bilingual individuals with DS.

The two groups with DS never differed significantly in their performance on any of the English language measures. This supports the conclusion that bilingualism is not detrimental to the dominant language development of children with DS, at least when they experience intensive, ongoing, and consistent exposure to both languages. There was also little evidence for an advantage of bilingualism, although the DS-M group did differ significantly from TD controls on measures of English language ability more often than did the DS-B group. It is possible that metalinguistic advantages of bilingualism might exist for the DS-B group. Note, however, that metalinguistic skills become most apparent in monolingual individuals with MAs of 4 years or higher, so most of the children in the present study would not be expected to show much development in this area (van Kleeck, 1994). As well, metalinguistic ability was not tested directly in the present study, so its impact for bilingual children with DS awaits further study. Nonetheless, our findings strongly suggest that these bilingual children with DS are developing English skills at least as well as their monolingual counterparts. Of course, the small number of participants, especially in the DS-B group, makes definitive statements impossible. Further research is certainly warranted.

How successfully were these children with DS becoming bilingual? One line of evidence comes from the two-way analyses of variance conducted for the two groups of bilingual children. These analyses were completed for the standardized tests of vocabulary (PPVT–R, EVIP), for parent reports of expressive vocabulary ability (CDIs), and for language sample measures. For all these measures, both groups of children performed statistically better in English than in the second language. (This also held true at the individual level for MLU in words and PPVT–R/EVIP scores compared across the two languages, with the exception of 1 child with DS who performed better on the EVIP than the PPVT–R.) There were also no significant interactions obtained in the analyses for any of these measures. Therefore, the children with DS showed patterns of response to these measures similar to the TD controls. As well, there were no consistent differences in the abilities of the two bilingual groups. Indeed, the only significant group finding (DS-B vs. TD-B) was obtained for MLU. As a group, then, the children with DS usually performed as well on vocabulary measures as their developmentally matched controls. This finding, then, goes beyond a simple reflection of English dominance (which we selected for) to a suggestion that, as a group, the children with DS are acquiring second-language vocabulary skills on par with their bilingual controls. Again, caution is warranted as the small sample size may have masked significant differences.

The individual data revealed that the bilingual children with DS all had acquired at least some testable abilities in both languages, but the degree of second-language ability that had been acquired differed extensively across children. Some exhibited considerable capacity in their second language, while others exhibited very limited skills. To illustrate, age-equivalent scores on the standardized receptive vocabulary test (EVIP) administered in French ranged from a performance low of 13 months to a performance high of 64 months. MLU (in words) showed less variability, ranging from 1.17 to 1.65. The number of words reportedly produced in the second language (shared plus unique to the second language, using the subset of words with translation equivalents in the English and French versions of the CDI) ranged from a low of only 12 to a high of 390. The range for the control participants was somewhat more restricted for the EVIP (23 to 49 months). However, the range of scores for MLU in words in the second language was much broader (1.20 to 3.31), and the reported second-language vocabulary on the CDI (using the subset of words with translation equivalents) never fell below 152. As well, 3 children in the TD-B group were judged to be balanced bilinguals, while none of the children in the DS-B group were judged so. It would appear, then, that not all children in the DS-B group were equally successful in achieving bilingualism.

