The Role of Syntax in Reading Comprehension: A Study of Bilingual Readers

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1. General introduction

English language learners (ELLs) from Spanish speaking homes tend to have comparatively low literacy achievements as early as first grade and continue to lag behind their English speaking peers throughout the school years, even when instructed and assessed in Spanish (CTB/McGraw Hill, 1982, 1988; De la Rosa and Maw, 1990; Orfield, 1986). This lag in reading skills manifested in the earlier grades is exacerbated at the middle school and high school levels when it is critical for students to understand and manipulate large volumes of written text to learn subject matter. The cognitive prerequisites for successful reading comprehension are already complex even when we consider this process for monolingual children reading in their native language, particularly when they come from low income families. In a widely cited study, Chall and Jacobs (1996) reported that by the time these children reach fourth grade, their reading scores begin to decrease and continue to do so for the next five years, a phenomenon that has been termed "the fourth grade slump."

For inner city bilingual and bidialectal children, learning to read is even more complex, as they have to negotiate two linguistic systems, acquire reading skills in a language not spoken at home, and face the challenges of an overburdened public school system (NYT, March 28, 2002). In a report on the necessity of research on reading comprehension (Snow 2002), the Rand Reading Study Group points out that in order to successfully negotiate textual meaning the reader must bring at least the following to the act of reading: cognitive capabilities (e.g. attention, memory), motivation (e.g. purpose, interest), linguistic knowledge and experiences. Yet educators do not understand these factors sufficiently, especially in the case of second language readers: "…the education field [does not] know how to limit the particular challenges that second language readers face due to those readers' limited vocabulary and linguistic knowledge, nor do educators know how to build on those readers' first language comprehension abilities." (pg. xiv)

In this study, we look at the relationship between emerging language knowledge and reading skills in the bilingual child. In particular, we investigate the role of the bilingual child's syntactic systems in the emergence of reading readiness. Our focus is on reading comprehension and more specifically its precursor skill, listening comprehension. The comprehension of written and aural text is an area of literacy development that has received relatively little attention, especially when compared to the investigation of decoding skills. Gough and Tunmer (1986) and Tunmer and Hoover (1993) were among the first reading theorists to identify two main areas of cognition that contribute to the ability to read and understand written text: decoding skills, consisting of the ability to identify speech sounds and link these to individual letters; and listening comprehension, which is based on the reader's ability to recruit her mental grammar of the language and process sentences. Since syntax is a significant component in processing and at the same time a domain of language that reading researchers are only beginning to investigate, we have made it the main focus of our study. In the following section we report some of the findings on the relationship between syntax and developing reading skills in monolingual children.

2.   The relationship between syntax and reading

Early studies targeting syntactic development in reading impaired children suggest that reading disabled children have deficiencies in their application as well as understanding of syntax. Cromer and Wiener (1966) proposed that unskilled readers do not use syntax to assist and help in decoding written material. Vogel (1975) demonstrated that reading impaired children had deficits in areas measuring "the syntax of expressive language" and found a significant correlation between productive syntax scores and reading comprehension scores, while Anderson (1982) revealed that poor readers exhibit syntactic deficiencies in the written language. There are two approaches with respect to impaired readers and the source of their inferior performance. Researchers who associate poor readers' difficulties with underlying phonological processing deficits (Crain and Shankweiler, 1988; Macaruso, Bar-Shalom, Crain and Shankweiler, 1989; Liberman and Shankweiler, 1985; Shankweiler and Crain, 1986; Shankweiler et al., 1995; Smith, Macaruso, Shankweiler and Crain, 1989) support the Processing Deficit Hypothesis (PDH). The PDH states that unskilled readers do not experience deficits in representing or processing syntactic information but do experience difficulty in processing and retaining phonological information in working memory. This deficiency occurring at the level of working memory keeps information from being delivered at the necessary pace and with the required precision for higher level processing.   For example, Shankweiler and Crain (1986) propose that difficulty in the processing of complex syntactic structures should be interpreted as difficulty at the phonological rather than the syntactic level.

The Structural Deficit Hypothesis (SDH) attributes difficulties in the acquisition of reading to syntactic processing deficiencies (Bentin, Deutsch and Liberman, 1990; Bowey, 1986a, 1986b; Menyuk et al., 1991; Scarborough, 1991; Stein, Cairns and Zurif, 1984). The SDH claims that an absence of grammatical knowledge or lack of processing ability interferes with higher level text comprehension. Under the SDH the acquisition of syntactic structures is staged and gradual with inherently simpler structures preceding more complex ones in language development. It is the more complex structures that beginning and poor readers have more difficulty with. The criterion for the complexity of syntactic structure is based on the claim that one form or construction is simpler than another if children can produce and comprehend it first.   For example, a sentence consisting of both a main clause and a subordinate clause such as *The woman saw a man who ate a sandwich* is considered more complex than a coordinate structure as in *The woman saw a man and ate a sandwich*, because the former comes later in acquisition than the latter.

Investigation into the relationship between syntactic processing and syntactic knowledge has also included "normal" populations classified into good and poor readers (Bentin, Deutsch and Liberman, 1990; Bowey, 1986a, 1986b; Byrne, 1981a, 1981b; Menyuk et al. 1991; Scarborough, 1998; Stein, Cairns, and Zurif, 1984, Waltzman and Cairns, 2000). Bentin et al. (1990) identified syntactic differences between good and poor readers. In a three experiment study they sought to examine the relationship between reading ability and syntactic awareness in children (native speakers of Hebrew) who differ in reading competence. Unlike the vast majority of previous studies, auditory rather than written stimuli were used. The groups consisted of severely reading impaired children and unimpaired good and poor readers in the fourth grade. The results indicate that the difference between the correct identification of syntactically deviant and syntactically accurate sentences was smaller in the group of children with severe reading disability than in either good readers or relatively poor readers. Good as well as poor readers performed better than the reading disabled children in the judgement task. According to Bentin et al. this apparent inferiority of the latter group cannot be explained only by a reduction of the participants' short term memory span since first, very short and simple sentences (three or four words) were used; second, when tested formally all the children repeated sentences verbatim without any problem; and third, the nature of the stimuli in question did not involve "the manipulation of subtle syntactic aspects" but rather included straightforward syntactic violations of the subject predicate relation and word order. They argue that inadequate phonological processing does not justify and explain all aspects of poor reading since in their study poor readers were nevertheless good decoders. The linguistic deficiency in these children is thus ascribed to syntax rather than phonology. Their findings are in accord with Byrne (1981b) who also questioned deficient use of verbal memory as the source of incorrect use of syntactic context. Similar results were obtained by

Stein et al. (1984) who found that nondisabled readers demonstrated higher performance on complex syntactic structures, such as adverbial and relative clauses, than reading disabled children. According to Stein et al these results suggest that nondisabled children performed more like adults, in that they were basing their interpretation of inherently complex sentences on a hierarchical, adultlike, structural analysis, as opposed to the linear one characteristic of early language development. For example, they found that there was an order of difficulty in the interpretation of relative clauses (OO > SO and OS) for reading disabled children, while no implied order of difficulty was found for the comparison group. Stein et al. defined the reading impaired children's linguistic system as being partially delayed and conclude that the language comprehension system of unskilled readers mirrors a deficit in "grammatical maturation" and thus must rely on early forms of sentence interpretation or lower levels of language processing.

