ELICITED PRODUCTION AND GRAMMATICALITY JUDGMENTS OF REGULAR AND IRREGULAR PAST TENSE USE IN BILINGUAL CHILDREN WITH SPECIFIC LANGUAGE IMPAIRMENT

By

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Abstract

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Advisor: Richard G. Schwartz

Little is known regarding the sequential acquisition of two languages. This study focuses on the extent to which theories of morphological representation and processing predict the outcome of second language acquisition in typically and atypically developing early sequential Spanish/English bilinguals. Given the hallmark deficits related to inflectional morphology among monolingual children with specific language impairment (SLI), inflectional morphology may distinguish bilingual children with SLI from bilingual children who are developing normally. Although production of the English past tense is problematic for monolingual children with SLI, less is known regarding bilingual children's production of these forms. This study examined English past tense morphology in early sequential bilingual Spanish/English speaking children, aged 7;0- 9;0. Fourteen bilingual children with SLI and 17 typically developing bilingual children (TD) participated. Thirty-six instances of the past tense including regular, irregular, and novel verbs were examined using an elicited production task. The extent to which models of past tense production, specifically, single mechanism connectionist accounts versus dual

mechanism, rule-based accounts apply to bilingual situations is addressed, with special attention given to the phenomenon of overregularization. The relationship between vocabulary scores and irregular past tense use was somewhat different than what researchers previously described. Children's performance on a grammaticality judgment task supported the relationship between children's productions and underlying grammatical knowledge for past tense use.

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ELICITED PRODUCTION AND GRAMMATICALITY JUDGMENTS OF REGULAR AND IRREGULAR PAST TENSE USE IN BILINGUAL CHILDREN WITH SPECIFIC LANGUAGE IMPAIRMENT

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Introduction

The English past tense has been widely studied because of its unique property of having both regular and irregular forms. Most verbs are regular and form the past by adding -ed, as in, "pull"–"pulled". Fewer verbs are of irregular status, and form the past with less predictability, as in, "eat"-"ate". Although native English-speaking children begin to use both forms at approximately 2 1/2 years of age, they are not fully mastered until school age, and occasional errors still appear in adult speech (Bybee & Slobin, 1982). The phenomenon of overregularization has proven to be especially useful for examining past tense morphology. Overregularization refers to the application of the regular grammatical morpheme to an irregular verb stem (e.g., the addition of -ed to "catch" to form "catched"). Because of the differing demands regarding lexical memory and rule learning, the study of overregularization has given rise to competing hypotheses regarding acquisition and use of the past tense. According to the dual mechanism hypothesis (Prasada & Pinker, 1993; Marcus, Pinker, Ullman, Hollander, Rosen & Xu, 1992) irregular past tense forms are stored in the lexicon and accessed, but regular past tense forms are created by applying the "add -ed" rule. Conversely, a single mechanism hypothesis (Plunkett & Marchman, 1991, 1993; Elman, Bates, Karmiloff-Smith, Johnson, Parisi, & Plunkett, 1996) claims no real difference between the learning and use of regular and irregular forms, attributing all errors to the phonological characteristics of the verbs and their relative frequency. These models provide a useful framework for examining the patterns of overregularization in typically developing children and children with SLI (Marchman, Wulfeck, & Ellis Weismer, 1999; Ullman & Gopnik, 1999; Oetting &

Horohov, 1997). However, the literature on overregularization among atypically developing bilingual children remains scarce.

Characteristically, children from bilingual backgrounds are excluded from studies of morphological acquisition. Although the preference for monolingual English-speaking children was intended to prevent the contaminating influence of other languages, little attention has been given to the specific morphological abilities of early sequential bilingual children learning English. Consequently, little is known regarding the nature of second language acquisition and specific language impairment in bilingual children. Degrees of bilingualism exist along a continuum, with abilities ranging from incipient to proficient users of a language (Diebold, 1964). For research purposes, closer attention is needed with respect to the particular bilingual environment of subjects, the age of initial exposure, the length of exposure, and extent of daily language use.

The participants in the present study are similar to other early sequential bilinguals growing up in the United States (Kohnert, Bates, & Hernandez, 1999). Exposure to the second language occurs early on, and a gradual shift in dominance from the first to second language commences approximately between 4 and 8 years of age. In actuality, the preference for speaking English over Spanish occurs quite rapidly once children enter school, irrespective of enrollment in bilingual or monolingual classes (Zentella, 1997). Furthermore, because these children often begin to use English before entering kindergarten, and prior to gaining reading knowledge, their language is initially acquired via more natural and experiential rather than formal teaching methods. The question remains as to whether early

sequential bilinguals will exhibit patterns of overregularization similar to those of first language speakers, or whether the patterns vary as a result of their bilingualism. Overregularization may be even more common in bilingual or bi-dialectal situations where speakers are dealing with two language systems. The regularization of irregular verbs has been reported in sequentially developing Spanish-English bilinguals (Anderson,1998), and among second language speakers of English (Wang, 1997). By examining the phenomenon of overregularization in early sequential bilinguals, we uncovered patterns specific to typically developing children and identified characteristics specific to children with SLI. The resulting information contributes to our discussions of the theoretical accounts of SLI. The literature review begins with a discussion of the current psycholinguistic models of past tense morphology, followed by a review of specific language impairment (SLI), and the special problems unique to bilingual situations. Finally, the research questions and predictions are presented.

Literature Review

Overregularization

Overregularization in monolingual children

One of the most noted phenomena of typical acquisition is overregularization. Overregularization occurs when, after attaining correct production of some irregular forms, children incorrectly apply the regular form/rule to the irregular form. Overregularization occurs naturally across languages early in development, subsides in school-aged populations, but continues to a lesser degree throughout adulthood (Bybee & Slobin, 1982). Examples of children's overregularized forms appear in the diary studies of children learning all languages. Application of the -ed past tense form to the irregular verb "go" to form "goed" constitutes a typical overregularization in English (Brown, 1973). Though less frequent, irregularizations constitute a similar error type. This occurs when a regular verb is produced in the past using an irregular pattern (e.g., sneak-snuck).

Grammaticality judgment tasks offer another way of gaining information regarding children's knowledge that supports the productions of these forms (McDaniel, McKee, & Cairns, 1996). Developmental trends in the acceptability of overregularization errors have been documented in children between the ages of 3 – 9 years (Kuczaj, 1978), whereby children's acceptance and productions of overregularizations decreased with age. Preschool children accepted and produced overregularization errors approximately 50% of the time; yet, school-age children, 7 – 9 years, accepted overregularization errors only 25% of the time, and rarely produced them. Similar developmental trends in the acceptance of

overregularizations were documented in children with SLI (Rice, Wexler, & Redmond, 1999). The representation, processing, and overregularization of past tense forms are explained by various psycholinguistic models.

Models of overregularization

Two competing models explain children's overregularization errors. According to the dual mechanism model (Pinker & Prasada, 1993; Marcus, et al., 1992) irregular past tense forms are stored and accessed from the lexicon, but regular past tense forms are created online via an active suffixation process. A Blocking Principal inhibits application of the suffixation process when retrieval of an irregular past tense form is required. Consequently, retrieval failure results in overregularization. A modification to the dual mechanism account concedes that frequency and phonological characteristics of the stem in relation to other words in the lexicon predict the use of irregular past tense forms by facilitating retrieval of phonologically similar forms, but regular past tense forms are not susceptible to the same influences (Pinker, 1999). Irregular forms are believed to be learned by associations in rote-memory, and are protected from overregularization by similarly sounding irregular forms (e.g., grow-grew, blow-blew, fly-flew, draw-drew). Conversely, a single mechanism hypotheses (Plunkett & Marchman, 1991, 1993; Elman, et al., 1996) claims no real difference between the learning and use of regular and irregular forms, attributing all errors to the distributed properties of the verb stems and their past tense forms.

The Connectionist Model

In connectionist accounts (Rumelhart-McClellan, 1986; Elman, et al., 1996), a single mechanism is responsible for storing both regular and irregular verbs in an associative memory network. Overregularization is attributed to an increase in the number of regular verbs learned during a period of vocabulary explosion. Novel past tense forms can be predicted from verb stems according to neighborhood effects. Neighborhood effects (Marchman, 1997) refer to the phonological characteristics of the verb stems and their past tense forms. Neighborhoods are composed of friends and enemies. Verbs that share a similar stem final vowel, consonant cluster, or rhyme reside in the same neighborhood (e.g., "drink", "blink", "wink", or "think"). Friends refer to those verbs sharing similar stem and past tense changes (e.g., drink-drank, sink-sank). These similarities facilitate correct production of similar irregular past tense forms, and may also result in occasional phonologically induced errors (e.g., wink-wank). Enemies within neighborhoods are irregular verbs that have similar sounding stems, but differing past tense forms (e.g., hit-hit, sit-sat). Dual mechanism models predict that overregularization occurs independent of neighborhood friends. Conversely, a single mechanism model predicts that both regular and irregular verbs are sensitive to the effects of neighborhood friends and enemies. Thus, the high number of regular verbs with similar "ed" endings facilitates correct production of past tense regulars, just as the tendency to leave verbs ending in alveolar consonants unmarked results in the use of bare stems (e.g., eat - eat).

Proponents of a single mechanism model (e.g., Marchman, 1997) claim that the ability to accurately produce regular past tense is based upon the high numbers of similar sounding stem and inflection pairs, just as irregular past tense forms with many stem-past resemblances (e.g., sing-sang, ring-rang) occasionally result in irregularization errors (e.g., bring-brang). The substitution of bare stems ending in alveolar consonants (e.g., "eat" for "ate") are interpreted as further evidence of irregularization, given that the syllable "eat" terminates in an alveolar sound shared by many other past tense forms (Marchman, Wulfeck, & Ellis Weismer, 1999). However, the case for a single mechanism is comparatively weak. Historically, relatively few regular verbs have become acceptable irregular alternatives (e.g., sneaked-snuck), in contrast to the large list of irregulars that have become regularized over time (e.g., dreamt-dreamed) (Pinker, 1999).

The Network Model

Though similar to connectionist accounts, the network model presents an alternative that focuses on the past tense forms of regular and irregular verbs, separate from the verb stems. In an earlier analysis, Bybee & Slobin (1982) separated irregular verbs into eight Verb Classes according to the changing patterns between the verb stems and their past tense forms and found differing rates of overregularization for verb type across three distinct age groups - preschoolers, third graders and adults. The verb classes were as follows:

> "I. Verbs that do not change at all to form the past tense, e.g. *beat, cut, hit.*
> II. Verbs that change a final *d* to *t* to form the past tense, e.g. *send sent, build built.*
> III. Verbs that undergo an internal vowel change, and also add a final *t* or *d*, e.g. *feel felt, lose lost, say said, tell told.*

> IV. Verbs that undergo vowel change, delete a final consonant, and add a final *t*, e.g. *bring/brought, catch/caught.*
> V. Verbs that undergo an internal vowel change and whose stems end in a dental, e.g. *bite/bit, find/found, ride/rode*
> VI. Verbs that undergo a vowel change of /I/ to /ae/ or to /^/, e.g. *sing/sang, sting/stung.*
> VII. All other verbs that undergo an internal vowel change, e.g. *give/gave, break/broke.*
> VIII. All verbs that undergo a vowel change and that end in a diphthongal sequence, e.g., *blow/blew, fly/flew.*" (Bybee & Slobin, 1982, p.268-269)

Frequency of use was an important predictor of regularization across all age groups, but other factors were also in operation. In particular, phonological distance, that is to say, the type and number of phonological features shared by a stem and past tense form, also influenced the rate of regularization, especially for preschoolers. Thus, verbs whose stems and past tense forms differed most in terms of phonological features (e.g., "teach-taught") were more likely to be overregularized.

The percentage of regularization decreased with age. However, the preschoolers did not differ from other groups in their regularization rate for verbs (Class 1) that end in /t/ or /d/, and do not undergo any change in the past tense (e.g., hit – hit, cut - cut). Thus, stems ending in /t/ or /d/ were treated as though they did not require further inflection. Berko (1958) found similar results for plural formation with nonce nouns ending in sibilants. Berko attributed this pattern to the children's failure to acquire a specific allomorph. In contrast, Bybee and Slobin (1982) suggested that this pattern resulted from the phonological similarity between the stem ending and the morphological ending for other past tense forms.

Bybee claimed that that past tense formation relied on "schemas", rather than on symbolic rules. Schemas were analogies based on information taken from family resemblances that were based on shared phonological properties. This information

accounts for non-standard uses, such as "bring-brang", and the construction of novel forms, such as "sneak-snuck". Proponents of symbolic rule-governed dual account acknowledge that such processes may account for irregular, but not regular forms (Marcus et al., 1992; Pinker, 1999). Still, Bybee (1985, 1988) insisted that schemas exist as part of a network in the formation of both regular as well as irregular forms. In this way, the network account resembles connectionist models; however, an important distinction is maintained. Although connectionist models derive a past tense form from a base, the network model proposes that the past tense forms for regular and irregular verbs are organized and stored separately from the verb stems. In the network model, lexical schemas are the associations that emerge from phonologically related words in lexical representation (Bybee, 1995). The model differs from rule-based accounts in its reliance on type and token frequency data. Lexical strength refers to the relative ease of a verb's access from the lexicon, and is determined by token frequency. Type frequency also influences production and is determined by the type and number of phonological and semantic features shared by past tense forms. Lexical strength prevents most irregular verbs from becoming regularized. The network model diverges from rule-based and connectionist accounts in that it is a "product oriented" as opposed to "source oriented" accounts. Source oriented schemas correspond to generative rules because they focus on deriving a past tense from a base form, such as wait-waited. In contrast, product oriented schemas focus on generalizations from sets of family resemblances among the derived forms (Bybee, 1995). Unique to Bybee's proposal is the notion that high frequency regulars are stored in the lexicon, and that low frequency regulars are

produced by the most common default schema, "add -ed". The connectionist and network models highlight the importance of phonological information for the storage and retrieval of past tense forms. However, both are limited in their ability to account for selective impairment of regular and irregular forms in disordered populations.

The Dual Mechanism Model

The dual mechanism model maintains that differing mental processes support regular and irregular past tense forms (Pinker, 1994). Regular past tense forms are produced by a symbol-processing rule that does not rely on memory; irregular forms are stored and accessed from memory. The rule serves as a default mechanism, taking over when memory and analogy for irregular forms fail, resulting in overregularization (Pinker, 1999). In contrast to single mechanism models, this rule-based mechanism represents innate symbolic computation ability (Marcus, Vijayan, Rao, & Vishton, 1999).

From the diary studies of Adam, Eve, Sarah, and Abe (Brown, 1973), Marcus et al. (1992) concluded that children use correct irregulars prior to regulars because they haven't yet acquired the production rule. From the beginning, both regular and irregular forms are learned by rote and stored as lexical items until the rule for past tense or plurals is deployed. Although it is not entirely clear how children move from a lexical strategy to a rule based strategy, it is crucial to note that there is no change in the input and children's productive vocabularies when the rule is deployed. The onset of overregularization occurs shortly after regular markings are

noted, when the child's productive vocabulary reaches the level of approximately 100 verbs (Marcus, et al., 1992).

Although frequency largely determines how readily an irregular form is accessed, it is not the only factor that influences lexical retrieval. Irregular verbs appear to be learned and stored in a memory system according to patterns of mapping between stems and past tense forms. Words that are phonologically similar sharing several phonetic features (e.g., sing-sang, swim-swam) are stored in an associative network that protects them from overregularization (Marcus et al., 1992). Regulars do not tend to be irregularized by phonologically similarly sounding irregulars (e.g., snow-snew; glow-glew). In analyzing the data of the diary studies, Marcus and his colleagues concluded that while the rates of overregularization varied across children, the rates, in general, remained relatively low. A Blocking Principle is purported to suppress the suffixation process, and is active as soon as the child realizes that there are two possibilities for forming past tense (Marcus, et al., 1992).

The Competition Model

Without disputing the existence of symbolic rules (i.e., dual mechanism), the Competition Model (Maratsos, 2000) challenges the existence of a Blocking Principle, in its place suggesting that both forms exist simultaneously until the child receives sufficient exposures to the irregular forms. This proposal was motivated by higher rates of overregularization than those reported in the previous analysis of the children studied by Roger Brown (Marcus et al., 1992). Maratsos claimed that the high proportion of high-frequency irregulars in the samples total drove down the

estimates of overregularization rates, given that highly frequent irregulars have lower overregularization rates overall. The previous analyses did not account for the frequency of exposure to certain verb forms in relation to the frequency of the child's productions. Instead of simply counting the total numbers of irregular verbs produced, Brown's data were re-analyzed using an adjustment for the number of inputs to the child and the child's output data for specific verbs. Inputs referred to the number of instances that a verb form appeared in the child's environment; outputs referred to the number of times that the child actually produced the form. The blocking-retrieval hypothesis predicts that once the irregular past tense form is learned, the rate of overregularization will return to zero for that verb. In contrast, the competition model maintains that both forms will exist in the child's productive data for an extended learning period. The number of inputs to the child and outputs by the child, in combination with potentially individual learning styles will predict when overregularization rates for particular verbs will subside. To illustrate, Maratsos used Abe's data for the past tense of "eat" ("ate"), which was first produced at 2;5. Several months followed and 700 input/output productions took place before overregularization of "ate" dropped to the near zero- rate. The competition model is neutral with respect to the dual and single-mechanism accounts, but does weaken the blocking-retrieval component of the former (Maratsos, 2000).

Models of overregularization in normal development are interesting in that they allow us to glimpse the potential influence of differing processes supporting phonology, morphology, and semantic acquisition. By extending these models to

language-impaired populations, the selective impairment of the linguistic processes supporting language use may be revealed. The added demands on typically developing bilingual speakers in terms of memory, frequency, and recency effects provide added dimensions to explore. The competition model (Maratsos, 2000) in particular, is important for the study of overregularization in bilingual situations because individuals who spend substantial amounts of time using two languages (e.g., children who hear English at school and Spanish at home), may show higher rates of overregularization and may entertain both forms for an extended period, given the potential for fewer inputs and opportunities for production of less frequently used irregular forms.