What was correlated with second-language success in these bilingual children with DS? Surprisingly, the reported duration of exposure did not predict any measure of second-language ability. All the DS-B children were reported to have been exposed to a second language for a minimum of 32 months (M = 82.4, range = 32–144), and the group had a mean proportional life exposure of .84 (range = .39 to 1.00). Indeed, both the highest and lowest language performers in this group had been exposed to their two languages from birth. It is possible that both groups of bilingual children may have been exposed enough to render this measure of duration no longer correlated with second-language performance. Perhaps if a more sensitive measure of language exposure had been employed the result would have been different. For example, Pearson et al. (1993) reported a significant relationship between exposure and language ability when they used a parental estimate of the percentage of time children were exposed to each language. MA was found to be significantly related to both NDW and MLU in the second language. Indeed, the child with the highest MA in the DS-B group was the child with the highest performance on all measures of language ability in both languages. Despite this, the child with the lowest measured MA (20 months) showed some capacity in both languages, and while his English skills were poorer than any other child in this group, his second-language skills were not (although these were less well developed than his own English skills). Clearly MA is not the only factor that might affect second-language performance. MLU in the second language, while less well developed in the DS-B group than in their bilingual controls, proved to be correlated with a larger number of factors than any other second-language measure. MLU was positively and significantly correlated with MA and CA as well as receptive vocabulary in the second language (EVIP). This would suggest that more developmentally advanced, older children who have better vocabulary comprehension skills will be those more likely to have acquired stronger morphosyntactic skills in the second language, as measured by MLU. Such a finding is consistent with that of Chapman et al. (2000), who reported that MA, CA, and comprehension were all separate predictors of MLU in monolingual children with DS. However, language comprehension proved to be the best predictor of MLU. Indeed, the general measure of comprehension used in the Chapman et al. study, when entered first in a multiple regression model, reduced the predictive power of MA and CA to a negligible amount. While multiple regression analyses were not appropriate for the current data, it is reasonable to expect that similar processes would be in operation here as well.

The EVIP and PPVT–R scores were also highly and significantly correlated with each other. This is likely due to the fact that similar cognitive processes are used to acquire words in both languages. However, it is interesting to note that many of the children's expressive vocabulary items in each of the two languages involved a shared concept (e.g., kitty, *chat*). The same could most likely be said of their receptive vocabularies. It is quite possible that word knowledge in one language supports word acquisition in the second language when the words share a common concept. Consistent with this interpretation, Tervoort (1979) reported that his young daughter initially acquired a Dutch lexicon by actively contrasting Dutch and French homonyms. Pearson (1998), however, notes that only 2 of the 24 bilingual children she studied seemed to use such a strategy.

Clinical Implications

As stated at the beginning of this paper, many professionals, including speech-language pathologists, often recommend to parents of children with language and cognitive impairments that they restrict input to their children to a single language (Thordardottir, 2002). In a multilingual environment, such a recommendation can effectively isolate children with DS from important life contexts shared with other family members. It can also seriously affect the natural interaction patterns of parents, if they choose to interact with their child in a language they do not feel as comfortable speaking. The current study, while finding evidence for language impairment in children with DS, found no evidence suggesting a detrimental effect of bilingualism. Thus, the findings do not support restricting language input to a single language. Instead, our results suggest that children with DS can be successful in acquiring two languages and that bilingual children perform in their dominant language (in this case English) at least as well as their monolingual counterparts with DS matched for developmental level. Therefore, rather than restricting input to one language, it seems important for speech-language pathologists to provide appropriate supports in both languages to bilingual children so as to ensure that they acquire each language to the best of their ability.

Conclusions

This study is the first to describe the bilingual abilities of a group of children with DS relative to developmentally matched monolingual and bilingual controls. The findings, however, must be considered preliminary in nature and require replication with a larger sample. Results provided evidence that some children with DS may be more successful than others in becoming bilingual. Future studies should focus on identifying the predictors of success. While awaiting more data, professionals and families should proceed with caution and careful attention to the individual needs of each family and child.

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Appendix

Parent Questionnaire, Language Exposure

Which languages does your child hear at home? Outside the home?
How long has your child been exposed to those languages?
Who speaks which language to your child?
Is your child learning both languages? How do you know?
Which language does your child speak best? Comprehend best?
Who lives in your home?
What language is used most often when the adults in the home talk to each other?
What language is used most often when the adults in the home talk to your child?
What language is used most often by the child in your home?
What language is used most often by your child's brothers? Sisters? Friends? Other significant people?
Does anyone take care of your child regularly when you are not home?
Yes _____ No______
If so, what language(s) does this person use? With your child?
When does your child speak each language at home?
English _______________________ Other _______________________
When does your child hear others use each language at home?
English _______________________ Other _______________________
When does your child talk with people who speak each language outside the home?
English _______________________ Other _______________________