Within the population of nondisabled readers similar findings have been presented by researchers investigating the relationship between syntactic measures and reading skills. Tunmer, Nesdale and Wright (1987) compared good, younger readers (in grade two) to poor, older readers (in grade four) on four measures of reading ability (real word recognition, pseudo-word naming, reading fluency and reading comprehension) as well as verbal intelligence. Tunmer et al. hypothesized that syntactic awareness is causally associated with learning to read in two ways: First, syntactic awareness may significantly aid the child in acquiring phonological recoding, which is understood as the ability to translate letters into phonological form. This skill may enable beginning readers to recognize new words, develop "speed and automaticity" in visual word recognition and indirectly support comprehension. Second, it is plausible that syntactic awareness enables beginning readers to monitor their comprehension processes more efficiently. The results of Tunmer et al. indicate that good, younger readers scored significantly better than poor, older readers on two tests of syntactic awareness, the oral cloze task and oral correction task. This further suggests that the older, unskilled readers were "developmentally delayed" in syntactic awareness and that this delay may have altered reading development. Compatible with this interpretation are the subsequent findings that the two measures of syntactic awareness varied with reading level at each grade: the better readers of each grade scored better on syntactic awareness tasks than the poor readers. In Tunmer et al.'s view it is the combination of both results, the higher performance of the good, young readers and the differences among the "chronological age matches", that points to a causal link between syntactic awareness and reading acquisition (see also Tunmer and Bowey, 1984).

Bowey (1986a) presented fourth and fifth graders with two parallel sets of syntactically incorrect sentences. Participants were told that all stimuli they would hear contained a mistake. In an elicited imitation task participants were asked to repeat the sentence with the mistake, and in an elicited correction task they were asked to fix the sentence. The difference between the number of elicited and spontaneous corrections in both tasks was calculated and labeled a "syntactic control", a nearly pure measure of syntactic awareness. The results suggested that although this syntactic control did not increase from fourth to fifth grade it was strongly correlated with both product and process measures of reading proficiency as measured by standardized reading test performance as well the ability to control and identify the acceptability of oral reading errors.

Bowey's (1986a) results concerning the relation between syntactic awareness and reading achievement in fourth and fifth graders were replicated, this time in a sample population of first to fifth grade children, with both verbal ability and grade effects partialed out. Inspired by her previous results, Bowey (1986b) investigated the development of metasyntactic skill (e.g. children's ability to correct grammatically incorrect sentences) and its relation to reading achievement. Syntactic awareness was significantly related to reading achievement. The significant correlation between reading ability and deviant sentence recall, with random sentence recall effects statistically controlled, remained significant with vocabulary, age and grade effects additionally controlled.

While most of the studies described above measured syntax in global ways, some studies have focused on more specific sentence types. Waltzman and Cairns (2000), for example, looked at binding and control and the reading abilities of good and poor readers in third grade and found that good and poor readers differed with respect to their interpretation of pronominal relations. Overall the good readers performed more adultlike (99% correct) than the poor readers (83%) on a comprehension task. They also found a significant correlation between their independent measure of reading and knowledge

of grammar. Waltzman and Cairns argue that it is highly unlikely that deviant ("non adult") responses of the children in their study could be associated with obstructions in phonological memory. The methodology of their study was designed in such a way so as to put as little strain on phonological short term memory as possible. The results further support the role of specific syntactic factors that are independent of phonological short term memory and that underlie initial reading skills.

2.1 Main research questions

Given that a role for syntax has been established in the acquisition of reading by monolingual children, we now want to extend this question to the bilingual population. Thus, the most general objective of this study is to discern the role that syntactic development (as opposed to phonology and vocabulary) plays in the acquisition of reading comprehension and its precursor skill, listening comprehension, in bilingual children. We focus explicitly on specific syntactic structures known to be milestones in the development of monolingual children, namely coordination and subordination. Our main question is whether bilingual children with a strong knowledge base in their first language, Spanish, acquire reading comprehension in English better than children with weaker Spanish syntax. The hypothesized relationship between a strong knowledge base in the first language and the development of reading skills in a second language has been proposed by many researchers on bilingualism, notably J. Cummins, (see Cummins, 1976, 1979, 1981), but it has not been investigated in a controlled experimental setting. This relationship is described in Cummins' threshold hypothesis and remains controversial today. A much more widely accepted idea is that a strong base in the second language (L2) serves the child well in developing reading skills in that same language. This constitutes our second question, namely to what degree does a strong syntactic base in the L2 (English) contribute to listening comprehension in the L2, and is this a more significant factor than the corresponding base in the L1 (Spanish). We are thus interested in the relative contribution that each of the bilingual child's languages makes to reading in the L2. Furthermore, we want to investigate the development of syntax in the bilingual child. Specifically, we want to know whether the syntactic systems in the bilingual child follow the same developmental patterns as that in the monolingual child. Finally, we want to know whether there is parallel development in the syntactic systems of the L1 and the L2.

The particular measures of syntax we chose are based on research in first language development: coordination with "and" and two types of subordination, relative clauses with the head in object position and the gap in subject position (OS relative clauses) and temporal adverbial clauses with "before". In the following section we motivate our choice of complex sentence types with a brief review of findings on monolingual L1 development and adult L2 development.

3. Background: complex sentences

The literature on complex sentence development in monolingual children shows that coordination precedes subordination in production and comprehension (Sheldon, 1974). In English, categories of the same type may be conjoined by *and* (*IP and IP*, *NP and NP*, etc.). Limber (1973) reported that prior to acquiring connectives, children will simply conjoin clauses. Connectives appear to emerge in production some time after 2;6 (Limber, 1973), and when connectives do emerge, the first to appear is *and* (Bowerman (1979), Bloom et al. (1980)). Ardery (1980) and Lust and Mervis (1980) converged on the finding that predicate coordinations precede subject coordinations. Thus, a sentence like *The dog kissed the horse and pushed the tiger* is predicted to be easier than a sentence like *The tiger and the turtle pushed the dog*.

Sheldon (1974) used an act out task with children ages 3;8 to 5;5 to test four relative clause structures (OO, OS, SO, SS) and their counterpart coordinate structures (four coordinate IP types). The coordinate IPs were much easier when comparing within a type (for example, the OO coordinate IP was easier than the OO relative) and across types (the average mean score for all coordinate IPs exceeded the average mean score for all relative clause types).

"Headless" relative clauses (*Look it mommy have on*, O'Grady, 1997:175) have been documented in the speech of 2 year olds, and headed relatives (*I want something that the cows eat* O'Grady, 1997:175) in the speech of children between 2;6 and 3;0 (example from Hamburger and Crain 1982:248). Subjectless infinitivals (*I wanna cookie*) are likely produced before the connective *and*, but subordinate clauses with relative pronouns and subordinate clauses with temporal adverbials are produced later in development. Although the order in which connectives are acquired varies, the adverbial connectives *before* and *after* are likely two of the more difficult to acquire (Bowerman, 1979). *Before* and *after* may emerge as temporal adjuncts prior to their successful use as connectives.

3.1 Relationship between coordination and subordination

It has been suggested that children rely on coordinate structures early in the stages of acquiring subordinate clauses, particularly when the phenomenon of control is involved (cf. Tavakolian (1978) and Lebeaux (1990)). The conjoined clause strategy predicts that children will interpret a sentence like *The dog kisses the bear that pushes the box* as *The dog kisses the bear and pushes the box*. The conjoined clause strategy is postulated to be an attractive tool for two reasons: first, when a relative clause begins with *that* (although this hypothesis may hold when the clause begins with a *wh* word such as *who*), it is plausible that children interpret it as *and*, another unstressed functional word. (Although see de Villiers et al. (1979) for an argument that this hypothesis is not so strong.) Also, by using a conjoined clause strategy, children are able to posit a structure that does not contain a gap, presumably a simpler structure to interpret. (O'Grady, 1997)

Although coordination is considered a precursor to subordination, Lust (1994) has argued that even when children convert subordinate structures to coordinate structures, it does not necessarily follow that the child is not grammatically equipped to deal with subordinate structures.