Factors that motivate overregularization

In English, low frequency irregular verbs (e.g., "shend-shent") are more likely to be overregularized, as are verbs whose stems end in vowels and liquids (e.g., "throw-throwed"). Other contributing factors include vowel dominance, semantic features, and grammatical status. Vowel dominance refers to those irregulars that undergo a vowel change from present to past tense, when the past tense form has a vowel that differs in perceptual salience from the vowel in the verb stem (e.g., bite-bit, get-got). When the vowel in the verb stem (e.g., "bite") was more perceptually salient, relative to the vowel of the past tense form (e.g., "bit"), the likelihood of overregularization was increased; whereas, the opposite held true for verbs having a dominant vowel in the past tense form (e.g., get – got) (Stemberger, 1993). The semantic status of a verb also influences whether or not it will be regularized. If the child already possesses a meaning for the irregular form (e.g., see/saw), it will be

regularized to avoid creating a homophone. This is termed "ambiguity reduction" (Shirai, 1997). Another motivating factor is grammatical status; verbs derived from nouns (e.g., "flied out" in baseball, and "ringed" the planet) are more prone to overregularization (Kim, Pinker, Prince, & Prasada, 1991). Moreover, studies of typically developing children (Kim, Marcus, Pinker, Hollander, & Coppola, 1994) and children with SLI (Oetting & Horohov, 1997) demonstrate that both groups respect grammatical status in forming the past tense when deriving past tense forms from nouns.

Two competing accounts predominate in discussions of overregularization. According to single mechanism accounts, overregularization occurs as a result of being bombarded with large number of regular verbs with past tense -ed endings. Conversely, dual mechanism accounts maintain that overregularization occurs when the child has learned "the add -ed rule" for marking past tense. The application of a rule process is seen as a measure of a child's productivity (Marcus, et al., 1992).

Jean Berko's (1958) early experiments with children and adults using the legendary Wug Test sparked an ongoing series of language experiments to address morphological productivity and overregularization. Importantly, overregularizations that failed to appear in spontaneous production could be obtained through the use of specific elicitation procedures. The use of nonce-forms to examine children's productivity in the application of a morphological rule has been especially telling, with children outperforming adults in some cases (Schnitzer, 1996). Yet this seemingly natural and effortless application of a morphological rule is at the very core of problems for children with SLI.

The Nature of Specific Language Impairment

The classification of SLI is based on exclusionary criteria. Children exhibiting significant limitations in language ability in the absence of mental retardation, hearing impairment, or frank neurological deficit fit this classification. Profiles of language limitation vary with the potential for co-existing or mixed semantic, morpho-syntactic and phonological deficits (Leonard, 1998; Watkins & Rice, 1994). However, all exhibit reduced performance on measures of expressive syntax and morphology (Leonard, 1998).

English-speaking *children with specific language impairment*

One reportedly consistent characteristic of SLI is a deficit in the production of inflectional morphology and function words (Leonard, 1998). However, there are conflicting findings regarding the integrity of certain inflectional markers in these children, with apparently greater difficulty for verb morphology. Children with SLI exhibit fewer verb types overall in their productive vocabularies (Conti-Ramsden & Jones, 1997; Fletcher & Peters, 1984), and may exhibit more restricted use of verb relational meanings in early word combinations (Leonard, Steckol & Schwartz, 1978). Verb acquisition is more difficult than noun acquisition at the single word stage (Schwartz & Leonard, 1984), and children with SLI show reduced performance in extending the forms in productive tasks (Camarata & Leonard, 1886; Camarata & Schwartz, 1985; Leonard, Schwartz, Chapman, Rowen, Prelock, Terrell, Weiss, & Messick, 1982; Leonard, Schwartz, Swanson, & Loeb, 1987; Schwartz, 1988; Schwartz, Leonard, Messick, & Chapman, 1987). They lag behind peers in the length and grammatical complexity of early word combinations, and

require higher MLU levels than peers before certain morphemes reach levels of mastery (Johnston & Schery, 1976; Kahn & James, 1986). Paradoxically, the special problems encountered with verb phrase morphology are not found to the same extent with noun phrase morphemes. Although children with SLI may lag in the use of noun morphemes (e.g., plural markers), they do not generally exhibit the same degree of difficulty on the use of these morphemes when compared to MLU matched controls (Oetting and Rice, 1993). Conversely, children with SLI perform differently from MLU matched controls on a variety of verbal morphemes, including the use of auxiliary verbs, copula, third person singular /s/, and the past tense -ed (Leonard, Eyer, Bedore & Grela, 1997; Oetting & Rice, 1993).

Production of affected morphemes is variable, so that individuals with SLI use them in some, but not all obligatory instances. The exceptional challenge posed by the acquisition of verb morphology motivates current theoretical accounts of SLI, while simultaneously addressing the issue of variability. According to the Extended Optional Infinitive.(EOI) account (Rice & Wexler, 1996; Rice, Wexler, & Cleave, 1995), individuals with SLI continue to use bare stems because they remain in a protracted stage of earlier development when tense marking is presumed to be optional. Alternatively, a Limited Processing Capacity account (Ellis Weismer, 1996; Leonard, 1998) attributes the deficits to generalized limitations at various levels of processing including short term memory deficits (Ellis Weismer & Thordardottir, 1998), and, slowed rates of access and retrieval (Leonard, 1998) culminating in an impaired construction (Miller, & Leonard, 1998) of the verb paradigms that support mental representations (Pinker, 1994). The EOI account is

appealing because it targets verb morphology, and selects tense marking as the specific deficit. However, it does not account for all the problems encountered by children with SLI. Conversely, the LPC account encompasses all possible areas of breakdown for children with SLI, but alternatively suffers from a lack of specificity.

Specific language impairment in other languages

Studies of SLI in children acquiring languages other than English have expanded our understanding of SLI (Hansson, Nettelbladt, & Leonard, 2000; Jakobuwicz, Nash, Rigaut, & Gerard, 1998; see Leonard, 1998 for a review). Although morphological deficits are universal across languages, the specific morphemes that are affected vary according to language structure. Thus, children learning romance languages, such as Spanish, French, and Italian, typically experience difficulty with clitic pronouns, and relatively little difficulty with the past tense inflection compared to children learning English (Jakobuwicz, et al., 1998; Leonard, Sabbadini, Leonard, & Volterra, 1987; Bosch & Serra, 1997). The realization of these morphemes in unstressed syllables of relatively shorter duration, together with the memory requirements for anaphoric reference lend support to a Limited Processing Capacity account to explain the omission of clitic pronouns in SLI (Leonard & Bortolini, 1998). Varying language structure also influences the extent of non-finite use by children with SLI across languages. Although children with SLI acquiring languages such as Italian (Bortolini, Caselli, & Leonard, 1997), German (Rice, Noll, & Grimm, 1997), Swedish (Hansson, Nettelbladt, & Leonard, 2000) and French (Paradis & Crago, 2000) also produce more non-finite forms in contexts of obligatory finiteness, this is not the dominant pattern of error and the particular

structure of the language being acquired influences both the age when typically developing children move out of the "optional infinitive stage", and the extent to which children with SLI continue to employ these forms (Paradis & Crago, 2000).

Specific language impairment in children acquiring two languages

The literature on SLI in children acquiring two languages is limited because these children are often excluded from research projects for those same reasons that bilingual children are excluded from studies of typical acquisition. The following study, though not specific to children with SLI acquiring two languages, warrants mentioning because it compares the morphological profiles of early sequential bilinguals to native speakers with SLI. In an attempt to separate groups of children with SLI from typically developing second language (L2) learners, Paradis and Crago (2000) examined SLI in children simultaneously exposed to two languages. Seven-year-old French-speaking children with SLI were compared to typically developing English-speaking children learning French as a second language to examine cross-learner similarities and differences. Although both groups used higher proportions of infinitive forms in obligatory contexts during spontaneous production, in comparison to French-speaking controls, the pattern of errors with past tense and future tense differed between the groups. Both groups substituted present and non-finite forms in obligatory past and future contexts, but L2 learners were more likely to substitute present tense, rather than non-finite forms for the past and future tenses. Conversely, children with SLI were more likely to substitute non-finite forms, though the rate of non-finite substitutions by French-speakers with SLI was disproportionately lower than that reported for English-speaking children with

SLI (Paradis & Crago, 2000). An extension of this line of research would be to examine the patterns of L2 learners with and without SLI.

The situation of children acquiring two languages offers another venue for exploring morphological deficits in SLI, yet we know little about this topic. Given the cross-language nuances that vary by language for monolingual children with SLI, questions arise as to how knowledge of a first language's structure influences learning of the second, and how children with SLI might differ from their typically developing peers. Evidence that differences do exist between monolingual and bilingual speakers comes from the literature for Spanish-speakers with SLI.

The problems reported for Spanish-speaking children in the United States are not fully consistent with those reported for Spanish-speakers from monolingual environments. For example, the morphological problems of Spanish-speaking children with SLI in Spain include omission of direct object clitic pronouns and difficulty with third person plural verb inflections. However, little difficulty with number and gender agreement for direct object clitic pronouns was noted when compared to a small group of MLU controls (Bosch & Serra, 1997). Consistent with what was reported for Spanish-speakers in Spain, preschool children in the United States with SLI omitted direct object clitic pronouns significantly more often than MLU-matched peers (Bedore & Leonard, 2001). Conversely, Spanish-speakers in the United States exhibited problems with noun plural inflections (Bedore & Leonard, 2001; Merino,1983), adjective agreement errors (Leonard & Bedore, 2001) and more frequent article omissions and gender agreement errors than age-matched controls (Restrepo & Gutierrez-Clellen, 2001; Restrepo, Chasteen, Bustelo,

& Matute, 1996). Although these children did not exhibit deficits in tense marking or substitute infinitive forms in obligatory finite contexts, the younger preschool children with SLI studied by Bedore and Leonard (2001) produced errors involving tense and plural errors on verbs, and occasionally substituted infinitive forms in finite contexts. One possible reason for this discrepancy lies in the differing ages of the children sampled. Although monolingual Spanish-speakers acquire and master gender agreement on nouns before age three (Perez-Pereira, 1991), typically developing Spanish-speakers in the United States continue to show gender marking errors in the early school years (Restrepo & Gutierrez-Clellen, 2001; Restrepo, et al., 1996). Although Spanish-speaking children with SLI in Spain did not exhibit errors involving number and gender agreement (Bosch & Serra, 1997), children in the United States produced more of these error types (Restrepo & Gutierrez-Clellen, 2001). The irregularities in reports of typical and atypical morphological acquisition between Spanish-speaking children in monolingual and bilingual contexts reflect the gaps in our knowledge of bilingualism. The morphological deficits in children with SLI acquiring two languages may extend beyond those problems reported for monolingual speakers because of the added challenge of learning a second language. If the patterns of morphological deficit vary between monolingual and bilingual children with SLI when speaking Spanish, then we would also expect to see differences in the patterns exhibited by monolingual and bilingual speakers with SLI learning English. Examining the use of English past tense morphology may reveal such differences.

The English Past Tense

Development and use of the English past tense by native speakers

Use of the past tense by English speakers emerges during Brown's Stage III of development at approximately 2 – 2 ½ years of age. Highly frequent irregular forms, such as, "broke", appear first in English-speaking children's vocabularies; regular past tense forms emerge at around 2 ½ years (Brown, 1973). Overregularizations appear when children have approximately 100 verbs in their spoken vocabularies (Marcus, et al., 1992), and there is some individual variation among children regarding the Stage of language development when this occurs. Prior to using the past tense, English-speaking children often rely on bare stems, such as, "mommy go work" for "mommy went to work". Use of lexically marked bare stems constitutes another phenomenon in children's early language use (e.g., "mommy just go"), before the past tense marker is consistently applied. Although appearance of the past tense emerges early on in development, mastery of these forms does not occur until much later. Phonological constraints and semantic aspects of the verbs are operative throughout development, and contribute to the likelihood of using a past tense form accurately. Highly frequent irregular past tense forms are among the first past tense forms used in children's early vocabularies (e.g., "broke"), but accuracy for less frequently used verbs (e.g., "lend-lent") is dependent upon age and educational experience (Shipley, Maddox, & Driver, 1991). Phonological factors also influence past tense formation in such a way that verb stems ending in vowels or liquids are among the first to be marked for regular past tense (e.g., tie-tied). Semantic factors, such as "telicity," referring to an obvious change in state as a result of the action

having been completed, (e.g., "broke") also contribute to early appearance in the past (Johnson & Fey, 2000; Smith, 1991).

Much of what is known regarding children's knowledge of the past tense is based on production data. Fewer studies of comprehension exist. One method that has traditionally been employed to obtain insight into children's underlying grammatical knowledge consists of grammaticality judgments (McDaniel, McKee, & Cairns, 1996). Developmental trends in children's acceptability ratings appear to parallel productions. In a longitudinal study of grammaticality judgments spanning a two-year period, children's acceptability ratings for accurate, bare stem, and overregularized past tense forms were correlated with the child's MLU (Rice, Wexler, & Redmond, 1999).

Past tense production in children with SLI

English-speaking children with SLI exhibit exceptional difficulty in forming the English past tense. Comparisons of regular and irregular past tense production in children with SLI yield varying results. Several studies comparing children with SLI to controls matched by mean length of utterance (MLU) have found differences in the use of regular, but not irregular, past tense forms (Leonard, Bortolini, Caselli, McGregor, & Sabbadini, 1992; Leonard, et al., 1997; Oetting & Horohov, 1997). These regular and irregular performance differences lend support to dual mechanism models (Oetting & Horohov, 1997). However, not all studies reveal differential treatment of regular and irregular forms (Marchman, Wulfeck, & Ellis-Weismer, 1999). Because typically developing children and children with SLI produced similar error types on regular and irregular verbs, these authors concluded that their

results supported a single mechanism account. Moreover, the problems with tense marking extended to irregular verbs in children with SLI (Redmond, 1997).

Similar to what has been observed in normal development, substitutions of bare stems, for example, "drop" for "dropped" or "eat" for "ate", are the most common error type for children with SLI in English. The proportion of bare stem use is higher among the affected group when matched to MLU controls. Frequent bare stem errors for irregular and regular forms lead some to conclude that these findings support a deficit in tense marking (Rice, Wexler, Marquis, & Herschberger, 2000). From another perspective, problems related to learning, storage, and retrieval of past tense forms might also explain these findings. Actually, the EOI and LPC accounts of SLI are not incompatible when it comes to describing the data. Differences emerge in the interpretation of the bare stem phenomena, with each pointing toward a separate source of the problem. According to the EOI account, children with SLI have a generalized deficit in tense marking, (i.e., tense marking is optional), and this would explain bare stem substitutions for both regular and irregular forms. However, a limited processing account (Miller & Leonard, 1998) maintains that both errors may result from any of several processes. Deficient lexical storage or access from the lexicon, or faulty construction of verbal paradigms might ultimately result in bare stem substitution. A dual mechanism model assumes that these errors result from different underlying processes. The use of "drop" results from failure to apply a morphological rule, and "eat" results from impaired retrieval of the irregular form. Single mechanism models attribute "eat" to the phonological relationship it has with other past tense forms, such as, "beat" (Marchman, Wulfeck, & Ellis-

Weismer, 1999). The single mechanism model also predicts that frequency plays a role in the substitution of bare stems because these forms of the verb occur more often in the input and are hence more readily available for retrieval.

Similar to typically developing children, children with SLI are sensitive to the phonological composition and grammatical status of verbs in past tense marking. Children from these two groups produced the -ed inflection more readily when the stem ended in a vowel or liquid, and were more likely to use the regular -ed inflection with verbs derived from nouns (Oetting & Horohov, 1997). Verb stems ending in alveolar consonants were left unchanged similar to the children in the youngest groups studied by other investigators (Bybee & Slobin, 1982; Berko, 1958). Children with SLI may continue to rely on these phonological schemas beyond the point at which their same-aged peers have moved on to more productively applying the regular rule. Evidence of this appears in the data presented by Marchman, Wulfeck, & Ellis Weismer (1999) who report a large number of unmarked bare stems ending in alveolar consonants produced by children in the SLI group in obligatory past tense contexts.

Overregularization and productivity in children with SLI

Studies regarding the degree of productivity and extent of overregularization among children with SLI have yielded varying results. Despite lower rates of regular past tense use by children with SLI compared to MLU controls, there is evidence of productivity as indicated by reports of overregularization errors (Eyer & Leonard, 1995; Leonard, et al, 1992; Leonard, et al., 1997; Oetting & Horohov, 1997; and, Smith-Lock, 1995). However, children with SLI produced lower rates of

overregularizaton when compared to age controls. Some studies have reported exceptionally low rates of overregularization (Rice, Wexler, & Cleave, 1995), but others (Marchman, Wulfeck, Ellis Weismer, 1999) reported overregularizations to be a fairly common error type, though lower than the rates produced by age controls. Children with SLI appear to be sensitive to those same factors that contribute toward overregularization of past tense forms in English including a verb's frequency, phonology, and grammatical status (Oetting & Horohov, 1997; Marchman, Wulfeck, Ellis-Weismer, 1999). However, the degree of morphological productivity may prove to be the factor that partitions out children with SLI from normally developing controls.

The use of novel forms has been especially useful for examining children's productivity. Several studies demonstrate that children with SLI are capable of applying the past tense -ed inflection to novel verb forms (Bellair, Plante & Swisher, 1994; Oetting & Horohov, 1997; Smith-Lock, 1995), thus supplying evidence of productivity. However, the degree of productivity may distinguish typical and atypical language users.

The use of novel forms to measure productivity in bilingual children with SLI yield conflicting results. By teaching an invented morpheme, several studies have confirmed the existence of a specific linguistic rule-learning deficit experienced by children with SLI (Connell & Stone, 1992; Connell & Stone, 1994). Extending this line of research to bilingual Spanish-English speakers, use of an invented language rule successfully differentiated incipient bilingual Spanish-speaking children with SLI from typically developing peers (Roseberry & Connell, 1991). However, the

teaching of a novel morpheme with another group of incipient bilinguals failed to confirm the earlier findings (Restrepo, 1998). One possible explanation for the children's lack of exceptional difficulty may have been the selection of a morpheme that was semantically concrete and phonologically invariable.