3.2 Hierarchy of subordination types

In this section we report some of the findings on relative clauses where the head is in object position and the gap is in subject position, commonly known as OS relatives. It has been reported that when children are asked in elicited imitation tasks to reproduce subject relatives, they often convert them to object relatives (Slobin, 1971; Menyuk, 1969; Slobin and Welsh, 1971). This may support the conclusion that children find subject relatives more difficult, (but see Sheldon, 1974). In first language acquisition, Bever (1970) and Sheldon have proposed that the order of difficulty in embedded relative clauses is based on "parallel function," meaning that children find relative clauses easiest to understand when the NP in the main clause has the same function as the relativized element in the subordinate clause (e.g. SS, OO). However, Sheldon (1977) tested native speakers of English on four relative clause types, and found the following hierarchy of difficulty: OS<SS<OO=SO. This hierarchy is consistent with the "avoid interruption and rearrangement of linguisitc units" principle, and with the accessibility hierarchy of Keenan and Comrie (1977). Prideaux (1980, 1982) also found object headed relative clauses to be easier than subject headed relative clauses.

Sheldon (1974) used an act out task to test monolingual children on OS relatives of the type *The pig bumps into the horse that jumps over the giraffe*. For the three age groups Sheldon tested, the mean percent correct on OS relatives was: 3;8 to 4;3 (N=11): 18 percent; 4;6 to 4;11 (N=11): 30 percent; 5;0 to 5;5 (N=11): 39 percent. De Villiers et al. (1979) used an act out task to test monolingual children on OS relatives of the type *The kangaroo kissed the camel that shoved the elephant*. 21 children (mean age 3;6), 37 children (mean age 4;7), 34 children (mean age 5;5), and 22 children (mean age 6;5) were tested (total N=114). 75 percent of these children performed the matrix clause correctly, and 39 percent of these children performed the subordinated clause correctly. Goodluck and Tavakolian (1982) used an act out task to test 20 4 and 5 year old children on sentences with relative clauses and adverbial clauses. When OS sentences of the type *The boy hits the girl that jumps over the fence* were tested, 59 percent of the children interpreted this sentence correctly, with the object (*the girl*) of the matrix interpreted as the subject of the relative clause. When OS sentences of the type *The dog kicks the horse that jumps up and down* were tested, 76 percent of the children interpreted this sentence correctly, with the object (*the horse*) of the matrix interpreted as the subject of the relative clause. Hsu,

Cairns and Fiengo (1985) used an act out task to test 64 monolingual English speaking children ages 3;2 to 8;3 on sentences with relative and adverbial clauses. When presented with OS sentences of the type *The lion pushes the bear that is climbing up the ladder* 90 percent of the children age 5;7 to 6;0 correctly chose the object of the matrix (*the bear*) to be the subject of the subordinate clause. 10 percent of them incorrectly chose the subject of the matrix (*the lion*) to be the subject of the subordinate clause.

A leading hypothesis is simply that the more embedded a gap, the more difficult it is to interpret it. An order of difficulty in comprehending gaps was proposed by de Villiers et al. (1979). Based on an act out task, she found a hierarchy with subject gaps being easiest, object gaps being more difficult, and object of preposition gaps being the most difficult. In a picture description task in which production of relative clauses was elicited, Pérez Leroux (1995) found resumptive pronouns filling in object gaps, but no resumptive pronouns being used to fill in subject gaps. The filling in of gaps was taken to be an indication of the difficulty of interpreting the gap.

3.3 Transitive and intransitive verbs, animate and inanimate objects

Goodluck and Tavakolian (1982) tested the OS relative clause with an act out task using three sentence types: one in which the object of the relative clause was an animate NP, one in which the object of the relative clause was an inanimate NP, and one in which the verb in the relative clause was intransitive. The number of syllables in the relative clauses were nearly identical, and still a hierarchy emerged. Relative clauses with intransitive verbs (*jump up and down*) were easier than relative clauses with transitive verbs. Relative clauses with inanimate objects were easier than relative clauses with animate objects.

3.4 L2 acquisition of relative clauses

The acquisition of relative clauses has provided an interesting field of inquiry for the L2 researcher where it has been approached from various perspectives (Adjemian and Liceras, 1984; Doughty, 1991; Flynn, 1983, 1987; Gass and Ard, 1980; Hawkins and Chan, 1997; Hyltenstam, 1984; Ioup and Kruse, 1977; Tarallo and Myhill, 1983). Much research in this area has investigated the proposal put forth in Keenan and Comrie (1977) that relative clauses are linked to implicational universals (Gass, 1979; Eckman, Bell and Nelson, 1988; Hyltenstam, 1984; Ioup and Kruse, 1977; Pavesi, 1986).

Here, there has been little support for the "parallel function" hypothesis. Gass and Ard (1980), reanalyzing the results of a sentence combination task, found that learners found relative clauses with subject heads easiest (SS and SO), regardless of whether the head of the relative clause had the same function as the relativized element in the subordinate clause. Gass and Ard's findings are compatible instead with the order of difficulty predicted by the Accessibility Hierarchy. However, results from other studies bring these findings into question as well. In a study of learners' production, Schumann (1980) found that learners used the OO and OS relative clauses with the most frequency. Munnich, Flynn and Martohardjono (1994), using both elicited imitation and a grammaticality judgement task, reported better performance on the OS relative type than the OO. It should be noted that most of the L2 research on relative clauses tests adult rather than child learners and is therefore not directly relevant to the present study.

3.5 Temporal adverbial clauses

In this section we report some of the literature on the acquisition of temporal adverbial clauses with *before* and *after* in monolingual children. In temporal adverbial clauses of the type *The dog kissed the bear before sleeping*, the subject of the matrix is the preferred controller. McDaniel, Cairns and Hsu (1990/91) tested adverbial clauses and complement clauses using an act out task with children 3;9 to 5;4. Their results provide further evidence for a series of developmental stages in the acquisition of control. In the first stage, children selected a character not mentioned in the target; in the second

stage, children preferred the object of the matrix as the controller; in the third stage children sometimes selected the matrix object and sometimes selected the matrix subject; and in the fourth stage, children selected the correct controller (object for the *tell* complements, subject for the adverbials).

Hsu, Cairns, and Fiengo (1985) also propose a developmental hierarchy, largely paralleling the hierarchy proposed by Chomsky (1969). Hsu et al. tested temporal adverbial clauses and control with sentences like *The boy hits the girl after jumping over the fence*. Children ages 3;2 to 8;3 participated in the study. The four stages Hsu et al. propose are: object oriented; mixed subject and object oriented; approaching adult; and adult. A "subject oriented" stage or strategy (Tavakolian, 1977; Goodluck and Roeper, 1978) is not uncontroversial, but Hsu et al. propose that it may precede the object stage described in their study. The object oriented grammar was characterized as the minimal distance principle in Chomsky 1969. Hsu et al. provide a more structural characterization of this phenomenon, proposing that the closest c commanding NP controls the missing subject (thus, children who misinterpret the object as the controller have not acquired the adult "structure" for these types of sentences).

A coordinate strategy may also be employed in the acquisition of temporal adverbials (Cairns, McDaniel, Hsu, DeFino, and Konstantyn, 1995) before the child learns to use words like *before*. As mentioned earlier, *before* is one of the later connectives to emerge in language development.

3.6 Adverbial clauses and sequencing

Coker (1978) reported that earlier research (Clark 1971, Coker and Legum, 1975, French and Brown, 1977, Hatch, 1971; and Johnson, 1975) indicated that when children are asked to act out sentences with temporal adverbials, they are most successful when the order of events matches the temporal order of the sentence itself. She also noted that previous research indicates that children perform better on *before* clauses than on *after* clauses. Although Coker (1978) disputes these claims, the children tested in her act out task (ages 5;3 to 7;7) produced the same rank order of difficulty as prior research (Event 1 *before* event 2 < *After* event 1, event 2 <*Before* event 2, event 1 < Event 2 *after* event 1). If this hierarchy holds, the structure tested in this study (*The dog pushes the cat before sleeping*) is predicted to be the simplest structure that incorporates a temporal adverbial. Only *before* was tested, and the sequence of the sentences was identical to the sequence of events. In Clark (1971) children as young as 3;7 successfully interpreted this structure.

The findings presented in section 3 provided the basis for the sentence types we selected as our syntax measure. They will be described in more detail in the methodology section below.

4. The present study
4.1 Hypotheses

We present two sets of hypotheses, based on the research questions we raised on the relationship between syntax and reading and on the nature of syntactic development in the bilingual child. We begin with the developmental hypotheses. Here we predicted that the development of complex sentences would parallel that of the monolingual child, and that similar patterns would be found for the L1 (Spanish) and the L2 (English). For the syntax reading relationship we predicted that higher performance on the syntactic measures in both the L1 Spanish and the L2 English would correlate with higher performance on a standardized reading readiness measure, the Gates MacGinitie reading test. We also hypothesized a stronger correlation between the L1 (Spanish) syntax measures and the L2 (English) reading measure.

4.2 Methodology
4.2.1 Subject/participant participant selection

All participants were kindergarteners from one of two New York City public elementary schools. 22 participants completed three syntax measures in Spanish and English and a standardized English pre-reading test. In addition to the subordination and coordination syntax measure reported on here, a

tense and aspect task (picture point) and a pronominal awareness task (picture point and act out) were administered. 22 participants completed all tasks, and the results of 13 of those 22 are reported here. For each of these 13 children, their scores on the Spanish versions of the syntax measures numerically exceeded their scores on the English versions of the syntax measures. Analyzed as a group, the Spanish score on the syntax measures is statistically higher than the English score on the syntax measures. The mean age of the 13 participants was 5;9.

A questionnaire was conducted with a parent of each participant (in most cases, the mother). To assess the level of literacy activities in the home and that the children participated in outside of school, we asked questions like *Did you bring your child to the library to borrow books any time during the past two weeks?*, *Is there pencil and paper in your house so that the child can write?*, and *Do you read the newspaper (a lot, sometimes, little, almost never)?* Possible scores ranged from 0 percent to 100 percent. Interviews were conducted with parents of 12 of the 13 participants discussed here. The literacy score ranged from 33 percent to 60 percent; the mean was 44 percent.

4.2.2 Subordination and coordination (syntax measure)

The subordination and coordination task is a comprehension task. In this task, children used props to act out sentences read to them by an experimenter. Although the act out task is typically cognitively more demanding than a picture point task, a benefit of the act-out task is that children's errors are more informative than in the case of the picture point. It has been argued that the act out can provide more reliable information than elicited imitation. For example, Sheldon (1974) noted that although her task was designed as an act out task, some children repeated the target (as though the task were a combined elicited imitation plus act-out). In some instances, children repeated the target incorrectly, yet acted out the target correctly.

Children were told that the experimenter wanted to play a game with them in which it would be their job to listen carefully to sentences and then act out the sentences using props. Simple lexical items were chosen in English and Spanish, and each child participated in a warm up before moving on to test items. Before beginning the warm up, the experimenter chatted with the child to make her comfortable and excited about the "game."

In the warm up, each child was introduced to five props: a plastic box and four stuffed animals, a cat, a dog, a bear, and a monkey. The props were placed between the experimenter and the child. During the warm up, the child was instructed to listen carefully to each sentence, then pick the props she needed to act out the sentence, and to return the props to the middle of the table when she had finished the act-out. All props and all verbs used in the experimental section were introduced during the warm up. The experimenter did not move on to the test items until the child demonstrated knowledge of all verbs and all props.

After the warm up, the experimenter asked the child for permission to videotape the session. When child assent was given, the session was taped. Videotaping is a common procedure used in act-out tasks to facilitate scoring.

The experimental section of the task included two blocks of 16 sentences (32 sentences total) with four fillers (simple sentences such as, *The monkey closes the box*). After the first block each child was asked if she would like to take a break to stretch, walk or get a drink of water. If a child asked to have a test item repeated, one repeat was allowed. If the child asked a second time, the test item was repeated, but the response was not scored.

Each child received one of four randomized batteries in English and one of four randomized batteries in Spanish. Half of the children received an English battery first, and half of the children received a Spanish battery first. Test items in each battery were identical (within languages and across the two languages).

4.2.2.1 Test items

Three types of coordinate structures were tested: subject coordination, object coordination and sentence (IP) coordination. Of the ten coordination types tested by Ardery (1980) these are among the six easiest. Four types of subordinate structures were tested: temporal adverbial (*before*) clauses

(intransitive and transitive) where the order of events matches the temporal order of the sentence; and OS (relativized object, subject relative pronoun) relative clauses (intransitive and transitive). When a transitive verb was used, the object was inanimate.

Sentences with relative clauses and sentences with embedded clauses missing explicit subjects are well researched in first language acquisition research and present a challenge to young learners (Goodluck and Tavakolian, 1982; Cairns, McDaniel, Hsu, and Rapp, 1994). We tested only the simplest relative clause type (OS), and the simplest temporal adverbial clause type (clause order matched temporal order). Work has been done on the acquisition of tensed subordinate clauses (Cairns, McDaniel, Hsu, and Rapp (1994); McDaniel et al. (1991), Lust et al. 1986), but we did not test this structure here. The overt pronoun in these structures is ambiguous (may be controlled by the subject or the object), while in the "missing subject" clauses tested here, there is always a correct and incorrect response. An interesting observation to come out of research in tensed adverbials is the Pronoun Coreference Requirement. Children who obey the PCR require that a pronoun be coreferential with a noun phrase in that sentence (in other words, a pronoun may not refer to an agent not mentioned in the sentence). However, the PCR seems to be a factor in the grammar of very poor readers, not normally developing readers. Simple transitive sentences were used as fillers.

Examples of sentence types

Simple Transitive (filler)
The cat pushes the box.
El gato empuja la caja.
IP Coordination (intransitive)
The cat jumps and the bear runs.
El gato salta y el oso corre.
Object Coordination (transitive)
The monkey touches the bear and the cat.
El mono toca al oso y al gato.
Subject Coordination (intransitive)
The dog and the cat sleep.
El perro y el gato duermen.
Subordination (relative clause, intransitive)
The monkey hugs the dog who jumps.
El mono abraza al perro que salta.
Subordination (relative clause, transitive)
The bear hugs the cat who pushes the box.
El oso abraza al gato que empuja la caja.
Subordination (adverbial clause, intransitive)
The monkey pushes the dog before dancing.
El mono empuja al perro antes de bailar.
Subordination (adverbial clause, transitive)
The dog punches the bear before touching the box.
El perro golpea al oso antes de tocar la caja.