Other studies using non-word stimuli have successfully partitioned out children with SLI across differing cultural-linguistic groups yielding support to language processing difficulties unrelated to tense marking (Campbell, Dollaghan, Needleman, & Janosky, 1997). Using a non-word repetition task, Dollaghan & Campbell (1998) found that second grade children receiving language intervention were significantly less accurate than their typically developing peers in the percent of phonemes repeated correctly. These findings were replicated in a recent study of second graders with SLI, and those with more broadly defined language impairment characterized by concomitant cognitive and linguistic delays (Ellis Weismer, Tomblin, Zhang, Buckwalter, Chynoweth, & Jones, 2000). The inaccuracies of non-word repetitions by children with SLI have led to suggestions of problems in the phonological processes related to forming and holding the phonological representations in working memory (Edwards & Lahey, 1998). Because novel non-word stimuli are not dependent on previous language experiences, their use holds promise as a non-biased measure for tapping into language processes across differing cultural groups (Campbell, et al., 1997).

Grammaticality Judgments

Most studies comparing typically developing children and children with SLI rely on production data. Given the metalinguistic demands of supplying grammaticality

judgments, the validity of using this task with children with SLI has been questioned (Kamhi & Koenig, 1985). Performance limitations subject to attention and memory demands may also result in reduced accuracy on this task for children with SLI. However, several studies have effectively used grammaticality judgments to extend our knowledge of SLI. Both preschool and school-aged children with SLI were less sensitive to overregularization errors than age-matched controls, yet similar to language age-matched controls in a grammaticality judgment task when simple declarative sentences were used (Smith-Locke, 1995; Redmond, 1997). A longitudinal study of grammaticality judgments in children with SLI over a two-year period indicated that judgments paralleled productions (Rice, Wexler, & Redmond, 1999). However, when the information appeared in an infinitival clause, the older school-aged group of children with a history of SLI was less likely to detect overregularization errors than either control group (Redmond, 1997).

Use of the English Past Tense by Speakers of Other Languages

Studies on the use of the English past tense by native speakers of other languages render conflicting reports of ability with learner age surfacing as one possible influence. Although methods of collecting data vary, earlier studies relying on natural language sampling techniques showed that younger L2 learners, aged 6 to 8 years, used the past tense of regular forms with high degrees of accuracy in their spontaneous data (Dulay & Burt, 1973; 1974). In opposition to the relative ease reported for younger learners, the performance of adults has been compared to that of language impaired individuals (Beck, 1997). The extraordinary difficulty experienced by adults has led to speculation that differences in adult-child

perceptual abilities lie at the core of the problem (Man, 1990). Specifically, the adults' ability to perceive the presence of the -ed inflection in a discrimination task depended on the phonetic context in which it appeared. Discrimination was easiest when the verb stem ended in a vowel or continuant, but became increasingly difficult when the syllable coda contained a cluster of segments. In contrast, no such effects existed for native speakers (Man, 1990). Native language and language proficiency level were less influential upon discrimination ability.

Similar age-related effects were obtained for grammaticality judgments on sentences containing morphology and syntax errors (MacDonald, 2000). Three groups of college students performed grammaticality judgments on sentences containing violations of 12 morpho-syntactic rules. No significant group differences were obtained between the native Spanish speakers who had learned English sequentially before the age of 5 and native English speakers. In contrast, those who had learned English after 14 were significantly less accurate at detecting grammatical violations (MacDonald, 2000). Among the stimuli presented , 11 sentences were designed to test judgments of regular and irregular past tense forms. Although the percentages varied across groups – native English (M = 95.3%, SD = 6.3), early acquirers (M = 87.7%, SD = 12.7), and late acquirers (M = 75.3%, SD = 21.5), significant group differences were not obtained. The author concedes that limited statistical power due to a limited number of past tense items may have precluded the ability to detect significance. However when the same tasks were administered to first language speakers of Vietnamese, a different outcome was obtained. Unlike the L1 Spanish speakers who had acquired English early, the L1

Vietnamese early acquirers did not perform as well as their native English counterparts on sentences containing violations of morphological inflections, in particular, past tense inflections (MacDonald, 2000). These results indicate that first language knowledge may continue to influence second language morphological representations even among early sequential bilinguals tested at college age.

Vocabulary Scores and Accuracy in the Use of Irregular Past Tense

Because of the claim that irregular forms are learned as part of the lexicon, the role of vocabulary has been explored in its relation to predicting the accuracy of past tense marking for irregular verbs. Studies of children with SLI (Oetting & Horohov, 1997; Ullman & Gopnik, 1999), as well as other disordered populations provide support for a dual mechanism model when vocabulary scores are compared with past tense use. A double dissociation exists between individuals with SLI and those with Williams Syndrome with respect to vocabulary scores and past tense morphology. Williams Syndrome is a rare genetic disorder characterized by relatively superior linguistic abilities relative to cognitive performance, the exact opposite of what is seen in SLI. Clahsen and Almazan (1998) reported on four individuals with this disorder with respect to the productive use of regular and irregular past tense forms. Using the same verb stimuli employed to differentiate the performance of individuals with and without SLI (Ullman & Gopnik, 1999; van der Lely & Ullman, 2001), individuals with Williams Syndrome performed significantly better on regular past tense forms requiring the application of the -ed past tense rule, and significantly worse on the production of irregular forms when compared to individuals with SLI. In another comparison, children with Williams Syndrome did

not exhibit the same patterns of tense marking difficulty as children with SLI, even though other aspects of their language were delayed relative to same aged peers (Rice, 1999).

A similar double dissociation exists in anterior and posterior aphasia. Individuals with anterior aphasia experience more difficulty with regular, than irregular verbs. Individuals with posterior aphasia have more difficulty with irregular verbs, and produce more overregularizations relative to controls (Ullman et al., 1997; Hagiwara, 1994). Adults with Alzheimer Dementia (AD), known for having severe memory problems, experience greater difficulty in the production of irregular past tense forms, yet also produce overregularizations (Ullman, et al., 1997). The selective impairment of one verb type relative to another lends support to the idea that differing mental processes are operative in the production of regular and irregular forms. Thus, it is anticipated that problems specific to the storage and retrieval of an item from memory, that depend on frequency of exposure, and opportunities for use will help to distinguish typically developing from atypically developing bilinguals.

Research Questions and Predictions

The purpose of this study was to examine use of the English past tense by typically developing early sequential bilingual Spanish / English speakers and children from a similar cultural / linguistic background who have SLI. Children's productivity was measured in elicited productions of high-frequency regular, high-frequency irregular, and novel past tense forms. Accuracy according to verb status (e.g., regular, irregular, and novel) was measured, and type of error was recorded.

Errors were further categorized according to "good" and "bad" errors. Good errors included possible dialectal variants, such as overregularizations or lexically marked stems. Bad errors included bare stems or other inappropriate responses. Children performed grammaticality judgments for sentences containing accurate regular and irregular past tense forms, and errors consisting of bare stems, lexically marked bare stems, overregularization, and irregularization errors. Children who produced more bare stems, overregularizations, or who marked the past tense lexically may also accept those variations in a grammaticality judgment task. The extent to which the data across these tasks converge sheds light on the relationship between children's productions and underlying grammatical knowledge. Measures of receptive and expressive vocabulary were obtained to explore the extent to which vocabulary raw scores predicted the rate and error type for each verb category.

The first question was to determine how performance varied for each verb category as a consequence of group membership. I expected that bilingual children with SLI would not only produce more errors overall, but that errors would be qualitatively and quantitatively different from age-matched controls. Consistent with what has been reported for monolingual English speakers, bilingual children with SLI should produce more bare stem errors, and fewer overregularizations of irregular verbs (Rice, et al., 2000). A high proportion of bare stem errors in all verb categories would support an EOI account of SLI. Yet, other error types, especially those reflecting other tensed verbs (e.g., "did"), or difficulty in separating the stem from the "ing" inflection would suggest problems at other levels of processing, hence providing more support to a limited processing capacity account of SLI.

Selective impairment of one verb type might also indicate processing limitations. In particular, performance for the novel verbs may be more problematic for children with SLI.

Typically developing children, on the other hand, were expected to be more accurate overall, and to have more "good errors" (e.g., overregularizations, lexically marked bare stems) than children with SLI. The competition model (Maratsos, 2000) predicts that bilingual children will produce and accept more overregularizations than monolingual speakers. This would be consistent with Maratsos' proposal that children may entertain both forms for an extended period if they are exposed to fewer inputs of verb forms in the environment and have fewer opportunities to produce them.

This study focused on the extent to which theories of morphological representation and processing in monolingual speakers predict the outcome of second language acquisition in typically and atypically developing bilingual children. The selection of stimuli precluded a thorough evaluation of single versus dual mechanism models because both regular and irregular verbs did not vary sufficiently with respect to frequency and phonological compositions. However, the models were useful for explaining the differential treatment of verb types by groups and the resulting error patterns. In monolingual English-speaking populations, the dual mechanism hypothesis predicts that performance on regular and irregular verbs will differ, and this difference was supported.

Another question was motivated by the possible relation between vocabulary score and irregular past tense. Specifically, do vocabulary scores predict children's

ability to select the accurate irregular past tense form? Moreover, do receptive and expressive vocabulary measures have differing predictive value? In monolingual English-speaking populations, the dual mechanism hypothesis predicts a positive correlation between vocabulary measures and accuracy of irregular past tense forms. Thus, bilingual children with SLI having vocabulary scores comparable to normal controls should not differ from normal controls on the use of irregular past tense. Finally, do differing experimental linguistic tasks (e.g., grammaticality judgments and elicited productions) provide converging evidence for children's performance? It was predicted that children's grammaticality judgments would reflect the linguistic knowledge supporting past tense use. Thus, children who used bare stems, lexically marked bare stems, or overregularized forms in their productive data would also accept these forms in a grammaticality judgment task. Both groups should also reject irregularized forms because they do not occur in the input provided. However, if children with SLI fail to reject irregularized forms, it would suggest that processing deficits interfere with the grammaticality judgment task. Recognizing a correctly produced form and recognizing an incorrect form with the intent of fixing it may differ in processing demands. Recognition of correct forms is easier, requiring only that the child discover a mental match. However, incorrect forms require searching for the match, and then searching for an alternative if no match is found, simultaneously increasing demands on attention and memory. Ultimately, the task of fixing the incorrect form requires additional processes that include accessing and executing the correct form. Failure to correct these forms may also suggest processing limitations.

Chapter II

Method

This study examined the use of English past tense morphology in early sequential bilingual Spanish / English speakers with and without a history of SLI. Children were tested as they produced regular, irregular, and novel verb past tense forms using an elicited production task. Receptive and expressive vocabulary scores were obtained to explore the correlation between these scores and the accuracy of producing the past tense of each verb type. A grammaticality judgment task was administered to examine the consistency between children's judgments of grammatical accuracy and their productions of past tense. Specifically, we examined whether children's acceptance of certain error types, such as, bare stems or overregularizations, was predictive of performance on the elicited production task.

Participants

The participants included 17 typically developing and 14 children with a history of language learning difficulty. All spoke Spanish as a first language, learned English at school, and continued to use Spanish at home. All children in the typically developing group (TD) attended second grade in the same school district. All attended regular education classes and were progressing adequately as per parental report. None received special services such as, speech-language therapy, resource room instruction, or remedial reading. Of these children, 15 were enrolled in bilingual classes and 2 were enrolled in regular classes where English was the primary language of instruction. The ages of the children ranged from 7;3 to 9;0 years ($\underline{M}$ = 8;0). Two children had previously been retained in earlier grades - one

because of excessive absenteeism due to frequent family moves, and another because of inadequate Spanish literacy skills following a move from a neighboring district's bilingual program.

Fourteen additional children comprised the group of children with a history of SLI. Identification of SLI remains problematic and controversial for monolingual children, and even more so among bilingual populations. The primary criterion for selection was the determination of and qualification for remedial speech-language services by the School Districts Committee on Special Education or Committee on Preschool Special Education. Some children who qualified for and received services at the preschool level had been declassified by second grade and were not receiving services at the time of the study. All children in the SLI group received a bilingual speech-language evaluation, bilingual psychological evaluation, and social history. Given the lack of standardized tests for linguistically and culturally diverse children, the Committee relies heavily on the behavioral observations, clinical interpretations and consistency of reports across evaluators. In addition, children with a history of SLI demonstrated a persistent language problem requiring speech-language therapy services for at least 2 years, and seven of the fourteen, or 50%, reported a history of speech-language learning difficulty in at least one sibling or parent, as compared to two of the seventeen, or 11%, typically developing children. Eleven of the fourteen were enrolled in second grade, two had been retained in first grade and one was assigned to third grade in the same district. Thirteen children attended classes in the same district as the typically developing children. One child had moved to a neighboring district within the past year. The ages ranged from 7;7 to 9;0 (M = 8;0).

Therapy status and gender of children with SLI

Nine of the fourteen children in the SLI group were currently receiving speech-language therapy services in the same school district. Five children had previously received speech-language services in the same school district, four had been declassified prior to first grade and one prior to second grade. Although there were equal numbers of males and females in the SLI group, it should be noted that all five children who had been declassified were female. Thus, of the nine children currently receiving therapy, six were male and three were female – a ratio of males to females that is more consistent with prevalence reports.

Years of residency in the United States

All children had resided in the United States for at least 2 years prior to participation in the study. Length of residency was determined by the number of years that a child spent in the US immediately prior the study. Some children were born in the US, but spent a significant amount of time outside of the country before returning at school age. In the population sampled, it is not unusual for a US born child to be cared for by family members outside of the country so that both parents could remain gainfully employed. For children in the typically developing group, the average length of residency ranged from 2 to 9 years with a mean of 6;5 years. For children in the SLI group, length of residency ranged from 3 to 9 years with a mean of 6;10 years.

Place of birth.

Most children were born in the United States to parents of Central American origin. Of the typically developing children, 14 (82.3%) were born in the United

States, and one child was born in each of the following countries: Mexico, Dominican Republic, and Puerto Rico. In the SLI group, 13 children were born in the United States; one child was born in Honduras. For both groups El Salvador was the country from which most parents originated. Parents of children in the typically developing group came from El Salvador (52.9%), Dominican Republic (11.8%), Mexico (5.9%), Columbia (5.9%), Honduras (5.9), Panama (5.9%), and Puerto Rico, (5.9%). Parents of children in the SLI group came from El Salvador (64.3%), Honduras (21.4%), Peru (7.1%), and Guatemala (7.1%).

Socio-economic status

The groups did not differ in socio-economic status. Socio-economic status was measured using the Four Factor Index of Social Status (Hollingshead, 1975). This widely used index combines information related to parent occupation, parental level of schooling, marital status, and gender to come up with a weighted index of social strata. Occupations are rated along a nine-point continuum ranging from a low score of "1" - farm laborers / menial workers- to a high score of "9" - higher executives / major professionals. Educational levels are ranked along a seven-point continuum ranging from a low score of "1" - less than seventh grade – to "7" – graduate degree. The weighted scores result in an index that ranges from a low score of 8 to a high score of 66. The scores are grouped into the following social strata.

[Social Strata	Range of computed scores
Major business and professional	66 – 55
Medium business, minor professional, technical	54 – 40
Skilled craftsman, clerical, sales workers	39 – 30
Machine operators, semiskilled workers	29 – 20
Unskilled laborers, menial service workers	19 – 8]

(Hollingshead, 1975, p.23):

Information regarding parental education and occupation was available for all 17 children in the TD group, and for 13 of 14 children in the SLI group. The computed index for each group resulted in a range of 17 to 37 ($M = 24.88$, $SD = 6.84$) for parents of children in the TD group, and a range of 18 to 37 ($M = 23.74$, $SD = 7.13$) for children in the SLI group. A *t* test confirmed that these scores did not differ significantly ($t = -.443$, $p = .662$). The weighted index for each group corresponds to the level of semi-skilled workers.

Home language use

Spanish was the language reportedly used most often at home. Parents supplied information regarding the extent to which English was used by parents and siblings. Because many of the participants resided in multiple family dwellings, other adults and children who interacted with the participants on a regular basis were included. Parental and sibling use of English was indicated on a five point rating scale that displayed a continuum of English language use. A score of "1" indicated that "only Spanish was spoken; a score of "2" indicated that "mostly Spanish with some English was spoken"; a score of "3" indicated that "English was spoken at least half

of the time"; a score of "4" indicated that "English was spoken most of the time; and, a score of "5" indicated that "only English was spoken". Reports of English language use ranged from "1" to "3" for parents of children in both experimental groups. Reports of English language use ranged from "1" to "4" for the siblings in both experimental groups. An ANOVA revealed no group differences for English language use by the parents $F(1,29) = .890$, $p = .353$, or the siblings $F(1, 29) = .809$, $p = .376$. Eventually, the scores were converted to create a dichotomous variable for logistic regression so that scores of "3" and above "4" were used to predict accuracy on the elicited production task.

Recruitment of participants.

A letter of cooperation was obtained from the school district superintendent prior to recruitment. Following CUNY IRB approval, letters explaining the project in English and in Spanish were sent home by the teachers in one elementary school to the parents of all children in the second grade. Parents checked off a box indicating either positive or negative interest in obtaining more information about the project. Those indicating interest provided their child's name and telephone number on the letter and returned the form to the teacher. Teachers were supplied with pencils to distribute to children who returned the forms regardless of interest outcome. The investigator contacted parents by telephone to further describe the project and to schedule an appointment if an interest in participating was expressed. Using this procedure, 17 typically developing and 4 children with a history of SLI were recruited. Because of the relatively few numbers of children meeting the SLI group criterion, additional efforts to recruit children into this group were necessary.

Additional participants were recruited by the present investigator who had maintained contact with the parents of former clients who were presently the same ages as the children presently being recruited. These parents were contacted by phone to determine if they would be interested in having their child participate. Importantly, the investigator no longer maintained a professional relationship with these families, nor did there exist any chance of her serving as their child's future speech-language clinician.

Six potential participants were identified but three were excluded because of grade retention. Three additional participants were successfully recruited this way. The remaining seven children in the SLI group were recruited with the assistance of Mary Ramirez-Torres, bilingual speech-language pathologist at the Morrow Elementary School, who sent Letters of Recruitment home to the parents of children in her caseload between the ages of 7 and 9 years. The letters were followed-up with written notes and phone calls to make certain that parents had received the letters and understood the nature of the project. She forwarded the telephone numbers of interested parents to this investigator.

Procedure

All children were tested in two sessions lasting approximately 40 to 60 minutes each. In the first session, the investigator explained the Letter of Informed Consent to the parent, obtained signatures, and obtained verbal assent from the child. Additional information was obtained from each parent regarding country of origin, years of residency in the US, and language use in the home. In order to verify English language proficiency, each child performed with at least 85% accuracy on

the first four subtests of the English version of the *Preschool Language Assessment Scales (PRE-LAS)*. These subtests included following directions, matching spoken sentences to pictures, labeling household items, and sentence repetition. Administration time was approximately 5-10 minutes. The elicited production task was then administered to the child. The child answered questions relating to videotaped actions that were presented on a computer screen. Each child received seven practice items prior to beginning this task, and an additional two practice trials prior to the elicitation of the novel verbs. Administration time for the elicited production task was approximately 15 minutes.

The procedure for this task was as follows. Children viewed the action at three temporal stages. Before the action, (e.g., "eating") takes place, the investigator mentioned the action, and requested that the child repeat the action word. For example, the examiner said: "This is a story about eating. What is it about?" The child replied: "eating". During the second stage, the moving image appeared on the screen accompanied by the audio recording of the action described (e.g., "look, the man is eating the apple"). When the video ended, the examiner administered the prompt: "What did he do with the apple?" The targeted response was "he ate it". All verbs were elicited in finite constructions that included the direct object pronoun "it". This facilitated the verb being followed by a vowel (e.g., "poured it") so that the morphological inflection was readily identifiable. All children were given verbal encouragement throughout the testing.

Reliability measurements for the elicited production task were obtained on six of the participants, using three children from each group. The examiner recorded the

children's responses during the testing. A second rater recorded the children's responses from an audiotape. Inter-rater agreement ranged from 88.8% to 100% for the six children with a mean of 93.9%.

The final task in the first session was a picture labeling task using the *Expressive One Word Picture Vocabulary Test (*Academic Therapy Publications, 2000). Although children were offered brief time off breaks between tasks, all were able to complete the tasks within the scheduled time frame without resting between tasks.

In the second session, children performed grammaticality judgments following a brief training period. During the practice period, children were instructed to listen carefully to the examiner's speech and to correct anything that sounded wrong. Children were trained with sentences containing agreement errors (e.g., "John and Mary am happy", "I is a girl/boy", "I have two book_", "My name is Peggy", and "I have three chairs") until they demonstrated the ability to recognize and "fix" errors and to accept what they believed to be accurate productions. The children performed grammaticality judgments for thirty pre-recorded sentences, and the examiner wrote down the children's "corrected responses". The child activated the computer when ready to view the following video. The grammaticality judgment task lasted approximately 15 minutes.

Upon completion of the grammaticality judgment task, the children pointed to pictures named by the examiner, using the *Receptive One Word Picture Vocabulary Test (ROWPVT-2000).* This lasted approximately 10 -15 minutes. Finally, a hearing screening was administered at 25 - 30 dB for the speech frequencies. When testing was completed the parents answered questions regarding any history of language or

learning difficulties in the child or immediate family, using questions similar to those posed by Restrepo (1998). A sample of this questionnaire appears in Appendix C. Additional information regarding country of origin, length of residency in the United States, parental level of education and occupation, and bilingual home language use by the adults and siblings was also collected.

Pure tone hearing screenings at 25dB and 30dB were administered to all but one participant who moved before the hearing screening was performed. The higher level for screening was necessary due to the ambient noise present in some of the children's homes. One child who failed the screening was referred for further evaluation, and did not ultimately participate due to previously documented learning problems. For most children, the hearing screening was performed on the second visit. However, a third visit to perform the hearing screening was necessary for the last five participants because the screening equipment was not available at the time of their second visit.

Stimuli

The *Expressive One Word Picture Vocabulary Test* (EOWPVT – 2000) is an expressive labeling task. It consists of a series of test plates that show a color illustration on each page. The examiner presents each test plate and attempts to elicit the labeling response from the examinee with verbal prompts and cues. Examples of prompts include "what's this?", "what are these?", "what's he/she doing?" "what word names all of these?". Subsequent cues are given if the examinee indicates failure to focus on the targeted aspect of the pictures. In such cases, the examiner may give a pointing cue and repetition of the verbal prompt one time for each test

plate. The test plates are organized in order of progressive difficulty. Although the EOWPVT is standardized for individuals between 2:0 – 8:11, there are no separate norms available for bilingual individuals. Consequently, the administration was altered so that only raw scores were obtained. Testing began with administration of the first test plate and continued until reaching a ceiling of six consecutive errors.

The *Receptive One Word Picture Vocabulary Test* (ROWPVT – 2000) is a single word vocabulary recognition test. It consists of a series of test plates that show four illustrations in color. The examiner orally presents a word that matches one of the illustrations, and the child must identify the illustration that matches the spoken stimulus word. The test plates are organized in order of progressive difficulty. Although the ROWPVT is standardized for individuals between 2;0 – 18;11, there are no separate norms available for bilingual individuals. Consequently, the administration was altered, and only raw scores were obtained. Testing began with administration of the first test plate and continued until reaching a ceiling of six errors in eight consecutive items.

The stimuli for the elicited production task consisted of 36 verbs, including 12 regular, 12 irregular, and 12 pseudo-verbs having phonological similarity to the regular and irregular verbs. The regular and irregular verbs appeared in the spoken vocabularies of 4;5 to 5;0 year old white and black working and middle class children in New York City (Hall, Nagy, & Linn, 1984). The novel actions associated with the novel verbs were previously used to compare children's acquisition of nouns and verbs (Schwartz & Leonard, 1984). The decision to use novel forms permitted a comparison between high and pseudo low-frequency status

while simultaneously allowing for the matching of the phonological characteristics. The syllable codas for both the high and low frequency stems were matched. Hence, the verb "burn" was matched with the pseudo correlate "gurn" in order to provide a novel verb with phonological similarity (See Appendix A).

A digital still camera (SONY DSC-S50) with video capacity was used to record the same man performing each of the 36 actions. The same female voice accompanied each action photo to describe the action as it occurred (e.g., "Look, the man is catching the fish."). An additional nine actions were developed for the practice trials. The duration of each action was between 4 and 5 seconds. The photos were recorded onto a Memory Stick (12MB), and then transferred to a Memory Stick Reader/Writer (SONY MSAC-US1) for display onto the screen of a laptop computer. The videos were then edited to run in a pseudo- randomized order with each separated by a 5 second delay.

The same videos representing the twenty-four high frequency verbs were used for the grammaticality judgment task. An additional eight videos were included for the practice trials (2) and filler sentences (6), and were not included in the scoring.

Scoring

Scoring for the elicited production task was as follows. A score of "1" was assigned for each accurate past tense production. Accuracy was determined according to standard use for the regular and irregular verbs. Accuracy for the novel verbs was any production containing the -ed suffix. A score of "0" was assigned to each error, and the errors were then categorized into six categories – overregularization (e.g., "buyed"), double marking (e.g., "broked"), bare stem (e.g.,

"eat"), stem + ing (e.g., "pushing"), other past tense (e.g., "was pulling"), and other verb (e.g., "did"). Eventually, for the statistical analysis these categories were collapsed into two error types, consisting of good errors (overregularization, double marking, and other past tense) and bad errors (bare stems, stem + ing, and other verb).

Scoring for the grammaticality judgment task was as follows. Sentences were scored as "1 = accepted" or "0 = rejected". A sentence was deemed "accepted" if the child agreed that the examiner's pre-recorded response sounded "okay". Other sentences scored as "accepted" included those that the child rejected, but did not change the verb form upon correction. Thus, if a child rejected "he already drop it", but fixed the sentence by stating "he drop it", a score of "1" indicated that the child accepted the bare stem. Requiring a change in the verb form was necessary for the sentence to be scored as "rejected" because the exact target of the child's focus was not always apparent. Occasionally, a child altered the phonological patterns of the examiner's response by inserting added consonant aspiration that might have been more consistent with the child's dialect. Sentences scored as "rejected" included only those in which the child altered the verb form. Thus, if a child changed the sentence "he already drop it" by stating "he dropped it", or simply "dropped" the sentence was considered to have been rejected.

Scoring for the picture labeling and single word recognition tasks was consistent with instructions outlined in the manuals for the expressive (*EOWPVT-2000*) and receptive *(ROWPVT-2000)* vocabulary tests using a binomial scoring system of plus for correct or minus for incorrect responses. However, scoring for the picture

labeling task was complicated by the fact that children sometimes produced a phonologically approximate label for an English word (e.g., "teleco" for "telescope"). Variations of this sort were accepted as correct unless the phonologically similar response actually represented another English word (e.g., "clowns" for "clouds"). Typical Spanish/English bilingual errors, such as, "clock" for "watch" were scored as incorrect.

Data Reduction

The nesting of variables in the present data set allowed for a newer, more efficient, yet less commonly used statistical analysis procedure called hierarchical linear modeling (HLM, Bryk & Raudenbush, 1992). Data in speech and language studies are frequently analyzed inappropriately by ignoring the fact that item scores are nested within individuals and individuals are nested within groups (Rindskopf, in progress). Traditional methods of analysis such as ANOVA, collapse data across groups and actually overestimate the significance of group differences when groups differ in number and the sample sizes are relatively small. HLM permits an analysis at the item level while simultaneously measuring the predictive factors related to subject level data. This enables us to look at verb type and error type for each verb category, and to simultaneously measure the effect of subject level data such as, group membership, family background, age, SES, vocabulary score, or grammaticality judgments on the outcome for the items. Traditional methods of analysis would fail to capture these results and subject level comparisons would yield less accurate estimations of significance levels.

Summary

This study examined the use of English past tense morphology in early sequential bilingual Spanish / English speakers with and without a history of SLI. Children were tested as they produced regular, irregular, and novel past tense verbs using an elicited production task. Receptive and expressive vocabulary scores were obtained to explore the correlation between these scores and the accuracy of producing the past tense of each verb type. A grammaticality judgment task was administered to examine the consistency between children's judgments of grammatical accuracy and their productions of past tense.

CHAPTER III

Results

Analyses Using Hierarchical Linear Modeling

Statistical analyses using Hierarchical Linear Modeling (HLM) were employed because of the nesting of the variables. Scores on the elicited production task are nested within individual children, who are in turn nested within groups of children with and without SLI. The data were analyzed at two levels. Level One consists of scores on each of the items for the elicited production task and Level Two represents each child and includes individual characteristics such as group membership.

For the first level of analysis, we constructed a simple model that illustrates the overall variance on scores that reflect accuracy on the items of the elicited production task. Each verb category was analyzed separately in order to compare residuals. The Variance Components Model is expressed through the equation $Y_{ij} = \pi_{ij}$, where Y_{ij} represents the responses on item "i" for each child "j", where "0" is incorrect,"1" is correct, and π is a constant which represents the proportion correct for each verb category for child "j". Given that the dependent is dichotomous, a logistic regression was employed to model the data. Thus, the Level 1 model became $Y_{ij} = \pi_{ij}$. A logit function, expressed as $\ln (P_{ij}/1\text{-}P_{ij})$, was used to model the data because it expresses the proportion as an odds ratio. Each proportion is converted to an odds ratio so that, the proportion .15 becomes an odds ration of .1764 using the formula (P/1-P). The logit of the proportion is obtained by taking the logarithm of the odds ratio, which for .176 is –1.735. The advantage of using

logits is that they are more conducive to regression analysis with a dichotomous dependent variable, and have the added advantage of reducing the obstacles imposed by the influence of floor effects in some individuals. Hence, the logit denotes the likelihood that an individual would obtain a correct response for that verb category. The information contained at Level One remains unchanged for each of the subsequent Level Two models.

Level Two is expressed through the equation $\pi_j = \beta_{oj} + r_j$, where π_j represents the proportion correct for child /j/, β_{oj} represents the overall proportion correct across children, and r_j represents the deviation of each child from the overall proportion. An example of the Variance Components Model with the changes resulting from group assignment follows. There are no predictor variables in the basic variance component model.

Variance Component Model

Level I: $\ln (P_{ij}/1\text{-}P_{ij}) = \pi_j$

Level II =

$\pi_j = \beta o + r_j$

Combined: $\ln (P_{ij}/1\text{-}P_{ij}) = \beta o + r_j$

Group Assignment

Level I: $\ln (P_{ij}/1\text{-}P_{ij}) = \pi_j$

Level II: $\pi_j = \beta o + \beta_1 + r_j$

The addition of β_1 reflects the difference in overall proportion (expressed in logit form) between the children in the TD and SLI groups. With the present model, it now becomes possible to add additional variables, (e.g., expressive vocabulary

score) which may predict performance. The resulting equation in Level II would be $\pi_j = \beta_0 + \beta_1 + \beta_2 + r_j$, where β_2 represents the increase in overall proportion correct for a 1 point change in vocabulary raw.

Additionally, it is possible to insert an interaction term into the equation to determine if the groups show divergent patterns. Such an equation would be constructed as follows: $\pi_j = \beta_0 + \beta_1 + \beta_2 + \beta_3 + r_j$. Outwardly, this equation resembles that previously presented, yet the values differ, so that β_0 represents the overall proportion for the TD group having an expressive vocabulary score of 0, β_1 now represents the difference between the TD and SLI groups for a child with an expressive vocabulary score of "0", β_2 represents the increase in proportion correct for a one point change in expressive vocabulary score for the TD group, whereas, β_3 represents the same increase for the SLI group. Appendix D illustrates the analysis across verb type by group. The Constant term represents the TD group. The coefficients are expressed as logits, and a z-score is obtained by dividing the coefficient by the standard error to determine the significance level or, the extent to which the score varies from the mean.

Results of the Elicited Production Task

Overall accuracy was significantly higher for children in the TD group on all verb types and a significant interaction between groups for regular and irregular verbs was obtained ($p < .001$). The raw data are summarized in Table 1.

Table 1. Group means and standard deviation scores for regular, irregular, and novel past tense productions.

Verb type	Group	N	Raw Score Means (SD)	Proportion Means (SD)
Regular	TD	17	9.82 (3.64)	.82 (.30)
	SLI	14	2.71 (4.28)	.23 (.36)
	Total	31	6.61 (5.28)	.55 (.44)
Irregular	TD	17	5.88 (2.44)	.49 (.20)
	SLI	14	3.57 (2.20)	.30 (.18)
	Total	31	4.83 (2.58)	.36 (.21)
Novel	TD	17	6.05 (3.00)	.50 (.25)
	SLI	14	1.42 (2.40)	.12 (.20)
	Total	31	3.96 (3.58)	.33 (.30)
Total	TD	51	7.25 (3.52)	.60 (.29)
	SLI	42	2.57 (3.16)	.21 (.26)
	Total	93	5.13 (4.0)	.43 (.33)

The raw data expressed as percentages appear in Table 2.

Table 2. Total numbers and percent correct on the elicited production task for each verb type by the TD and SLI groups.

Verb Type	TD Group		SLI Group	
	Total Correct	Percent Correct	Total Correct	Percent Correct
Regular	167 / 204	82.3%	38 / 168	22.3%
Irregular	100 / 204	48.8%	50 / 168	30.1%
Novel	103 / 204	50.5%	20 / 168	11.9%

Table 2 shows that the TD group performed with 82.3% accuracy on regular verbs, with 48.8% on irregular verbs, and with 50.5% accuracy on the novel-verb forms. In contrast, the SLI group performed with only 22.3% accuracy on regular verbs, 30.1% on irregular verbs, and with 11.9% on the novel-verb forms. Table 3. shows the proportion correct for each individual verb according to groups. The verbs are listed in columns according to type – regular, irregular, and novel.

Table 3. Proportion correct of past tense forms according to group, individual verbs, and verb type.

Regular verbs	TD Group	SLI Group	Irregular Verbs	TD Group	SLI Group	Novel Verbs	TD Group	SLI Group
Tape	.882	.142	Shut	1.0	.785	Nop	.764	.214
Lock	.882	.214	Hit	.941	.714	Wick	.764	.142
Burn	.882	.214	Eat	.823	.428	Flimb	.764	.142
Pull	.823	.285	Find	.764	.357	Dill	.764	.071
Drop	.823	.214	Win	.647	.142	Bape	.647	.214
Climb	.823	.285	Take	.470	.142	Tull	.705	.142
Tie	.823	.214	Make	.470	.071	Gurn	.588	.142
Push	.823	.214	Throw	.294	.285	Pow	.470	.142
Kill	.823	.214	Break	.352	.142	Lind	.117	.142
Roll	.764	.285	Buy	.176	.071	Mit	.117	.071
Move	.764	.142	Catch	.117	.142	Keat	.176	0
Turn	.705	.285	Stick	.058	0	Lut	.176	0

The groups also differed on the relative difficulty posed by verb type, yielding an interaction between groups for regular and irregular verbs. Although typically developing children performed better on regular verbs, children with SLI performed relatively better on irregular verbs (B = 1.992, $SE\ B$ = .340, z = 5.8588, p = < .001). Given the possibility that the observed interaction could be attributed to the nature of the stimuli, a separate analysis was performed. Because children with SLI tended

to produce more bare stems as responses, this may have resulted in their better performance for irregular verbs. Thus, proportions for the irregular verb category were separated into "irregular A" (including "hit" and "shut") and "irregular B" (excluding the verbs "hit" and "shut" from the analysis) as indicated in figure 1.