4.2.2.2 Scoring

A very conservative scoring procedure was used. No animal substitution errors or verb substitution errors were permitted. A response counted as correct only if the entire sentence was acted out as read to the child with no lexical errors.

4.2.3 Gates MacGinitie (reading measure)

The test was administered in two sessions. In each session one experimenter administered the test to a group of two to eight children, using the manual provided by Gates MacGinitie. This multiple

choice test is administered orally, and participants respond in a booklet, marking down their answers in pencil. A second experimenter was present to make sure participants remained on task. At least one day separated each session.

4.2.3.1 Test items

The Gates MacGinitie Kindergarten pre-reading test (Riverside Publishing) measures pre-reading abilities in English and is appropriate for children in kindergarten and early first grade. The four sections of this version are: Literacy Concepts, Phonological Awareness, Letter and Letter-Sound Correspondence, and Listening Comprehension. Being a pre-reading test, it does not contain a reading comprehension section, but rather includes a listening comprehension section. The selection of this test was suggested by the New York City Board of Education's Division of English Language Learners.

4.2.3.2 Scoring

The multiple choice test was scored using the key provided by Gates. Scores were totaled by subsection and overall. Scores reported are mean percent correct.

5. Developmental results
5.1 Research questions

In addition to our primary investigation into the relationship between syntax and reading, we also wanted to characterize the development of our participants' L1 and L2. First we asked whether the participants would display the same developmental patterns that have been described in studies of monolinguals (primarily English-learning monolinguals). Second, we were interested in whether the patterns they displayed in their L1 (Spanish) would similar to the patterns they displayed in the L2 (English).

5.2 Overall results

The participants' performance on coordination exceeded their performance on subordination in both languages by a statistically significant amount.

	L1 (Spanish)	L2 (English)
Coordination	85%	71%
Subordination	15%	13%
Overall	45%	38%

Figure 1. Mean percent correct overall and by sentence type on syntax measure

As you can see in the table above, performance on coordination in Spanish (85% correct) was better than performance on subordination in Spanish (15% correct) ($F (1,12) = 230.27$, $p < 0.01$), and performance on coordination in English (71% correct) was better than performance on subordination in English (13% correct) ($F (1,12) = 74.95$, $p < 0.01$). Performance on Spanish coordination exceeded performance on English coordination by a statistically significant amount ($F (1,12) = 5.60$, $p < 0.05$). Performance on subordination in the two languages was similar. That is, although performance on Spanish subordination exceeded performance on English subordination, the amount was not statistically significant. Overall performance (coordination and subordination combined) in Spanish (45% correct) was better than overall performance in English (38% correct) by a statistically significant amount ($F (1,12) = 4.78$, $p < 0.05$).

5.3 Coordination results

A hierarchy emerged with respect to coordination type, shown in the table below.

Coordination Type	L1 (Spanish)	L2 (English)
Subject [The monkey and the bear] dance	94%	94%
Object The monkey pushes [the bear and the cat]	83%	58%
IP [The monkey dances] and [the cat jumps]	76%	62%

Figure 2. Mean percent correct by coordination type

Our participants found subject coordination (Spanish 94% correct; English 94% correct) to be easier than object coordination (Spanish 83% correct; English 58% correct) and IP coordination (Spanish 76% correct; English 62% correct) in both Spanish and English.

This difference between subject coordination and object coordination, and between subject coordination and IP coordination was statistically significant in both languages. Performance on Spanish subject coordination exceeded performance on Spanish object coordination ($F(1, 12) = 4.60$, $p=0.053$), and performance on Spanish subject coordination exceeded performance on Spanish IP coordination ($F(1,12) = 6.12$, $p < 0.05$). Performance on English subject coordination exceeded performance on English object coordination ($F(1,12) = 19.34$, $p < 0.01$), and performance on English subject coordination exceeded performance on English IP coordination ($F(1,12) = 15.91$, $p < 0.01$). Performance on object coordination and IP coordination was similar in both languages. The difference between the two was not statistically significant.

When comparing performance in Spanish on coordination with performance in English on coordination, performance on subject coordination was identical. Performance on object coordination in Spanish exceeded performance on object coordination in English by a statistically significant amount ($F(1,12) = 4.88$, $p < 0.05$). Performance on IP coordination in Spanish also exceeded performance on IP coordination in English by a statistically significant amount ($F(1,12) = 5.02$, $p < 0.05$). Overall, participants' performance in Spanish is better than their performance in English.

5.4 Subordination results

Subordination results for both languages are shown in the table below.

Subordination Type	L1 (Spanish)	L2 (English)
Relative clauses overall	18%	19%
RC with intransitive verbs The bear pushes the monkey [who dances]	23%	29%
RC with transitive verbs The bear pushes the monkey [who touches the box]	13%	10%
Adverbial clauses overall	12%	7%
AC with intransitive verbs The bear pushes the monkey [before dancing]	13%	10%
AC with transitive verbs The bear pushes the monkey [before touching the box]	10%	4%

Figure 3. Mean percent correct by subordinate clause type

As shown above, the overall score on relative clauses in Spanish is 18% correct; the overall score on relative clauses in English is 19% correct. The score on relative clauses with intransitive verbs in

Spanish is 23% correct; the score on relative clauses with transitive verbs in Spanish is 13% correct. The score on relative clauses with intransitive verbs in English is 29% correct; the score on relative clauses with transitive verbs in English is 10% correct. The overall score on temporal adverbial clauses in Spanish is 12% correct; the overall score on temporal adverbial clauses in English is 7% correct. The score on temporal adverbial clauses with intransitive verbs in Spanish is 13% correct; the score on temporal adverbial clauses with transitive verbs in Spanish is 10% correct. The score on temporal adverbial clauses with intransitive verbs in English is 10% correct; the score on temporal adverbial clauses with transitive verbs in English is 4% correct.

Our participants performed at about the same level when presented with subordinate clauses (relative clauses and temporal adverbial clauses) in the L1 (Spanish) and the L2 (English). The difference between the two was not statistically significant. In both languages, performance on relative clauses with intransitive verbs was statistically significantly higher than performance on relative clauses with transitive verbs. This is true on both Spanish ($F (1,12) = 4.55$, $p = 0.054$) and English ($F (1, 12) = 8.96$, $p < 0.05$).

5.4.1 Error analysis

The results reported in the previous section reflect our participants' ability to correctly act out sentences with coordination and subordination. In this first level of scoring we adhered to very strict criteria. An act out was scored as correct only if the sentence was performed without any errors, including lexical substitutions (i.e., *punch* for *kiss*). Each act out was transcribed and checked by two experimenters.

In the next level of scoring, transcriptions of the act outs with errors were analyzed in order to discern the most prominent error patterns among our participants.

As described in the developmental results section, the 13 participants performed well on coordination in both languages but experienced greater difficulty on subordination in both the L1 and L2. What follows is a descriptive picture of the common errors exhibited on the subordination section of the act-out in both Spanish and English.

5.4.1.1 Major error types

Two major error types emerged in the two languages: reduction to a simple clause and incorrect identification of the agent of the subordinate clause. These two errors occurred at about the same rate in Spanish and English, with reduction accounting for 34% of the responses to Spanish subordinate structures and 36% of the responses to English subordinate structures. Incorrect identification of the agent of the subordinate clause accounted for 22% of the responses to Spanish subordinate structures and 15% of the responses to English subordinate structures. The table below shows a breakdown of major error types. All responses, correct and incorrect, are included in this table.