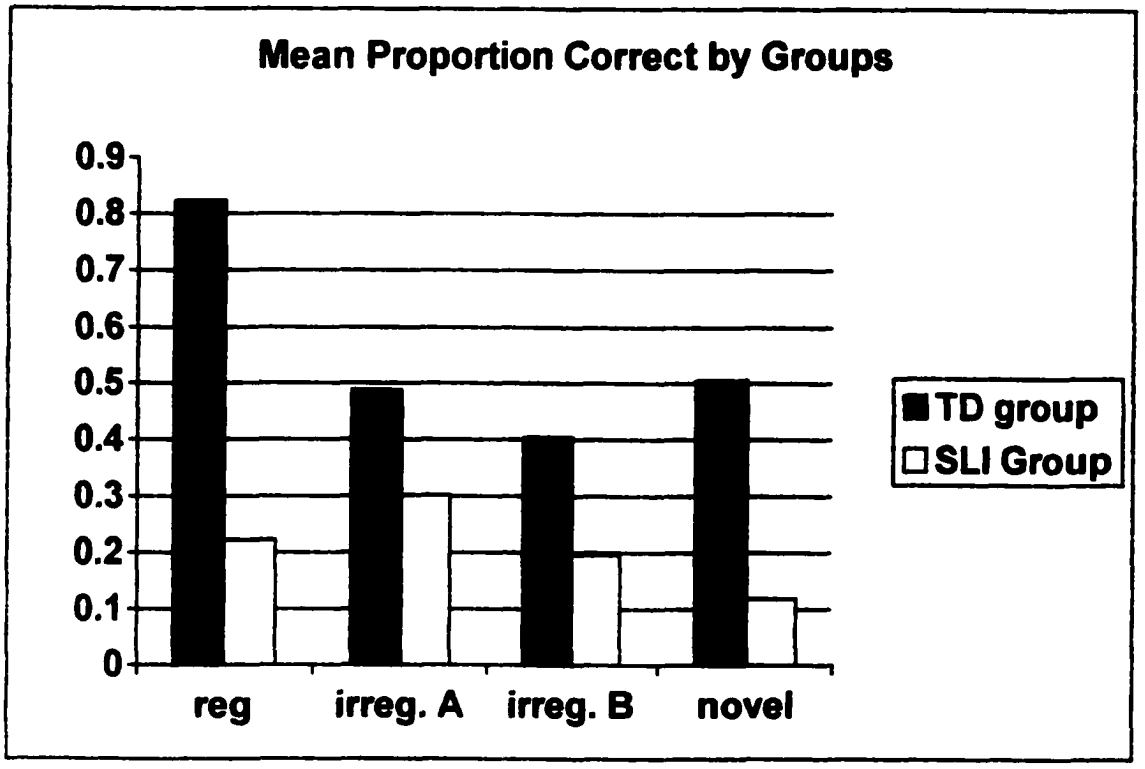

Figure 1. Mean group performance on regular, irregular, and novel verbs. Irregular verb accuracy is divided into Irregular A. (including "hit" and "shut") and Irregular B. (excluding "hit" and "shut").

Using these proportions, children with SLI appeared to perform better on irregular verbs (irreg.A), than on regular verbs. Yet even when "hit" and "shut" were omitted from the analysis (irreg.B), because they were consistent with typical bare stem errors, the interaction of verb type by group remained significant even after removing the two irregular verbs that did not vary in stem and past tense form..

Thus children in the SLI group still did better on irregular verbs relative to regular verbs, compared to the TD group (B = 1.763, $SE\ B$ = .371, z = 4.7520, p = < .001). When both sets of data were examined, the results of the multi-level model analysis revealed a significant difference according to verb type when "hit" and "shut" were included as in Model 1 (B = 1.992, $SE\ B$ = .340, z = 5.8588, p = < .001) a finding that is still upheld when "hit" and "shut" were excluded as in Model 2 (B = 1.763, $SE\ B$ = .371, z = 4.7520, p = < .001). Both models are displayed in appendix E.

Separate correlations examined pairwise relationships across verb categories – regular, irregular, and novel-verbs. The results revealed a highly significant correlation between regular and novel-verbs (r = .861, p < .01), a moderately high significant correlation between regular and irregular verbs (r = .392, p < .05), and no correlation between irregular and novel-verbs (r = .290, p = .114). These correlations suggest that nearly three-quarters of the variance in the performance on novel-verbs is shared with performance on the regular verbs.

The groups also differed with respect to error type. These errors are broken down by verb type because certain errors can only occur in a specific verb category. The total number of errors was much larger for the SLI group. For the regular verb category, the most common error type for both groups was the use of bare stems - 75% (27 of 36) for the TD group, and 87.9.4% (117 of 133) for the SLI group. The second most common error was the use of the stem + ing. This accounted for 22% of errors (8 of 36) in the TD group and 10.5% of errors (14 of 133) in the SLI group.

A different picture emerges for the irregular verb category. Overregularization accounted for most errors in the TD group, 61.9% (65 of 105 errors), compared to

14.7% (17 of 115 errors) in the SLI group. Similar to their treatment of regular verbs, children in the SLI group were most likely to produce bare stem errors, 73.9% (85 of 115 errors), when producing the past tense of irregular verbs though this accounted for only 24.7% percent (26 of 105) of the errors by the TD group. The groups did not differ in the percent of errors realized as stem + ing, 9.5% (10 of 105) of errors for the TD group and 10.4% (12 of 115) errors for the SLI group.

The errors on novel-verbs also differed by group. The most common error type was the production of bare stems, 76.2% (77 of 101 errors) for the TD group, and 63.2% (93 of 147 errors) for the SLI group. Children in the SLI group produced disproportionately higher numbers of stem + ing errors for the novel-verb forms, 35.3% (52 of 147 errors) by the SLI group, compared to 15.8% (16 of 101 errors) by the TD group. A breakdown of error count and type by group appears in Table 4.

Table 4. Total number and percentages of error types by group and verb category.

	Regular Verbs		Irregular Verbs		Novel Verbs	
	TD group	SLI group	TD group	SLI group	TD group	SLI group
Overregularization Errors	0/36 (0%)	0/133 (0%)	65/105 (61.9%)	17/115 (14.7%)	0/101 (0%)	0/147 (0%)
Double marking Errors	0/36 (0%)	2/133 (1.5%)	3/105 (2.9%)	0/115 (0%)	6/101 (5%)	1/147 (0.6%)
Bare stem Errors	27/36 (75%)	117/133 91.4%)	26/105 (24.7%)	85/115 (73.9%)	77/101 (76.2%)	93/147 (63.2%)
Stem + ing Errors	8/36 (22.2%)	14/133 (10.9%)	10/105 (9.5%)	12/115 (10.4%)	16/101 (15.8%)	52/147 (35.3%)
Other types of Errors	1/36 (2.7%)	0/133 (0%)	1/105 (0.9%)	1/115 (0.8%)	2/101 (2%)	1/147 (0.6%)
Total Errors	36	133	105	115	101	147

Because the groups differed on the types of errors produced, especially for the irregular verb category, a separate analysis was performed after dividing the errors into "good" versus "bad" error types. Specifically, good errors included overregularization and double marking errors because these error types indicated that children had learned to apply a rule even if inappropriately in some instances. In contrast, bad errors included bare stems, stem + ing errors, and other verb forms

(e.g., "did"). Children in the TD group produced a total of 241 errors. Of these errors, 73 were classified as "good errors" and 173 were classified as "bad errors". In contrast, children in the SLI group produced a total of 395 errors. Of these errors, 20 were classified as "good errors" and 375 were classified as "bad errors". Unlike the TD group for whom "good errors" constituted a proportion of .695 of total errors, the proportion of "good errors" produced by the SLI group was only .05. Results of the HLM analysis confirmed that the groups differed significantly on the type of errors produced with the TD group producing more of the "good errors" (B = -1.203, $SE\ B$ = .576, z = -2.088, $p < .05$) and the SLI group producing more "bad errors" (B = 2.064, $SE\ B$ = .447, z = 4.617 $p < .001$). Thus, being in the TD group increased the likelihood of producing a "good error" by an odds ratio of 2.72 to 1, and decreased the likelihood of producing a "bad error" by a ratio of .36 to 1. The opposite held true for children with SLI. Being in the SLI group decreased the odds of producing a "good error" by .30 to 1, but increased the likelihood of producing a "bad error" by 7.87 to 1. The model for these results appears in appendix F. A separate analysis was performed for the irregular verb category to compare the number of overregularizations produced. The groups differed in the number of overall good errors (B = -1216, $SE\ B$ =.256, z = -4.75, p = < .001) and there was a significant group interaction for the use of overregularizations (B = -.697, $SE\ B$ = .432, z = -1.613, $p < .053$) when producing irregular verbs. The table depicting these results appears in appendix G.

The predictive value of parents' and siblings' use of English at home on the accuracy of the child's performance on the elicited production task was also

explored. Results of the HLM regression analysis revealed that parents' use of English, but not siblings' use of English significantly predicted accuracy on producing regular past tense verbs on the elicited production task. Thus, having one parent in the home who reportedly used English at least half of the time resulted in an increased likelihood of getting a regular verb item correct by an odds ratio of 12.37 to 1 (B = 3.030, $SE\ B$ = 1.204, z = 2.516, $p < .01$), yet reported use of sibling's English did not effect the same result (B = -0.422, $SE\ B$ = .701, z = -.601, p = .725). Results of this analysis appear in appendix H. The same pattern of influence was demonstrated for the irregular and novel verb categories. Again, having one parent in the home who reportedly used English at least half of the time resulted in an increased likelihood of getting an irregular verb item correct by an odds ration of 3.08 to 1. (B = 1.127, $SE\ B$ = .359, z = 3.139, $p < .001$), yet reported use of sibling's English did not effect the same result (B = .021, $SE\ B$ = .293, z = .0716, p = .527). Results of this analysis appear in appendix I. Similar results were obtained for novel verbs. Having one parent in the home who reportedly used English at least half of the time increased the likelihood of getting a novel verb correct by an odds ratio of 3.32 to 1.(B = 1.202, $SE\ B$ = .640, z = 1.878, $p < .03$), yet reported use of sibling's English did not effect the same result (B = -.006, $SE\ B$ = .483, z = -.012 p = .504). Results of this analysis appear in appendix J.

Verb frequency and accuracy on the elicited production of irregular verbs

The possible relationship between ratings of spoken frequency (Hall, Nagy, & Linn, 1984) and accuracy of irregular past tense use was examined. Because of the small sample of irregular verbs, Spearman's rho, a nonparametric correlation of the

ranks between spoken frequency and accuracy of irregular past tense was used, and the results were non-significant ($r_s = .428, p = .15$). Thus, there appears to be no relationship between reports of spoken word frequency and accuracy of irregular past tense use on the elicited production task. In Table 5, all verbs are listed according to the total count, total percentage correct on the elicited production task, and the ratings of spoken frequency (Hall, Nagy, & Linn, 1984). Data from both groups are combined for this table.

Table 5. Accuracy of Irregular, Regular, and Novel-verbs Listed according to Total Correct, Percent Correct, and Spoken Frequency Counts by the Combined Groups.

Irregular Verbs	Total Correct (Percent Correct)	Spoken Frequency Count	Regular Verbs	Total Correct (Percent Correct)	Spoken Frequency Count	Novel Verbs	Total Correct (Percent Correct)
shut	28 (90%)	92	burned	18 (58%)	6	nopped	16 (52%)
hit	26 (83%)	131	climbed	18 (58%)	10	wicked	15 (48%)
ate	20 (65%)	94	locked	18 (58%)	10	flimbed	15 (48%)
found	13 (42%)	59	pulled	18 (58%)	13	dilled	14 (45%)
won	13 (42%)	34	dropped	17 (55%)	28	baped	14 (45%)

Table 5. continued

Irregular Verbs	Total Correct (Percent Correct)	Spoken Frequency Count	Regular Verbs	Total Correct (Percent Correct)	Spoken Frequency Count	Novel Verbs	Total Correct (Percent Correct)
took	10 (32%)	148	killed	17 (55%)	24	tulled	14 (45%)
made	9 (29%)	237	rolled	17 (55%)	8	gurned	12 (39%)
threw	9 (29%)	33	taped	17 (55%)	10	powed	10 (32%)
broke	8 (26%)	92	tied	17 (55%)	15	linded	4 (13%)
bought	4 (13%)	56	turned	16 (52%)	64	mitted	3 (10%)
caught	4 (13%)	37	moved	15 (48%)	15	keated	3 (10%)
stuck	1 (3%)	56	pushed	14 (45%)	23	lutted	3 (10%)
Mean # Mean %	12 (39%)	89.08		17 (54%)	19.5		10 (33%)

According to the spoken frequency data (Hall, Nagy, & Linn, 1984) ratings for regular past tense verbs included in the present study ranged from 6 – 64, (M = 19.5), compared to a range of 33 – 237 (M = 89.08) for irregular past tense forms. Yet regular verb past tense forms were generally produced more accurately. For the irregular forms, low frequency status may have contributed to lower accuracy on certain forms, (e.g., "caught", "stuck", "bought"), which were produced correctly at a rate of 8%. However, other verbs with relatively low frequency ratings, such as "found" and "ate" were produced with considerably higher rates of accuracy, (42% for found, and 65% for "ate"). Finally, the relatively high spoken frequencies of "made" and "took" were not reflected in greater accuracy on these forms, (29% for "made", and 32% for "took"). The chart in Figure 2 illustrates the lack of relationship between ratings of spoken frequency and percent correct, where the bar on the left indicates the percent correct for each irregular verb and the bar to the right indicates the spoken frequency rating (Hall, Nagy, & Linn, 1984).

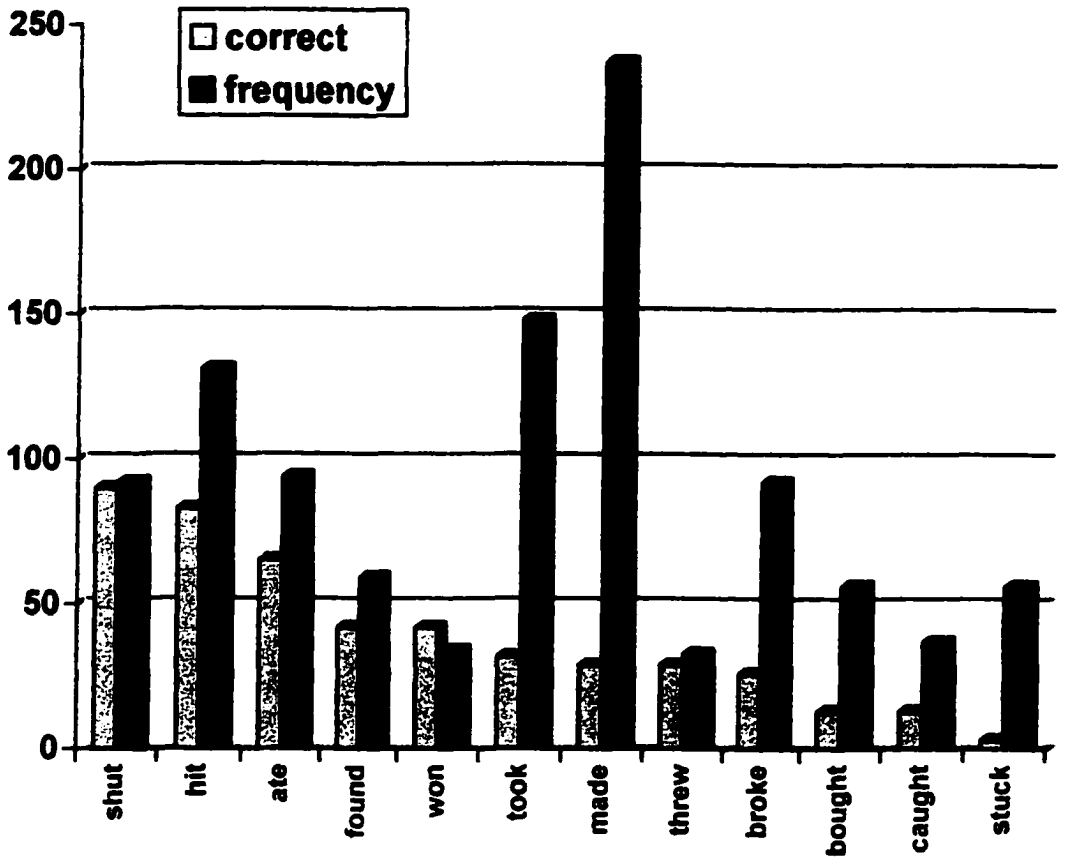

Figure 2. Percent correct for each irregular verb together with spoken frequency ratings for each verb.

Vocabulary Scores

Measures on tasks related to receptive and expressive vocabulary, single word recognition in pictures (ROWPVT-2000) and picture labeling (EOWPVT-2000), were obtained for children in each group. The groups' performance did not differ significantly on these tasks. Expressive vocabulary raw scores ranged from 28 to 65 ($M = 48.29$, $SD = 10.09$) for children in the TD group, and from 25 to 67 ($M = 45.57$, $SD = 15.88$) for children in the SLI group. Receptive vocabulary scores

ranged from 56 to 98 (M = 70.52, SD = 12.43) for children in the TD group, and from 45 to 97 (M = 65.64, SD = 15.44) for children in the SLI group.

Although the groups did not differ significantly on the mean scores for each of the vocabulary tasks, other factors, such as age, group, and length of residency in the United States were taken into account. When each of these variables was entered separately into a regression, with expressive vocabulary score as the dependent variable, age and group had no effect, but recent years in the United States did have a significant predictive effect on vocabulary score. However, no differences between groups existed when the number of recent years in the United States were netted out (r = .464, R^2 = .132, SE = 11.98). The same pattern of non-significant group difference was obtained when the dependent variable was switched to receptive vocabulary score (r = .429, R^2 = .184, SE = 12.9569).

Vocabulary scores predicted accuracy on the elicited production task and this prediction was strongest for regular verbs. Expressive vocabulary score significantly ($p < .01$) predicted accuracy on regular past tense forms, so that an increase of one point increased accuracy on the elicited production task by an odds ratio of 1.16 to 1. A one point increase in receptive vocabulary score resulted in an increase expressed as an odds ratio of 1.09 to 1 for regular verbs ($p < .05$). The results of this analysis appear in appendix K. Expressive vocabulary scores significantly predicted ($p < .05$) irregular past tense forms, so that an increase of one point increased accuracy on the elicited production task by an odds ratio of 1.028 to 1. A one point increase in receptive vocabulary score resulted in a similar increase of 1.02 to 1 on irregular verbs. The results of this analysis appear in appendix L. Receptive, but not

expressive vocabulary scores significantly predicted ($p < .01$) accuracy on the novel verb category, so that a one point increase in receptive vocabulary score resulted in an increase by an odds ratio of 1.05 to 1 for novel verbs. The results of this analysis appear in appendix M. These results diverge from those of monolingual individuals with language disorders. Those studies reported correlations between vocabulary score and irregular past tense use, and no correlation between vocabulary score and regular past tense use

Individual patterns

Tables 6. and 7. illustrate each individual's raw score on the receptive and expressive vocabulary tests (*ROWPVT-2000, EOWPVT-2000*) and the elicited production task (regular, irregular and novel verbs). Individual characteristics such as, group membership, age in months, sex, whether currently receiving speech-language therapy, months of residency in the United States, and type of class placement (English or Bilingual) are also included.

Table 6. Individual characteristics of TD children and their raw scores on the vocabulary tests and the elicited production task..

TD	Age	Sex	Time in U. S.	Class	ROWPV	EOWPV	Regular	Irregular	Novel
1	90	M	90	ENG	98	63	12	8	8
2	91	F	91	BIL	83	57	12	6	4
3	89	F	89	BIL	82	55	12	7	11
4	104	F	104	BIL	64	41	10	2	8
5	96	M	96	BIL	74	43	5	6	0
6	88	F	30	BIL	62	37	5	6	5
7	87	M	60	BIL	61	50	12	6	11
8	98	F	30	BIL	63	28	1	2	0
9	98	F	98	ENG	77	65	11	8	7
10	88	F	88	BIL	90	54	11	7	7
11	108	M	108	BIL	61	44	12	6	8
12	97	M	97	BIL	68	57	12	7	1
13	105	M	105	BIL	80	58	12	7	8
14	96	M	96	BIL	59	43	11	2	9
15	99	M	48	BIL	62	44	12	9	8
16	95	F	95	BIL	59	38	11	3	5
17	97	F	97	BIL	56	44	3	10	2

Table 7. Individual characteristics of children with SLI and their raw scores on vocabulary tests and the elicited production task.

SLI	Age	Sex	Therapy	Time in	CLASS	ROWPV	EOWPV	Regular	Irregular	Novel
1	95	F	no	54	BIL	45	40	0	2	0
2	106	M	yes	66	BIL	51	41	0	4	0
3	93	F	no	93	BIL	54	25	1	2	0
4	94	F	no	94	BIL	80	49	4	2	2
5	92	F	no	66	BIL	53	43	0	2	0
6	91	M	yes	91	ENG	82	67	11	0	9
7	91	M	yes	91	ENG	62	54	7	2	4
8	91	M	yes	36	BIL	67	32	0	4	0
9	104	M	yes	72	BIL	59	39	0	3	0
10	108	M	yes	108	BIL	97	67	3	7	2
11	96	F	no	96	ENG	84	67	11	6	4
12	100	M	yes	100	BIL	73	63	0	4	0
13	94	F	yes	94	BIL	62	26	0	3	0
14	93	F	yes	93	BIL	50	25	0	4	0

The Grammaticality Judgment Task

Children performed grammaticality judgments on the accuracy of regular and irregular past tense verbs as they occurred in six types of productions: correct regular (e.g., "he pulled it"), correct irregular (e.g., "he made it), bare stems (e.g.,

"he eat it"), lexically marked bare stems (e.g., "he already drop it"), overregularizations, (e.g., "he sticked it"), and irregularizations (e.g., "he tode it" – "tied"). Because only four responses were available for each of these six categories, the group means were compared using a *t* test comparison. Accuracy on this task was determined by acceptance or rejection of grammatical forms that are consistent with standard English past tense use. The accuracy of judgments by category and group appear in Table 8. *T* tests demonstrated that the groups differed significantly on the acceptance of correct regular verbs ($t = 2.255, p < .023$), on the acceptance of bare stem errors ($t = -2.515, p < .018$), and, on the acceptance of lexically marked bare stem errors ($t = -3.222, p < .003$). Conversely, *t* test comparisons failed to yield significant group differences for the acceptance of correct irregular verbs ($t = 1.193$, $p = .243$), the acceptance of overregularization errors ($t = -.527, p = .602$), or the acceptance of irregularization errors ($t = .905, p = .373$).The following table illustrates that children with SLI accepted significantly fewer correct regular past tense forms, and significantly more bare stem responses in the bare stem category and the lexically marked bare stem category in comparison to the TD peers. The fact that children in both groups overwhelming rejected the irregularization errors validates the paradigm.

Table 8. Means and standard deviations for the acceptance rates, also expressed as percents, for each sentence type by group.

	TD Group (n = 17)	SLI Group (n = 14)	T value (d = 29)	p
Accurate Regular verbs	3.70 (.4697) 93%	2.285 (1.204) 73%	2.255	.032
Accurate Irregular verbs	2.764 (1.032) 69%	2.2857 (1.204) 57%	1.193	.243
Overregularization Errors	1.882 (.8575) 47%	2.0714 (1.141) 52%	-.527	.602
Bare Stem Errors	1.4118 (1.27) 35%	2.6429 (1.446) 66%	-2.515	.018
Lexically Marked Bare Stem Errors	.5882 (1.175) 15%	2.1429 (1.511) 54%	-3.222	.003
Irregularization Errors	.2425 < 1%	0 0%	.905	.373

The acceptance rate on a four point scale appears for each group according to sentence type followed by the standard deviation scores in parentheses. The mean

acceptance rates were converted to percentages which appear below. Children in the TD group accepted regular past tense verbs significantly more often than children in the SLI group, 93% for the TD group and 73% for the SLI group. Although children in the TD group accepted correct irregular past tense verbs more often (69%) than children in the SLI group (57%), the groups were not significantly different on this comparison. However, the groups differed in how they "fixed" the rejected forms. Children in the TD group fixed the irregular past tense forms by overregularizing in 13 of 21 instances (61.9%), compared to only 8 of 24 instances (33%) by children with SLI, who typically fixed the rejections by supplying bare stems. The groups treated the individual verbs in a similar fashion when deciding which verbs to reject. The order of rejection was "bought", "flew", "took" and "shut" for both groups.

The groups did not differ significantly in their acceptance of overregularized irregular verbs, 47% for the TD group, and 55.5% for the SLI group. Children in the TD group accepted "sticked" in 76.4% cases, compared to 71.4% for children with SLI. Children in the TD group accepted "throwed" in 64.7% of cases, compared to 78.5% for children with SLI. Children in the TD group accepted "maked" with 41.1% of cases, compared to 71.4% for children with SLI. Finally, neither group accepted "hitted" to any degree, with the exception of one child in the TD group. Intuitively, the children in the SLI appeared to be less discriminating in their acceptance of overregularizations. However, a chi-square analysis revealed no significant differences between groups, x^2 (1, $N = 31$) = .149, p = .093, possibly due to the few number of items (four in each category) included in the analysis.

The following analysis examined whether the acceptance of bare stem errors on the grammaticality judgment task predicted bare stem use on the elicited production task. A similar analysis examined whether the acceptance of overregularization errors on the grammaticality judgment task could predict the extent of overregularization errors on the elicited production task. The analysis shown in Appendix N revealed that acceptance of bare stem verbs on the grammaticality judgment task significantly predicts the extent of bare stem errors by group for regular verbs ($z = 3.48583, p < .001$), irregular verbs ($z = -3.93525, p < 001.$), and for novel-verbs ($z = -2.0067, p < .05$). Thus, acceptance of a bare stem error on the grammaticality judgment task increased the likelihood of producing a bare stem by an odds ratio of 2.36 to 1 for regular verbs, and by 1.72 to 1 for irregular verbs. However, for novel verbs accepting bare stem errors reduced the odds of producing bare stem errors by about a quarter or .74 to 1.00. Similarly, acceptance of overregulariation errors on the grammaticality judgment task had a significant negative effect on the extent of overregularized irregular forms on the elicited production task ($z = -3.51648, p < 001.$), as appears in appendix J. Thus, acceptance of a sentence containing an overregularized verb on the grammaticality judgment task reduced the odds of producing an overregularization error by approximately two-thirds, (.38 to 1.00). This pattern was most likely attributable to the fact that the groups did not differ on their acceptance rates for sentences containing overregularized verbs.

Individual patterns for making grammaticality judgments

The following tables illustrate how each subject performed on each of the sentence types included in the grammaticality judgment tasks. Each row shows identifying information for each subject including age, sex, time in the United States, and type of class enrollment (Bilingual / English). This information is followed by the total number of accepted responses for each sentence type – accurate regular verb, accurate irregular verb, bare stem verb, lexically marked bare stem verb, and overregularized verb. Patterns for Children in the TD group are presented in Table 9; patterns for children in the SLI group are presented in Table 10.

Table 9. Individual response patterns for children in the TD Group on the grammaticality judgment task.

TD	Age (mo.)	Sex	Time in U. S.	Class	Regular	Irregular	Stems	LMstems	Overregs
1	90	M	90	ENG	4	3	1	0	1
2	91	F	91	BIL	4	3	1	0	2
3	89	F	89	BIL	4	4	1	0	1
4	104	F	104	BIL	4	3	3	4	2
5	96	M	96	BIL	4	2	1	0	2
6	88	F	30	BIL	3	2	2	0	0
7	87	M	60	BIL	3	3	1	0	3
8	98	F	30	BIL	4	2	4	3	1
9	98	F	98	ENG	3	2	1	0	3
10	88	F	88	BIL	3	4	1	1	1
11	108	M	108	BIL	4	2	0	1	2
12	97	M	97	BIL	3	1	4	0	2
13	105	M	105	BIL	4	4	2	0	2
14	96	M	96	BIL	4	1	1	0	3
15	99	M	48	BIL	4	3	0	0	2
16	95	F	95	BIL	4	4	0	0	2
17	97	F	97	BIL	4	4	2	1	1

Table 10. Individual response patterns for children in the SLI group on the grammaticality judgment task.

SLI	Age (mo.)	Sex	Time in US	CLASS	regular	Irregs	Stems	LMstems	Overregs
1	95	F	54	BIL	2	2	4	4	2
2	106	M	66	BIL	2	1	1	3	2
3	93	F	93	BIL	4	4	4	1	3
4	94	F	94	BIL	2	2	2	1	1
5	92	F	66	BIL	4	2	4	4	3
6	91	M	91	ENG	4	2	3	0	4
7	91	M	91	ENG	4	1	0	0	3
8	91	M	36	BIL	1	1	3	2	2
9	104	M	72	BIL	4	4	4	4	3
10	108	M	108	BIL	3	4	3	2	1
11	96	F	96	ENG	4	4	0	0	1
12	100	M	100	BIL	3	1	3	3	1
13	94	F	94	BIL	4	2	4	3	3
14	93	F	93	BIL	0	2	2	3	0

Summary

Bilingual children with TD and bilingual children with a history of SLI were compared on their use of the English past tense using an elicited production task.

Performance was measured across three verb categories, regular, irregular, and novel. The groups differed in the overall accuracy of past tense use according to verb type, and the types of errors produced. Although children with SLI performed proportionally and absolutely lower than their TD peers on all verb categories, a significant interaction indicated that they did better on irregular verbs. The groups differed quantitatively and qualitatively on error types. Children with TD produced significantly more "good errors" (e.g., overregularization and double marking); whereas, children with SLI produced more "bad errors" (e.g., bare stems, stem + ing, and, other errors). Significant positive correlations were found between receptive and expressive vocabulary measures and the production of regular, irregular, but not novel past tense forms. In another analysis, the effects of English language use by parents and siblings served as a variable to predict performance on the elicited production task. English language use by parents, but not siblings significantly affected performance in a positive direction for both groups, and this influence was strongest for the production of regular verbs. Finally, children's performance on a grammaticality judgment task served to provide converging evidence for the production data.

CHAPTER IV

Discussion

Accurate identification of language impairment among early sequential bilingual children for research and clinical purposes is hampered by our lack of knowledge regarding the patterns of typical and atypical bilingual development. When bilingual children are compared to monolinguals in either language, specific language skills may appear deficient, resulting in the awkward and unwarranted use of the term "semilingualism" to account for bilingual differences (Owens, 2001; Romaine, 1994). Comparing bilingual speech to a monolingual standard is justifiable only as a first step. In the next phase, it becomes crucial to outline the patterns of similarity and divergence from the monolingual model that characterize typical and atypical bilingual language development. Although a substantial literature addresses monolingual acquisition of English past tense morphology, the psycholinguistic models currently in use do not fully extend to bilingual situations. In particular, the phenomenon of overregularization may assume a more prominent role.

The present study examined the use of English past tense forms in two groups of bilingual Spanish/English speaking children between 7 and 9 years of age. The groups consisted of 17 typically developing (TD) children, and 14 children with specific language impairment (SLI) who were currently receiving or had previously received speech-language therapy intervention. Additional information regarding family history of language learning difficulty further substantiated the accurate assignment of group membership (Restrepo, 1998). Although production of the past

tense is problematic for English-speaking children with SLI and adults learning English as a second language, less has been known regarding early sequential bilingual children's production of these forms. The patterns exhibited by early sequential bilingual children both simulate and depart from monolingual expectations. We illustrate how both groups perform across the various experimental tasks in relation to the proposed hypotheses, and discuss our results within the theoretical frameworks outlined in chapter one. The extension of previous research to bilingual populations also increases our understanding of SLI in monolingual English speakers.

The Elicited Production Task

Consistent with what has been reported for monolingual English speakers with SLI, bilingual children with SLI exhibited unusual difficulty in producing past tense forms for regular, irregular, and novel verb forms on an elicited production task compared to age-matched controls. Additionally, the profiles of typical and atypical bilingual development differed. Typically developing bilinguals were better at producing regular than irregular past tense verbs; however, the reverse was true for children with SLI. Bilingual children with SLI performed poorly on all verb types, yet performed significantly better on irregular verbs relative to regular and novel verbs. Given the possibility that the observed interaction could be attributed to the nature of the stimuli, a separate analysis was performed excluding "hit" and "shut" because children with SLI tended to more produce bare stems as responses. Still, a significant interaction was obtained even when the two verbs that did not did not alter the stem for past tense production ("hit" and "shut") were excluded from the

analysis. Although both groups performed less accurately on the novel verb category, novel forms resulted in a greater number of phonological errors for children with SLI.

The groups of typical and atypical bilingual learners differed according to frequency of error type, and the degree of productivity served to partition out children with SLI from normal controls. As predicted, bilingual children with SLI produced errors that were quantitatively and qualitatively different from those of typically developing peers. Morphological productivity surfaced as a serious challenge to these children. In the present study, bare stem errors were fairly common to children in both groups, accounting for approximately 79% of the errors by children with SLI and 56% of the errors by TD children, as were "stem + ing" errors, accounting for 15% of errors among the TD children and 16% of errors among children with SLI. Both of these errors have been reported to occur in the speech of younger typically developing English speakers (Berko Gleason, 1958). In the treatment of novel verbs, children with SLI were more likely to revert to earlier developmental patterns, especially the "stem + ing" error, possibly due to the added difficulty of dealing with novel forms for which no established representation was available. Novel forms presented the added challenge of generalizing rule knowledge to unfamiliar verbs.

In the present study, the parents' but not siblings' use of English at home predicted the accuracy of past tense use. These results are inconsistent with the assumption of a positive effect of siblings' use of English at home. Several factors can account for this lack of sibling effect. First, because most children resided in

multiple-family dwellings, the definition of sibling was extended to include other children living in the home with whom the participants were reported to have had ongoing contact. Second, because the study was not designed specifically to answer the question of sibling influence, birth order was variable but not balanced across the two groups. Third, the age gap between a participant and an older sibling was sometimes quite large, and there may have been less direct sibling contact in these situations. Finally, the amount of time spent directly between the participant and each sibling was not collected. For these reasons, the present results differ from those of other studies.

Bare stem errors.

Similar to monolingual children with SLI, bilinguals produced bare stems as the most common error response. Bare stem errors accounted for 88% (117) of the errors for regular verbs, and 73.3% (85) of the errors on irregular verbs, and 63.3% (170) of the errors for novel verbs. These errors are identical to those produced by native English speakers during acquisition, suggesting that it is the ambient language that is shaping children's use of past tense morphology.

The influence of the Spanish dialect spoken at home on English past tense forms was also considered. Certain dialects, specifically Caribbean Spanish, omit or nasalize final consonants. However, none of the children in the SLI group came from homes where a Caribbean dialect of Spanish was spoken. Furthermore, the three children in the TD group who came from homes where Caribbean Spanish was used all evidenced production of final consonants.

Overregularization errors

Overregularization errors were relatively rare among children with SLI, accounting for only 4% of the total errors, compared to 28% of the errors produced by TD controls. Similar to previous reports for monolingual children with SLI (Marchman, Wulfeck, & Ellis Weismer, 1999; Oetting & Horohov, 1997;), there was evidence of productivity in the form of overregularization errors for both groups. However, the rates of productive errors (i.e., good errors) versus non-productive errors (i.e., bad errors) were significantly lower in the SLI group. Although other comparisons that used age-matched controls (Marchman, Wulfeck, & Ellis Weismer, 1999), found no significant differences in the rates of overregularization between groups, the present data differ. When children in the TD group erred on irregular past tense production, overregularization accounted for 61.9% (65) of these errors. Contrast that figure with the mere 14.7% (17) of overregularization errors produced by children with SLI. Thus, the present data refute the claim that children with SLI and TD both exhibit flexible and productive past tense use (Marchman, Wulfeck, & Ellis Weismer, 1999).

Further evidence of reduced productivity comes from the comparison of "good" (i.e., productive) versus "bad" (i.e., non-productive) error types. The typically developing children produced far more of the "good" productive than the "bad" non-productive errors. Good errors were evidence of a child's morphological productivity and consisted of overregularization (e.g., "buyed") and double marking (e.g., "burneded"). The children with SLI produced more "bare stems" and "stem + ing" errors. Although the use of lexically marked stems (e.g., "he already eat" for

"he ate") has been informally noted among African American children attending the local Head Start Center, children in the present study did not produce these forms spontaneously. The substitution of verb stems for regular past tense appears in certain varieties of African American English (Washington & Craig, 1998). However, these morphological variations sometimes noted in the children's speech community are not reflected in the speech of typical L2 Spanish/English speakers in the second grade, possibly for the following reason. Based on parental report, children in the present study appeared to be learning English from other bilingual speakers that included parents, siblings, and teachers at school. Although Hispanic and African American children were enrolled in the same classes at the preschool level, most children in the present study were enrolled in bilingual classes since Kindergarten thus reducing the potential extent of verbal interaction between the groups.

Phonological errors on novel verbs

Consistent with other reports (van der Lely & Ullman, 2001; Oetting & Horohov, 1997), children in both groups were sensitive to the phonological characteristics of the novel verbs and did not differ on the apparent strategies used for generating past tense forms. Although children with SLI were consistently lower in producing the past tense on novel verbs, children in both groups appeared to rely on similar phonological cues, such as leaving stems ending in alveolar sounds unmarked. Group differences emerged with respect to the presence of phonological errors on novel verbs by children with SLI.