Response Type	L1 (Spanish)	L2 (English)
Correct	15%	13%
Reduction to simple clause	34%	36%
Incorrect agent of subordinate clause	22%	15%
Other errors (primarily lexical)	29%	36%
Total	100%	100%

Figure 4. Responses Given for Sentences with Subordinate Clauses (Adverbial and RC) in L1 and L2

5.4.1.2 Reduction to simple clause

The most common error is reduction to a simple clause. Hamburger and Crain (1982) and de Villiers et al. (1979), among others, also report "reduction" errors in monolingual children ages 3 to 7. Researchers have argued these errors are the result of processing load. Another possibility is that

participants interpret the relative clause as unnecessary to act out. O'Grady (1997) reported that adults sometimes omit the subordinate clause when asked to act out such sentences. For example, when asked to act out a sentence such as *The dog that the horse kissed jumped on the camel,* adults took the dog, and assumed that they selected the dog that the horse had kissed (but would not actually act out this part of the sentence), and then had the dog jump on the camel.

Ten of the 13 participants made at least one reduction error, and seven of those 10 made a reduction error in Spanish and English. Three types of reduction errors were observed: reduction with no errors in the matrix performed; reduction with only a verb substitution in the matrix; and reduction with further lexical errors (for example, selection of an incorrect subject or object). Looking only at reduction errors, the table below shows the percentage of each error type.

Reduction Error Type	L1 (Spanish)	L2 (English)
Matrix clause correct (reduction only)	60%	62%
Verb substitution	21%	15%
Further lexical errors	19%	23%
Total	100%	100%

Figure 5. Percentage of reduction error types produced for all reduction errors on subordinate clauses

5.4.1.3 Control errors

The participants made errors identifying the agent of the subordinate clause when presented with adverbial clauses and relative clauses.

Looking first at the adverbial clauses, six of the 13 participants made this error at least once, and five of those six made an error of this type in Spanish and English. This error pattern is widely attested in studies of monolingual children who are tested on this type of sentence. Often, several different structures are tested in concert with two temporal adverbials, for example, *before* and *after* (Coker, 1978). In this task, only the simplest of these structures was tested. These sentences are sometimes referred to as a subject control structures, since the subject of the matrix clause is the subject of the adverbial clause.

When participants selected an incorrect character to serve as the agent of the adverbial clause, these selection errors largely patterned with errors described in studies of monolinguals. In particular, the errors reinforce the developmental stages discussed in Chomsky (1969) and Hsu, Cairns, and Fiengo (1985). An initial stage in which children select an animal from outside of the sentence to be the agent of the adverbial clause has been described in studies of monolinguals. None of our participants made this type of error. We hypothesize that these participants have passed this stage of development. A second stage in which the object of the matrix is selected as the subject of the matrix clause is described in the L1 literature. Our participants did make this error. A third stage, in which children alternate between selecting the object of the matrix and the subject of the matrix as the subject of the adverbial clause has been described in studies of monolinguals. Again, our participants made errors of this type. In addition, our participants made an error that we have not seen described in L1 studies. They allowed both the subject and the object of the matrix to simultaneously serve as the agent of the adverbial clause, in other words, the subject of the adverbial was a coordinate NP. We hypothesize that these children may be providing evidence for an intermediate developmental stage (falling between stages two and three described above).

All relative clauses tested were of the type OS (object head, subject gap), as in *The cat kisses the bear who sleeps*. The most common error our participants made when presented with the OS relative was reduction to the matrix.

When presented with a relative clause, 10 of the 13 participants made at least one error identifying the agent of the relative clause, and five of those 10 made an error of this type in Spanish and English. As with the adverbial clauses, this error is widely attested in studies of monolingual children. (Tavakolian, 1978; Sheldon, 1974; Hsu, Cairns and Fiengo, 1985; Hsu et al., 1989) Several different

structures are often tested in studies of monolinguals, but in this task only the simplest of these structures was tested. With relative clauses, the simplest structure is sometimes referred to as object control since it is the object of the matrix that is the subject of the relative clause.

As with the errors made in adverbial clauses, the errors our participants made when presented with relative clauses largely pattern with errors described in studies of monolinguals. In no case (as with the adverbials) did a participant select a character from outside the sentence to be the subject of the relative clause. Participants often incorrectly selected the subject of the matrix to be the subject of the relative clause. And as with the adverbials, some participants allowed the subject and object of the matrix to simultaneously serve as the subject of the relative clause. Again, this coordinate NP error is not one we have seen described in studies of monolinguals, and we hypothesize that the participants who made this error may be providing evidence for an intermediate stage in development.

5.4.1.4 Errors pattern in previous research

Our preliminary error analysis is descriptive only, but a few observations can be made nonetheless. In general, the 13 participants made errors that pattern closely with the errors described in studies of monolinguals. Reduction errors and "control" errors are widely attested in the L1 literature, and so we see that these 13 participants are demonstrating developmental patterns similar to monolingual learners. Further, these participants made these errors in both the L1 (Spanish) and the L2 (English). This indicates that the development of their L1 and their L2 is progressing in a similar fashion. An error we hope to investigate further is the coordinate error that was made in adverbial and relative clauses.

5.5 Relationship between L1 and L2 development

When we looked at the relationship between the Spanish coordination scores and the English coordination scores, we did not find a significant correlation. This is likely due to the very high overall scores obtained on coordination in both languages. However, when we compared the Spanish subordination score with the English subordination score, we did find a significant correlation ($r= 0.5$, $p= 0.05$). When overall performance (coordination and subordination combined) in Spanish was compared with overall performance in English, we also found a significant correlation ($r= 0.5$, $p= 0.05$).

5.6 Language development summary

Looking at the patterns exhibited by the participants, we observed that coordination was much easier than subordination. This pattern is consistence with research in monolingual language development. (Sheldon, 1974)

Within coordination, the participants performed better on subject coordination than on object or IP coordination. Studies of monolinguals have shown IP coordination to precede object coordination, but since these two types of coordination emerge very close together in development, it is not surprising that our participants performed at about the same level.

A surprising result is that the participants found subject coordination to be easier than IP and object coordination. This is true in the L1 (Spanish) and the L2 (English). Although these participants exhibited an atypical pattern, they demonstrated this pattern in both languages.

In subordination, the participants did better on relative clauses with intransitive verbs than on relative clauses with transitive verbs. This is also consistent with research in monolingual language development.

In general, the participants show developmental patterns similar to the patterns of monolinguals, and their developmental patterns are the same in their L1 and their L2. When we did observe a difference between the two languages, performance was better in the L1 than in the L2.

6. Results: Syntax and reading
6.1 Scores on Gates MacGinitie reading test

Gates MacGinitie Reading Test Level PR Mean Percent Correct *(n=13)*					
	Literacy Concepts	Oral Language Concepts	Letters/Letter-Sound Correspondences	Listening Comprehension	Total
mean	54	35	71	43	53
sd	17.54	9.79	13.91	13.6	10.36

Figure 6. Mean scores on Gates MacGinitie Pre-Reading Test

We first report the group results of the standardized measure of English reading, the Gates MacGinitie Reading test, level Pre-Reading. The total score is based on four sections: Literacy Concepts, Oral Language Concepts, Letter-Sound Correspondences and Listening Comprehension, all of which are predicted to indicate later reading skills. Of particular interest is learners' performance on the Listening Comprehension section of the reading test. These percentages show that, on average, learners have difficulty with measures of reading skills, in particular with oral language concepts and listening comprehension.

6.2 The relationship between L1 and L2 syntax overall and reading

Next we report significant correlations between overall syntax scores and scores on the test of English reading. In general more significant correlations were found between the Spanish syntax scores and English reading than with the English syntax scores.