The role of frequency

According to the single-mechanism model, the frequency that a particular past tense form is available in the spoken input determines children's accuracy on that form. The present data do not support a single-mechanism hypothesis, as indicated by the lack of significant correlations obtained for the spoken frequency ratings and the accuracy of past tense production, even when Spearman's rho was employed with a one-tailed *t* test. The spoken frequency ratings for regular past tense verbs included in the present study ranged from 6 – 64, (M = 19.5), compared to a range of 33 – 237 (M = 89.08) for irregular past tense forms. Yet regular verb past tense forms were generally produced more accurately, and no relationship existed between frequency and irregular past tense use.

In monolingual development, frequency determines accurate production of irregular but not regular past tense (Bybee & Slobin, 1982). One possible reason for not obtaining frequency effects for irregular verbs in the present study was the limited range of frequency ratings among the twelve irregular items. Other studies of frequency effects (Marchman, Wulfeck, & Ellis Weismer; 1999; Oetting & Horohov, 1997; van der Lely, & Ullman, 2001) relied all or in part on adult frequency data. But the primary aim of the present study was to choose familiar verbs that were likely to have occurred in the environments of the participants. Consequently, past tense verbs that appeared in the spontaneous language of Head Start preschool children across four socio-economic and racial groups were targeted for inclusion (Hall, Nagy & Linn, 1984). Many appeared as high-frequency items in other studies (Marchman, Wulfeck, & Ellis Weismer, 1999; Oetting, & Horohov,

1997), but the low-frequency items used in other studies (e.g., shed, mend, plug) were absent among the present stimuli.

Although frequency was not directly manipulated, frequency was influenced by familiarity with specific verb items on three levels. The novel words represented a level of zero frequency, and the remaining items represented low-familiarity (e.g. "caught") and high-familiarity ("took") forms. The possibility exists that the low frequency items used in other studies served the same function as novel forms in the present. Recall that a strong correlation exists between regular and novel past tense use. This being the case, there is clear counterevidence to frequency effects for the three categories of verbs sampled, thereby weakening the single-mechanism account.

Another explanation for the failure to obtain frequency effects for irregular verbs is that the status of frequency and regularity may be different in bilingual speech communities. Additional descriptive data that describe typical usage patterns in bilingual populations are needed to explore this possibility.

Vocabulary Measures

Vocabulary measures represent the most significant point of departure when comparing early sequential bilingual children to their monolingual counterparts. Two formal measures were used to evaluate the extent of the children's English vocabulary using a picture labeling task (*EOWPVT-2000*) and a single word recognition task that involved matching spoken words to pictures. (*ROWPVT-2000).* Several comparisons of aged matched monolingual English-speaking children with and without SLI to typically developing controls show differences on vocabulary

tests (Rice, Wexler, Marquis, & Hershberger, 2000; Marchman, Wulfeck, & Ellis Weismer, 1999; Oetting & Horohov, 1997). This was not true in these bilingual children. The groups did not differ on the raw scores, nor did the scores improve with age. Previously reported higher correlations between vocabulary and irregular past tense use were not replicated. Although chronological age predicts accuracy among monolingual children on the receptive and expressive versions of this test, recent years of residency in the United States, but not chronological age, was found to significantly predict accuracy among the bilingual speakers in the present study.

Standard vocabulary tests assume that specific words are acquired at different ages. Hence, the test items are arranged according to a presumed level of difficulty that coincides with chronological age. When several consecutive items are missed, testing is discontinued. Such practices fail to accurately measure a bilingual's word knowledge because length of exposure to English significantly increased the likelihood of getting an item correct; whereas, an increase in chronological age did not effect a positive change.

Another departure from monolingual performance lies in the interpretation of a discrepancy between scores on the receptive and expressive versions of this test. According to the test manual, a statistically significant difference on these scores would suggest a problem related to the child's ability to access and retrieve specific labels. This might lead to over-identification of typically developing bilingual children as having language-learning disorders. However, the discrepancy between the receptive and expressive scores by children in both groups may be indicative of the unique way that early sequential bilinguals label pictures.

Low vocabulary scores in bilingual populations may be due to the fact that the child may have learned an object label in only one of the languages. Testing in one language and use of monolingual norms do not take into account such differences. However, a more interesting explanation relates to bilingual processing differences. Studies on lexical priming in bilinguals reveal differences on receptive and expressive tasks. Whereas receptive tasks appear to have a facilitative effect, inhibition effects occur on expressive naming tasks, suggesting a competition between the bilingual's two forms. Priming experiments with monolinguals even show that naming is faster when the individual is not distracted by related words (Porter, So, von Eckardt, & Feldman, 1984). The situation is complicated in bilingualism. When a picture is shown, representations from both languages may be activated and ability to ignore a word in the first language may be hampered (Dijkstra, Timmermans, & Schriefers, 2000; Jared & Kroll, 2001). Competition between the two forms may slow down naming as active inhibition and disregarding of the other language is required. Evidence of slowed naming and increased demands on attentional processes were revealed in an online study of picture naming by early sequential Spanish/English bilingual children. An fMRI study of picture naming showed that slowed reaction times were accompanied by increased activation in the prefrontal cortex when both languages were used in the mixed language condition (Hernandez, Martinez, & Kohnert, 2000). Thus, in the present study, when the child saw a picture of an object, both forms may have been activated. In fact several children said that they knew an item label in Spanish, before producing the English equivalent.

Degrees of language proficiency have also been shown to influence lexical associations across languages in adult trilinguals (Goral, 2001). In children aged 4 – 10 years, highly proficient bilingual children had greater accuracy and faster reaction times for naming pictures in each language (Kohnert, Bates, & Hernandez, 1999). Additional on-line measures to explore bilingual representation and processing may reveal useful information on the differing ways that bilinguals represent and retrieve lexical information. Bilingual children with SLI may differ from typically developing bilingual peers as a result of the demands for increased attention during online picture naming in the mixed language condition.

In the present study, previously reported correlations between vocabulary measures and irregular past tense production in disordered populations (Ullman, & Gopnick, 1999; Clahsen, & Almazan, 1998; and, Oetting, & Horohov, 1997) were not upheld. Although failure to obtain such correlations falls short of supporting a dual mechanism model, there is evidence to suggest that vocabulary measurements mean something different in bilingual populations. Thus, the model doesn't apply. Among monolingual English-speakers, chronological age and educational experience predict accuracy on irregular forms (Bybee, & Slobin, 1982); yet, the same does not hold true for bilingual speakers. In the present study, vocabulary scores were more predictive of the accuracy for regular rather than irregular verbs for both groups of children, and parental use of English fostered increased accuracy on regular past tense use. In monolinguals, the older you get the higher you score. Yet with bilinguals, receptive and expressive scores increase with time spent in the United States. Expressive vocabulary scores may reflect competition in naming

between a bilingual's languages and consequently were not useful for determining the existence of a dual mechanism for past tense production.

The lack of observed differences between groups of impaired and non-impaired bilingual children are consistent with other studies of bilinguals that have failed to show that performance on English vocabulary measures are useful for identifying language impairment in bilingual children (Restrepo, 1998). And taken alone, vocabulary measures have failed to distinguish typical from atypical language learners in monolingual populations.The task of accounting for all items in an individual's experience becomes increasingly challenging with age. Exposure to more than one language system, as in the case of bilingualism, further complicates the challenge.

Recent bilingual editions of the *EOWPVT* and *ROWPVT* (Academic Therapy Publications, 2001) recommend that the child label a missed vocabulary item in the other language if it is available. Although this practice may give a more comprehensive measure of the bilingual child's overall picture labeling ability and semantic knowledge, this procedure was not adopted. Vocabulary scores were used to measure the potential correlation between retrieving object labels depicted in pictures and retrieving irregular English past tense forms from the lexicon.

Single- Versus Dual-mechanism

The high correlations between accuracy on regular and novel-verb forms lend support to children's ability to apply the "add -ed" morphological rule, and argue against the frequency effects that drive single mechanism accounts. Children who could produce regular forms could also apply the same rule to the novel-form.

Because novel forms have zero frequency ratings, this capability must be rule driven. Although children who were good at producing regular past tense forms were also better at irregular forms, this correlation was somewhat weaker, suggesting something else. Another explanation is possible. A different type of rule, perhaps phonological, may be required for the production of past tense irregular verbs. The rules for producing irregular forms are similar to those involved in derivational morphology and involve internal word changes relating to the vowels, in addition to endings. This process differs from operations involving inflectional morphology that add suffixation.

The ability to produce past tense irregular verbs involves both the implementation of phonological rules for the storage and retrieval of lexically learned verbs. Phonological working memory deficits (Marton, 1998; Gathercole, & Baddeley, 1990) and more general memory and retrieval problems in children with SLI (Edwards & Lahey, 1998) make this a plausible prospect.

Support for a dual mechanism model is provided by the group interaction for the treatment of regular and irregular verbs because these verbs were treated differentially by the two groups of children. In a dual mechanism model, the ability to apply a morphological rule is considered to be dependent on linguistic maturational factors, and on a different kind of memory, rather than on exposure to specific irregular forms (Marcus et al.,1992). The superior performance of TD children in producing past tense forms for regular verbs confirms this supposition. Their significantly lower performance on the irregular verb category supports the notion that mastery of irregular forms is dependent to some extent on prior

knowledge and experience with such forms. The production of past tense irregulars is dependent on experience with, knowledge of, and application of phonological rules for the learning, storage and retrieval of these forms. The opposite pattern exists for the SLI group. Children with SLI, who are by definition less linguistically mature, show extraordinary difficulty in applying the past tense rule to regular verbs. Unlike their TD peers, they performed relatively better, though still poorly, on the irregular verb category. Although they produced past tense irregular forms less accurately, they still treated this verb category differently than the regular or novel past tense forms. Thus, the results support a dual mechanism of past tense production based on the differentially impaired morphological and phonological operations in children with SLI.

Comparison to Other Groups of Children with SLI

Because the groups in the present study performed similarly on the receptive and expressive vocabulary measures, our results warrant comparison with another study that contrasted the performance of children with SLI and normal controls matched on vocabulary scores. Van der Lely and Ullman (2001) found that vocabulary-matched controls performed with 80.2% accuracy on high-frequency regular past tense verbs and with 59.5% accuracy on high-frequency irregular verbs. In sharp contrast, children with SLI performed with 33% accuracy on the high-frequency regular verbs, and with 19.9% accuracy on the high-frequency irregular verbs. The patterns in the present data are strikingly similar. Typically developing bilingual children matched on vocabulary score and chronological age performed with 82.3% accuracy on high-frequency regular verbs, and with 40.4% accuracy on

high-frequency irregular verbs, yet, the children with SLI performed with 22.2% accuracy on high-frequency regular verbs, and with 19.6% accuracy on the high-frequency irregulars. In both studies, children with SLI did not show the same large discrepancy in the production of regular and irregular verbs, nor did they exhibit the enhanced performance on regular past tense forms demonstrated by both groups of typically developing children.

Performance by normal controls in the present group differed from that reported by van der Lely and Ullman (2001) with respect to the numbers of "stem + ing" responses. Although these authors reported no instances of stem + ing responses among younger normally developing controls, typically developing bilingual children also produced these responses (total count 34), though not as frequently as children in the SLI group (total count 78). However, it should be noted that among the TD children this error type was produced almost exclusively by one child (19 errors) who had resided in the US for only 2.5 years. This same child was already using past tense forms to a greater extent than some of the children with SLI who had been living considerably longer in the U.S. Furthermore, the type of verb appeared to influence the extent of stem+ ing error. Novel verbs that required generalization of previous rule learning presented the greatest challenge. Children in both groups produced more of these errors with novel verbs, and this was especially true of children with SLI. Instances of stem + ing errors and the preponderance of these errors with novel forms suggest incomplete learning of the process for past tense production.

Theories of SLI

The Extended Optional Infinitive (EOI) account of SLI is not supported by the present data. Infinitival forms were produced by both groups of children, especially with novel verbs. The EOI account fails to explain why TD children would revert to the optional infinitive stage when presented with novel verb forms. Perhaps, the interaction of phonological information from the stem ending and the absence of a long-term representation for the novel verbs hinder morphological productivity. Additionally, the EOI account does not explain why bilingual children with SLI are capable of using tensed forms in Spanish. Four children in the SLI group also participated in another elicited production task that was administered within a few months of the present study, and exhibited no difficulty with Spanish past tense inflections. Furthermore, as pointed out by other investigators (Paradis & Crago, 2000) the use of infinitive forms by older school-aged second language learners weakens the assumed biological ties with the proposed optional infinitive stage.

The differential treatment of verb types by groups, together with the increased number of phonological errors on novel verbs by children with SLI lends support to a Limited Processing Capacity account (Leonard, 1998) of SLI. Children with SLI were better at irregular verbs, and children who were TD were better at regular verbs. When TD children erred on irregular verbs, the tendency was toward overregularization, yet children with SLI were most likely to produce bare stems. A limited processing capacity account claims that as the number of mental operations come into play, increasing the demands on attention, memory, storage, and retrieval, performance on linguistic tasks diminishes. According to this account, children with

SLI differ from normal controls only in their capacity for handling the various operations. The additional challenge of dealing with novel forms was apparent in the high rates of bare stem errors by both groups. However, children in the SLI group reverted to an even earlier developmental error characterized by failure to separate the stem from the "ing" inflection in their responses.

The higher prevalence of phonological errors by children with SLI in the production of novel past tense forms supports a limited processing account of SLI. Although typically developing peers showed negligible difficulty in reproducing the phonological information in the novel forms, children with SLI exhibited increased difficulty in retaining the new information despite having had the same opportunity to repeat the prompt after the examiner at the onset of each trial. Unlike the performance of TD children, children with SLI produced more phonological errors when dealing with novel forms, a pattern that also exists in the data set reported by van der Lely and Ullman (2001). Consistent with their results, phonological errors were rare in both groups for true regular and irregular verbs. These results are consistent with previous reports documenting the difficulties experienced by children with SLI on nonword repetition tasks (Campbell, et al., 1997; Dollaghan & Campbell, 1998; Edwards & Lahey, 1998; Ellis Weismer, et al., 2000), and substantiate the added practice needed by children with SLI for the learning of novel forms. Hence, children with SLI might be experiencing processing capacity limitations that affect differing processing components. Breakdown may occur in the ability to encode these forms in working memory, their storage in long term memory, or accurate retrieval.

A substantial literature documents that children with SLI differ from typically developing controls in the learning of novel words (see Leonard, 1998 for a review). Several studies conducted by Leonard, Schwartz and colleagues in the 1980's demonstrated unique differences in lexical learning from early ages. The learning of action words used in transitive situations proved to be harder for children with SLI, and children with SLI showed reduced performance extending the forms in productive tasks (Camarata & Leonard, 1886; Camarata & Schwartz, 1985; Leonard, Schwartz, Chapman, Rowen, Prelock, Terrell, Weiss, & Messick, 1982; Leonard, Schwartz, Swanson, & Loeb, 1987; Schwartz, 1988; Schwartz, Leonard, Messick, & Chapman, 1987). This line of research was extended to explore children's fast mapping (quick incidental learning) of novel words. Children with SLI learned to associate novel words on a comprehension task via fast mapping strategies that were similar to those used by typically developing controls, but required additional opportunities involving practice and learning before they could use the new words spontaneously (Dollaghan, 1987; Rice, Buhr, & Nemeth, 1990; Rice, Buhr, & Oetting, 1992).

The prevalence of phonological errors by children with SLI shows that the problems extend beyond adding -ed to a segmented verb stem. They show low rates of productivity overall, and fail to learn fully a set of complex verbs that are learned, stored, and retrieved according to phonological characteristics. One bilingual child with SLI produced "blot" for "dropped". However, when unfamiliarity was introduced into the task, as in the production of novel verb forms, children in the SLI group made more phonological errors. Children in both groups occasionally

substituted a real verb for a phonologically similar novel form (e.g., keating/killed, powing/pour; powing/pulled; and, baping/baked). However, children in the SLI group produced more phonological errors that did not constitute substitution of real forms (e.g., gurning/gurk, knopping/lop, lutting/blutting, dilling/litting, baping/biped, linding/limb, knopping/bop, knopping/mop). These errors clearly illustrate the multiple language processing difficulties exhibited by children with SLI.

The increased presence of phonological errors on the production of novel verbs provides further evidence that the problems experienced by children with SLI extend beyond tense marking deficits. Although not the focus of this study, the error patterns are consistent with previous reports of memory and memory-retrieval deficits in children with SLI (Marton, 1998). The difficulties extend beyond morphological acquisition to lexical learning. Although the groups did not differ on the vocabulary measures utilized (EOWPVT, ROWPVT), the performance demands for these tasks were not particularly challenging with respect to processing capacity. Most pictures depicted objects as referents and relatively few verbs were included overall. Children were merely required to label the action (e.g., painting). Moreover, factors related to competition of selection during naming, language proficiency, and length of exposure to English influenced performance on these tasks.

The use of novel forms has proven to be beneficial for manipulating frequency effects in monolingual studies (Schwartz, 1988), and holds tremendous promise for examining potential language difficulties in bilingual children. Frequency effects are helpful in analyzing the performance of monolingual speakers because they provide

an opportunity to compare children's differential treatment of forms for which they have previous experience and knowledge. Because we cannot assume that bilingual children have had the same amount of exposure and experience with certain forms, the use of novel items reduces the bias imposed by interpreting bilingual performance according to monolingual standards.

The Grammaticality Judgment Task

The acceptability ratings for specific grammatical structures largely matched the production data, with the exception of overregularization errors. Children performed grammaticality judgments on the accuracy of regular and irregular past tense verbs as they occurred in six types of productions – correct regular (e.g., "he pulled it"), correct irregular (e.g., "he made it"), bare stems (e.g., "he eat it"), lexically marked bare stems (e.g., "he already drop it"), overregularizations, (e.g., "he sticked it"), and irregularizations (e.g., "he tode it" – "tied"). Children with SLI produced higher numbers of bare stems and accepted bare stems at a higher rate (66%), compared to children in the TD group (35%).

Children's grammaticality judgments were examined as predictors of overall accuracy on the elicited production task and type of error produced. Specifically, the acceptance of bare stem errors on the grammaticality judgment task predicted the use of bare stems on the elicited production task. However, the same prediction did not hold true for overregularization errors. Although children in both groups accepted overregularization errors half of the time, children with SLI rarely produced them. The judgments for correct and overregularized irregular verbs are interesting for both groups of children. Children in both groups were more likely to

accept correct production of regular as opposed to irregular past tense forms, and typically developing bilingual children "fixed" the correct irregulars by overregularizing in 61.9% of instances. This pattern is evidence that the phenomenon of overregularization assumes a more prominent status among bilingual speakers, consistent with the predictions of Maratsos' competition model (2000).