A correlation for the data revealed that overall Spanish syntax scores and scores on a test of English reading were significantly related, $r = +.63$, $n = 13$, $p < .05$.

A second correlation revealed that overall Spanish syntax scores and scores on the test of English listening comprehension were also significantly related, $r = +.87$, $n = 13$, $p < .000$.

Overall English syntax scores also correlated with the test of English listening comprehension, $r = +.70$, $n = 13$, $p < .01$. However, it is important to note that when we compare the two correlations, as we predicted, the correlation between Spanish syntax scores and English listening comprehension appears to be stronger than the relationship between English syntax and English listening comprehension.

Next we report significant correlations between the sub-tests of the syntax measure, coordination and subordination, and scores on English listening comprehension. As we reported above, more significant correlations were found between scores on the sub-tests of the Spanish syntax measure and English reading than with the scores on the English syntax measure and English reading.

When we looked at the coordination sub-test, a correlation for the data revealed that knowledge of coordination in Spanish and performance on English listening comprehension were significantly related, $r = +.62$, $n = 13$, $p < .05$.

When we looked at the subordination sub-test, significant correlations were found between both English and Spanish subordination and English listening comprehension as depicted below in Figures 7 and 8. However, the correlation observed between Spanish subordination and English listening comprehension ($r = +.78$, $n = 13$, $p < .01$) was stronger than the correlation observed between English subordination and English listening comprehension ($r = +.57$, $n = 13$, $p < .05$).
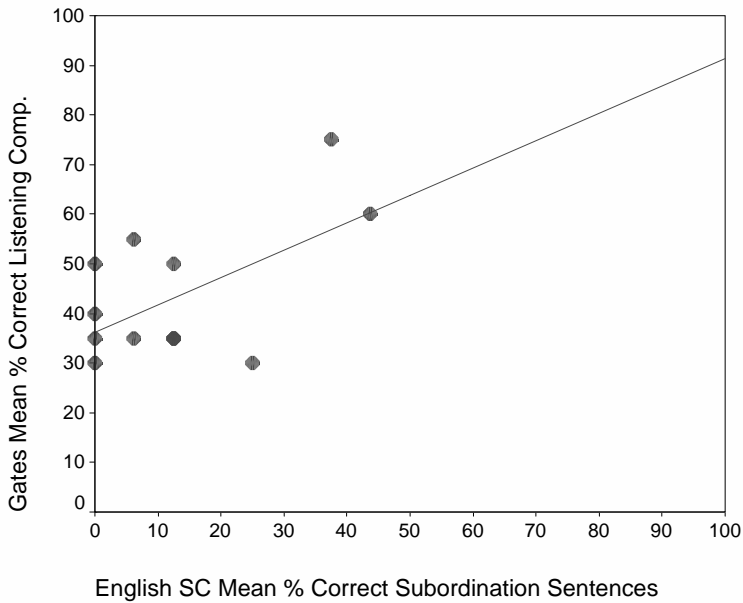
Figure 7. Correlation between English Subordination and English Listening Comprehension
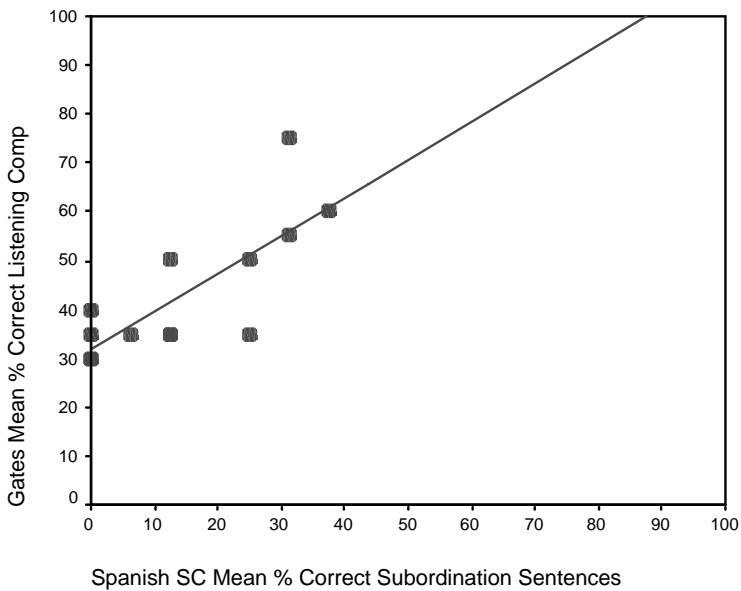

Figure 8. Correlation between Spanish Subordination and English Listening Comprehension

7. Discussion
7.1 Developmental results

In our investigation of syntactic development in bilingual children we first asked whether or not the same patterns observed in monolingual children can be discerned. With regard to coordination and subordination, we can conclude that the acquisition sequence is the same, since our participants

performed much better on coordination than they did on subordination. Furthermore, since this result was found for both the L1 (Spanish) and the L2 (English), we can conclude that at least for the sentence types we investigated, there is parallel development in the two languages of the bilingual child. One reason for the similarity between L1 and L2 may be that the structures tested (coordination, relative clauses and adverbial clauses) are nearly identical in Spanish and English. In future research, it would be interesting to study the development of L2 reading skills when the L1 and L2 are typologically very different (English and Japanese, for example). However, at this time, our concern for the academic challenges faced by the population we tested override concerns for investigating bilingual acquisition when the L1 and L2 are structurally dissimilar.

One result that pointed to a divergence from the monolingual pattern was our participants' superior performance on subject over sentence coordination. Recall that both Lust and Mervis (1980) and Ardery (1980) found sentences like *The dog kissed the horse and pushed the tiger* easier than a sentence like *The tiger and the turtle pushed the dog*. Our subjects, on the other hand, performed at much higher levels on subject than on sentence coordination (94% vs. 76% in their L1). This may in part be due to the fact that our subject coordination sentences contained intransitive verbs, rather than the transitive verbs used in both Lust and Mervis' and Ardery's studies, thus not allowing for a direct comparison between the monolinguals in their study and the bilinguals in ours. Note, however, that our participants found object coordination, which necessarily contains transitive verbs, significantly easier than sentence coordination, which contains intransitive verbs. This, together with the subject coordination result, suggests that for our bilinguals the facility lay not in the type of verb used (transitive vs. intransitive) but rather that the coordination of predicates (VP's) requires more processing and resources than coordinating NP's.

A striking difference between monolingual children and our bilingual participants is the latter's overall low performance on subordination. The age of the monolingual children tested on coordination and subordination ranged from about 3 to 5. The mean age of our participants was 5;9. On the OS relative clauses, for example, our participants performed at 18% in their L1 (Spanish), compared to 70% for Goodluck and Tavakolian's (1982) younger monolinguals. Clearly, our bilinguals lag behind the monolinguals tested in the studies we reported earlier.

Although this may be taken as support for the claim that growing up bilingual somehow retards cognitive development (see discussion in Hakuta 1986, Grosjean 1982), we believe it is instead a reflection of the socioeconomic status of our particular population. First, our participants come from inner-city schools where around 98% of the children are eligible for free lunch—an indication of their families' low income level. Second, our participants all come from immigrant families, where in general both parents work out of the house. Some of the parents of our participants did not go beyond an elementary school education themselves. It is fair to assume that the general living and working conditions of these families militate against providing their children with the optimal support for language or literacy skills. Such unfavourable conditions stand in stark contrast to those of the families of monolingual child populations typically used in L1 developmental studies who usually have mid to high income levels. From a questionnaire we administered to assess the level of literacy activities in the home we found that the literacy indices of our participants' families was fairly low. The questionnaire contained questions like Did you bring your child to the library to borrow books any time during the past two weeks?, Is there pencil and paper in your house so that the child can write?, and Do you read the newspaper (a lot, sometimes, little, almost never)? Possible scores ranged from 0 percent to 100 percent. Interviews were conducted with parents of 12 of the 13 participants discussed here, and the literacy score ranged from 33 percent to 60 percent with a mean of 44 percent.

7.2 Syntax and reading

The broad goal of our study was to discern the role that syntactic development, as opposed to phonological development or lexical acquisition, plays in the acquisition of pre-reading abilities in bilingual children. The results we presented point to a strong relationship between syntactic skills and listening comprehension in young English language learners; the relationship between knowledge of subordination and listening comprehension is particularly strong in both the L1 and L2.

On first glance, the correlation between our measure of syntactic knowledge and listening comprehension might seem self-evident; the act-out task is, after all, a test that requires listening

comprehension skills. However, further analyses have provided us with strong evidence that this correlation is clearly meaningful. First, all sub-sections of the Gates MacGinitie test are administered orally, thus all sections, not just the Listening Comprehension subtest, recruit learners' listening comprehension skills. In addition, all sub-sections make use of relative clauses, one of our target structures, in the instructions to the test-taker. For example, in the Oral Language Concepts sub-test, which targets phonological awareness, a typical question asks the child to "*Listen for the sound that begins with the same sound as dance*." Despite the fact that all four sub-tests require listening comprehension skills and comprehension of relative clauses, remarkably the only sub-tests which correlated significantly with our syntax measure was the test of Listening Comprehension and the test of Literacy Concepts. The Literacy Concepts subtest includes items that test children's knowledge of sequencing vocabulary. For example, children are instructed to "*Find the letter at the beginning of the word*." Knowledge of sequencing could clearly be connected to children's ability to process structures such as the temporal adverbial clauses that we tested in our test of subordination. There is a straightforward explanation for the significant correlation between the two measures.

Importantly, there was not a significant correlation between knowledge of coordination and subordination (in either the L1 or L2) and either the Oral Language Concepts subtest or the Letters and Letter-Sound Correspondences sub-test of the Gates. These results suggest that what is correlating in our results is *not* simply general listening skills, but rather knowledge of specific syntactic structures and listening comprehension. Contrary to what has been argued by supporters of the sound based Processing Deficit Hypothesis for example, our results strongly suggest that phonemic awareness and word level decoding may not be as strongly related to syntactic processing as is currently believed (cf. Crain and Shankweiler, 1986; Shankweiler and Crain, 1986, among others).

Additional analyses have suggested that it is not knowledge of syntax *in general* that is a good predictor of pre-reading skills, but particularly knowledge of complex sentence structures. As we mentioned earlier, participants were also tested on other measures of syntactic knowledge, specifically tense and aspect and referential awareness. While we do not have the space to discuss the results of these measures in detail, what is relevant to the present discussion is that these measures did not indicate as strong of relationship between knowledge of syntax and pre-reading skills. In particular, in the test of referential awareness, knowledge of reflexive pronouns and knowledge of personal pronouns did not correlate significantly with listening comprehension. We tested referential awareness using both picture-point and act-out tasks. These results provide further evidence that the relationship we report cannot be reduced to the relationship between general listening skills. Furthermore, the non-correlations with the test of referential awareness suggest that it is a certain type of syntactic knowledge that is important for listening comprehension, specifically it is the ability to process complex structures such as subordinate clauses, that might be directly relevant to the task.

Our results suggest that models of reading instruction which focus particularly on skills based acquisition may be particularly effective in the population we tested. Models of reading instruction which purposely avoid skills acquisition, and focus instead on whole pieces of literature and integrated language experiences (cf. the vast literature on the Whole Language approach) may not serve the best interests of the students. It has been argued in the educational literature that non-skills based approaches are not effective in bilingual students or students of low socioeconomic backgrounds (cf. Jeynes and Littell, 2000; de la Reyes, 1992). Our results provide further empirical support for their arguments.

While the general relationship between syntactic skills and reading ability has been previously documented for monolingual readers, our study is unique in that it examines this relationship in a group of bilingual readers and investigates the relative contribution of knowledge of the first and second language syntax to reading in the L2. Our main question was whether bilingual children with a strong knowledge base in their first language would acquire pre-reading skills with greater success than bilingual children whose knowledge of Spanish syntax was not as strong. Our results showed a surprising role for the L1 syntax with respect to L2 reading skills. The L1 syntax measure (Spanish) correlated with L2 (English) listening comprehension (r=.87, p=0.000), and the L2 syntax measure (English) also correlated with L2 (English) listening comprehension (r=.70, p=0.007). However, the r values shown above indicate that L1 (Spanish) syntax is the stronger contributor to L2 (English) listening comprehension.

A strong relationship was also observed between performance on sentences with subordinate clauses and listening comprehension. The L1 (Spanish) subordination scores correlated with L2 (English) listening comprehension (r=.78, p=0.002), and the L2 (English) subordination scores also correlated with L2 (English) listening comprehension (r=.57, p=0.038). However, the r values shown above indicate that L1 (Spanish) subordination is the stronger contributor to L2 (English) listening comprehension.

To further investigate the contribution made by the L1 syntax and the L2 syntax to L2 reading, we ran a step-wise regression. Spanish (L1) subordination (mean percent correct) and English (L2) subordination (mean percent correct) were the independent variables, and the dependent variable was mean percent correct on the listening comprehension section of the (English) Gates MacGinitie test. The two dependent variables accounted for 80 percent of the variance (R = .802) in the English listening comprehension scores. When the Spanish subordination score was entered as the first independent variable, adding the English subordination score explained an additional 3 percent of the variance (R Square = .609 with the Spanish subordination score only; R Square = .643 with the addition of the English subordination score).

When the English subordination score was entered as the first independent variable, adding the Spanish subordination score accounted for an additional 31 of the variance (R Square = .336 with the English subordination score only; R Square = .643 with the addition of the Spanish subordination score). Although the number of subjects is small (N=13), these regressions again point to the L1 as the stronger contributor of success in L2 reading.

Previous research has shown that language development suffers when the educational environment excludes the child's native language (or the language that is spoken at home). Skutnabb-Kangas and Toukomaa (1976) discuss the challenges in acquiring the L2 when development of the L1 is not strong. The threshold theory or threshold hypothesis (Toukomaa and Skutnabb-Kangas (1977), Cummins (1976, 1979) puts forth the idea that a minimal threshold in the L1 must first be attained if negative effects on cognitive development are to be avoided. Furthermore, the attainment of a second, higher threshold is expected to have positive effects on cognitive development. Hoffman (1991) notes that this model may lead to different results for different populations. If development of the L1 is below the lower threshold, instruction only in the L2 may be detrimental. However, if development of the L1 is already very strong, instruction in the L2 may not have detrimental effects.

Although we did not set out to test the ideas underlying the Threshold Hypothesis, the results obtained in this investigation do point to a need for L1 support in the L2 classroom. While we found that for our bilinguals the L1 and L2 are developing according to the hierarchies described in research on monolinguals, their actual performance, even in the L1, was far below the performance of monolinguals at younger ages. It seems quite likely that our participants are in danger of not attaining the minimum level of proficiency in the L1 that is needed to avoid detrimental developmental effects when learning the L2. We therefore take our results to suggest that reinforcing syntactic knowledge of the L1 will have positive pedagogical effects on reading in the L2.

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