Both groups accepted overregularization errors approximately half of the time (47% for the TD group and 52% for the SLI group) suggesting that they were behaving at chance levels for these forms. Neither group accepted irregularization errors to any significant degree, an outcome that validates the grammatical judgment task. A limitation in the grammaticality judgment task lies in the small number of items (4) in each category. It is possible that a larger number of items would have revealed above chance performance.

Although the use of lexically marked and zero-marked stems (e.g., "he already eat" / "he eat" for "he ate") occurs in African American English (Craig, & Washington, 1998) and has been informally noted among African American children attending the local Head Start Center, children in the present study did not produce lexically marked stems spontaneously, nor did they regard them as acceptable in the grammaticality judgment task. Typically developing children rejected these sentences with lexically marked stems at a high rate, and changed the stem to the past tense. Children in the SLI group also rejected the sentences with lexically marked stems. However, they fixed the sentence by omitting the lexical marking "already", without converting the stem to the past tense.

Directions for Future Research

The extent to which theories of morphological representation and processing predict the outcome of second language acquisition in typically and atypically developing early sequential Spanish/English bilinguals can be further examined. Comparisons to MLU matched bilingual children who are also matched on socio-economic status, language level, and relative length of exposure to English would be desirable. Such information would shed light on the extent to which morphological characteristics of bilingual children with SLI vary from normally developing bilingual children functioning at a similar language stage. As a result, problems specific to SLI, not exclusively attributable to delayed language development, could be identified. A cross-sectional comparison of monolingual English speakers from the same community matched on language level would also provide insights into the potential differences between monolingual and bilingual speakers. This would help inform a theory regarding the patterns and stages of l2 acquisition. Second language acquisition of English may simulate monolingual acquisition overtime, or may differ as a result of factors such as age of acquisition, length and frequency of exposure to English, degree of bilingualism maintained, and presence or absence of SLI. Performance by children from other L1 backgrounds might yield additional information regarding the influence of other first languages on the acquisition of English. Spanish and English share many structural similarities that may account for how children performed on the experimental tasks. However, children from more structurally different native language backgrounds, such as Cantonese, might exhibit divergent patterns resulting from first language influence.

Currently, word frequency counts are not available for the population of bilinguals presently studied. This precludes proper examination of the frequency effects that are so central to single mechanism accounts of past tense production. Frequency assumes experience with a linguistic form. Controlling for frequency assumes that all participants have had similar exposure to the forms used in testing. Existing word frequency counts are based on monolingual English speakers. Spoken word frequency data for bilingual children at home and in school settings are needed to determine if irregular verbs maintain their same irregularity status for the English that is spoken in bilingual communities. Consequently, additional descriptive data are needed before the hypotheses that have been proposed for English speaking children with SLI can be tested in bilingual populations.

An extension of the grammaticality judgment task to include more items in each sentence violation category would prove useful to compare children's judgments to the production data for each specific verb. Thus, it would be possible to determine if children who produced a correct irregular form also accepted an overregularization of the same form. Bilinguals may entertain more than one form and select a preferred form depending on the speaking context.

The present data represent a discreet point in the acquisition process. Longitudinal or cross-sectional studies at differing ages and stages of second language acquisition are needed to provide information about how children's past tense productions and grammaticality judgments change over time. Such information is crucial to forming a theory of morphological representation and processing that applies to bilinguals as well as monolinguals. Despite the imposing

bias of previous research, the world norm is not monolingual language acquisition. In fact, most of the world's population speaks more than one language (Grosjean, 1984), and the numbers of children entering schools are increasingly from bilingual homes (US Census Bureau, 2001). Without an adequate theory of typical bilingual acquisition, the task of pinpointing atypical patterns remains unfeasible.

Conclusion

This study focused on the extent to which theories of morphological representation and processing predict the outcome of second language acquisition in typically and atypically developing early sequential Spanish/English bilinguals. Typically developing bilingual children (TD group) and bilingual children with a history of specific language impairment (SLI group) were compared on their use of the English past tense using an elicited production task. The groups differed in the overall accuracy of past tense use according to verb type, and the types of errors produced. Children with SLI performed more poorly than their TD peers on all verb categories. Within the groups, the TD children did best on regular verbs; whereas, the children with SLI did better on irregular verbs. The groups differed quantitatively and qualitatively on error types. Children with TD produced significantly more "good errors" (e.g., overregularization and double marking); whereas, children with SLI produced more "bad errors" (e.g., bare stems, stem + ing, and, other errors). Significant positive correlations were found between receptive and expressive vocabulary measures and the production of regular and irregular past tense forms, and the effect was stronger for regular verbs. Finally, grammaticality judgments were generally consistent with the production data, with

one exception being the acceptance of overregularization errors by children in both groups.

Current models of past tense production and representation require some modification when being extended to bilingual and second language acquisition situations. This seems especially true when considering the role of frequency for irregular past tense forms and the resulting phenomenon of overregularization. Given the potential for fewer instances of irregular forms in the input, our results are consistent with a Competition Model (Maratsos, 2000) suggesting that bilinguals may produce and accept overregularizations for an extended time period.

A dual mechanism model of past tense production and representation is supported by the groups' differential performance on the production of regular and irregular forms. The extent of overregularization errors and acceptance of overregularized forms on the grammaticality judgment task suggests that both regular and irregular forms may remain active longer in bilinguals. A bilingual individual who has heard both forms (e.g., "catched" and "caught") may entertain both in representation and use one or the other depending on the speaking context. Natural language samples obtained from a limited number of participants confirmed that children entertained and used both forms of the same verb in a narrative task. However, we still don't know the eventual outcome of overregularization in bilingual communities. The following question remains unanswered. Do bilingual children continue to accept overregularizations as part of a spoken bilingual dialect in later school years or does this phenomenon represent a transient stage of second language acquisition? Also, if use of an overregularized form constitutes a particular

dialect feature, then bilingual individuals may choose one form over another depending on the speaking context. Additional data from older children, bilingual teachers, and adult bilingual speakers in this community are needed to begin to answer this question.

The comparisons between typical and atypical bilingual language learners in the present study mimic that of monolinguals with respect to lexical learning, morphological productivity and phonological difficulties. In comparing children with SLI to normal peers, there are relatively minor differences in lexical ability, compared to the striking differences noted in morphology, and to a lesser extent, phonology (Leonard, 1998). Although typical and atypically developing bilingual children did not differ on the vocabulary measures, differences were obtained on the production of irregular past tense forms, with children in the SLI group performing significantly worse. This would imply that irregular past tense production and lexical knowledge do not derive from an identical learning mechanism. Rather, it appears that the rule learning deficits exhibited by children with SLI on the past tense production of regular verbs also surface when producing the past tense of irregular verbs. However, the difference lies in that the rules for generating irregular past tense forms may be phonological in nature, largely similar to the schemas described by Bybee and Slobin (1982). Although group studies of children with SLI show that some children experience problems in the area of phonology, not all children exhibit phonological problems to the same extent as for morphology (Leonard, 1998).

Although one might be tempted to equate eight-year-old bilingual children with younger monolingual children, such comparisons are inappropriate for several reasons. Monolingual English speakers begin to produce regular past tense forms at approximately 2 ½ years of age, but do not produce these forms with high rates of accuracy until age 4- 5. Yet prior to reaching this linguistic milestone, these children attain accuracy on the production of the highly frequent irregular forms. As a result of the difference in chronological age, children in the present study appeared to possess a linguistic-cognitive advantage that facilitated a more rapid course of acquisition for learning the regular past tense rule. In fact, two of the TD children who had resided in the US for only 2 years produced regular past tense verbs with higher rates of accuracy than some of the children with SLI who had resided in the US for several years. Aside from the obvious age difference, children in the present study also had increased exposure to formal schooling, literacy concepts, and a wider base of world experiences to draw upon. This experience would have enabled them to employ additional meta-cognitive strategies unavailable to younger language learners. It is also possible that the status or verb regularity may be different in the spoken input to which bilingual children are exposed.

Appendix A

List of Verb Stimuli for Elicited Production Task

Practice trials:

crack – cracked	He cracked it (the egg).
peel – peeled	He peeled it (the orange).
fly – flew	He flew it (the plane).
pour - poured	He poured it (the juice).
open – opened	He opened it (the box).
drink – drank	He drank it (the juice).
cut – cut	He cut it (the apple).
leave – left	He left it (the last chip).

Regular Verbs		Elicited Sentences
burn	burned	He burned it (the match).
turn	turned	He turned it (the lid).
climb	climbed	He climbed it (the tree).
lock	locked	He locked it (the box).
drop	dropped	He dropped it (the plate).
kill	killed	He killed it (the bug).
pull	pulled	He pulled it (the dog).
tape	taped	He taped it (the picture).
push	pushed	He pushed it (the box).
roll	rolled	He rolled it (the ball).

tie	tied	He tied it (the shoe).
move	moved	He moved it (the piece).

Irregular Verbs		Elicited Sentences
throw	threw	He threw it. (the ball)
took	take	He took it. (the toy)
win	won	He won it. (the game)
catch	caught	He caught it. (the fish)
stick	stuck	He stuck it. (the paper)
find	found	He found it. (the ball)
break	broke	He broke it. (the stick)
buy	bought	He bought it. (the candy)
make	made	He made it. (the plane)
eat	ate	He ate it. (the apple)
hit	hit	He hit it. (the monster)
shut	shut	He shut it. (the door)

Novel Verbs		Elicited Sentences
Practice trials:	*goop gooped	He gooped it.
	*gack gacked	He gacked it.
gurn	gurned	He gurned it.
lut	lutted	He lutted it.

dill	dilled	He dilled it.
pow	powed	He powed it.
flimb	flimbed	He flimbed it.
wick	wicked	He wicked it.
mit	mitted	He mitted it.
lind	linded	He linded it.
bape	baped	He baped it.
tull	tulled	He tulled it.
knop	knopped	He nopped it.
keat	keated	He keated it.

Appendix B

Sentences for Grammaticality Judgments

A = accurate regular past tense

B = accurate irregular past tense

C = bare stems

D = lexically marked bare stems

E = overregularized irregular verbs

F = irregularized regular verbs

A = He burned it.

A = He rolled it.

A = He opened it.

A = He turned it.

B = He shut it.

B = He took it.

B = He flew it.

B = He bought it.

C = He push it. (pushed)

C = He eat it. (ate)

C = He pull it.

C = He find it. (found)

D = He already kill it.

D = He already lock it. (locked)

D = He already win it. (won)

D = He already break it. (broke)

E = He throwed it. (threw)

E = He sticked it. (stuck)

E = He hitted it. (hit)

E = He maked it. (made)

F = He tode it. (tied)

F = He topt it. (taped)

F = He clumbed it. (climbed)

F = He drobe it. (dropped)

Appendix C

Questionnaire regarding history of speech and language problems in the family

(Restrepo, 1998)

[History of speech and language problems in the family

Has or had any of the child's (brothers, sisters) any of the following?

	bro/sist	father	mother	par/fath	par/moth
Normal language development	yes no	yes no	yes no	yes no	yes no
Problems of attention or hyperactivity	yes no	yes no	yes no	yes no	yes no
Difficulties in school or learning	yes no	yes no	yes no	yes no	yes no
Dyslexia or problems learning to read	yes no	yes no	yes no	yes no	yes no
Speech or pronunciation problems	yes no	yes no	yes no	yes no	yes no
Language problems / grammar	yes no	yes no	yes no	yes no	yes no
Special education classes	yes no	yes no	yes no	yes no	yes no
Speech and language therapy	yes no	yes no	yes no	yes no	yes no
Special Program for learning problems	yes no	yes no	yes no	yes no	yes no
Omits parts of words after age 3	yes no	yes no	yes no	yes no	yes no
Problems producing sentences	yes no	yes no	yes no	yes no	yes no
Problems making him/herself understood	yes no	yes no	yes no	yes no	yes no
Problems expressing ideas with words	yes no	yes no	yes no	yes no	yes no
Problems following directions	yes no	yes no	yes no	yes no	yes no
Problems understanding questions	yes no	yes no	yes no	yes no	yes no
Problems producing certain sounds	yes no	yes no	yes no	yes no	yes no
Problems reading or learning to read	yes no	yes no	yes no	yes no	yes no

	bro/sist	father	mother	par/fath	par/moth
Stuttering after 4 years of age	*yes no*	*yes no*	*yes no*	*yes no*	*yes no*
Difficulty learning English	*yes no*	*yes no*	*yes no*	*yes no*	*yes no*
Repeated one or more grades	*yes no*	*yes no*	*yes no*	*yes no*	*yes no]*

(Restrepo, 1998, p.1411)

Appendix D

Logistic Model Predicting Proportion Correct on Elicited Production Task.

	Regular	Irregular	Novel-verbs
Constant	1.527	-.049	.020
SE B	(.482)	(.193)	(.307)
SLI Group	-2.782**	-0.795*	-2.018**
SE B	(.713)	(.295)	(.492)

(* < .05, ** < .01)

Appendix E

Proportion Correct (in logits) by Verb Type and Analysis of Interaction

	Model 1	Model 2
Constant	1.533	1.533
SE B	(0.287)	(0.324)
Irregular	-1.580	-1.922 .
SE B	(.231)	(0.241)
Novel-verbs	-1.513	-1.513
SE B	(0.231)	(0.231)
GRP	2.784**	-2.784**
SE B	(0.419)	(0.475)
GRPXIRREG	1.992**	1.763**
SE B	(0.340)	(0.371)
GRP X NOVEL	0.767	0.766
SE B	(0.380)	(0.380)

(* < .05, ** < .01)

Appendix F

Logistic Model Predicting Good versus Bad Errors on Elicited Production Task.

	Good errors	Bad errors
Constant	1.984**	-.997**
SE B	(.367)	(.300)
SLI Group	-1.203*	2.064**
SE B	(.576)	(.447)

(* < .05, ** < .01

Appendix G

Performance on Irregular verbs using Good Errors as a predictor.

	Model 1	Model 2
Constant	-0.049	-0.697*
SE B	(0.193)	(0.432)
SLI Group	.795*	-1.475
SE B	(.295)	(.672)

(* < .05, ** < .01)

Appendix H

Performance on Regular Verbs Using Parents' and Siblings' Use of English at Home as Predictors.

	Model 1	Model 2	Model 3
Constant	1.527	1.174	1.811
SE B	(.482)	(0.495)	(.608)
SLI Group	-2.782	-2.719	-2.790
SE B	(.713)	(.689)	(0.700)
Parent Eng		3.030*	
SE B		(1.204)	
Sibling Eng			-0.422
SE B			(.701)

(* < .05, ** < .01)

Appendix I

Performance on Irregular Verbs Using Parents' and Siblings' Use of English at Home as Predictors.

	Model 1	Model 2	Model 3
Constant	-.049	0.307	-0.060
SE B	(.193)	(0.187)	(0.247)
SLI Group	.795	-0.633	-0.795
SE B	(.295)	(0.266)	(0.295)
Parent Eng		1.127**	
SE B		(0.359)	
Sibling Eng			0.021
SE B			(0.293)

(* < .05, ** < .01)

Appendix J

Performance on Novel-verbs Using Parents' and Siblings' Use of English at Home as Predictors.

	Model 1	Model 2	Model 3
Constant	0.020	-0.251	0.023
SE B	(.307)	(0.338)	(.400)
SLI Group	-2.018	-1.889	-2.017
SE B	(.492)	(.499)	(0.493)
Parent Eng		1.202	
SE B		(0.640)	
Sibling Eng			-0.006
SE B			(.483)

(* < .05, ** < .01)

Appendix K

Performance on Regular Verbs Using Expressive One Word Picture Vocabulary Test and Receptive One Word Picture Vocabulary Test Raw Scores as Predictors.

	Model 1	Model 2	Model 3
Constant	1.527**	-5.189**	-4.572*
SE B	(.482)	(1.533)	(2.067)
SLI Group	-2.782**	-4.286**	-3.241**
SE B	(.713)	(.756)	(0.747)
EOWPVT		.155**	
SE B		(.033)	
ROWPVT			.091**
SE B			(.029)

Appendix L

Performance on Irregular Verbs Using Expressive One Word Picture Vocabulary Test and Receptive One Word Picture Vocabulary Test Raw Scores as Predictors.

	Model 1	Model 2	Model 3
Constant	-0.049	-1.381*	-1.626*
SE B	(0.193)	(0.545)	(.738)
SLI Group	.795*	.740**	-0.706*
SE B	(.295)	(.268)	(0.278)
EOWPVT		.028*	
SE B		(.011)	
ROWPVT			0.022*
SE B			(.010)

(* < .05, ** < .01)

Appendix M

Performance on Novel-verbs Using Expressive One Word Picture Vocabulary Test and Receptive One Word Picture Vocabulary Test Raw Scores as Predictors

	Model 1	Model 2	Model 3
Constant	0.020	-3.555*	-3.402*
SE B	(0.307)	(0.998)	(1.277)
SLI Group	-2.018**	-2.388**	-2.110**
SE B	(.492)	(.485)	(0.487)
EOWPVT		.073	
SE B		(.020)	
ROWPVT			.049**
SE B			(.018)

(* < .05, ** < .01)

Appendix N

The Production of Bare Stem Errors on the Elicited Production Task Using the Acceptance Rate for Sentences Containing Bare Stems as a Predictor

	Regular	Irregular	Novel-verbs
Constant	-0.061	-0.706	0.256
SE B	(.743)	(.415)	(.462)
SLI Group	2.168	1.477	0.384
SE B	(.698)	(.393)	(.428)
GramJudgmt	.861**	-0.547**	-0.297
SE B	(.247)	(.139)	(.148)

(* < .05, ** < .01)

Appendix O

The Production of Overregularization Errors on Irregular Verbs Using the Acceptance Rate for Sentences Containing Overregularized Verbs as a Predictor

	Irregular
Constant	1.186
SE B	(.614)
SLI Group	-2.103
SE B	(.515)
GramJudgmt	-.960**
SE B	(.273)

(* < .05, ** < .01)

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