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Morphological Priming in Spanish-English Bilingual Children with and without Language Impairment

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Morphological Priming in Spanish-English Bilingual Children with and without Language Impairment

by

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Dedication

This thesis is dedicated to my parents, Daniel Gutierrez and Ana I. Gutierrez, for their love, patience, and support. I also dedicate this thesis to my sister, Ana D. Gutierrez, and my brother, Daniel E. Gutierrez, for their encouragement and support these past two years of graduate school. I would not be here without you!

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Abstract

Morphological Priming in Spanish English Bilingual Children with and without Language Impairment

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Abstract

The purpose of this study was to gain insight into the amount of language models (i.e., dose frequency) that Spanish-English bilingual children with and without specific language impairment (SLI) require in order to consistently produce challenging target grammatical forms for 6 morphemes, 3 in English and 3 in Spanish, via a structural priming task. Participants included two 2nd grade children with SLI, five typically developing kindergarten children, and three typically developing 2nd grade peers. Participants were administered 10 control and 10 experimental cloze phrase computer tasks for each morpheme. In the control condition participants finished cloze phrase sentences which targeted the target morpheme while in the experimental task participants heard a model of the target morpheme and were subsequently required to finish the cloze phrase. Results replicated results of structural priming for all groups in each language. Results also indicated that Spanish was more robust in producing morphological priming effects in comparison to English morphological forms possibly due to linguistic differences. Clinical and research implications are discussed.

Key words: children, bilingual, specific language impairment, grammatical morphology, dose frequency, syntactic priming

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INTRODUCTION

The majority of people across the world use more than one language to communicate (Sandoval, Gollan, Ferreira, & Salmon, 2010); however, this seemingly effortless task entails a considerable amount of cognitive demand (Bialystock & Feng, 2009; Gollan, Montoya, Cera, & Sandoval, 2008; Hernandez, Dapretto, Mazziotta, & Brookheimer, 2001; Jackson, Swainson, Cunnington, & Jackson, 2001). U.S. Census data informs that the United States educational system enrolls a substantial amount of bilingual children and that Spanish constitutes the foremost minority language. In 2009, over 11 million children who enrolled in primary or secondary education spoke more than one language (U.S. Census, 2012) with over 8 million reporting Spanish as the other language (U.S., Census, 2012). Speech-language pathologists are required to provide clinical services to children of diverse linguistic backgrounds that are on their caseload; however, limited evidence based treatment exists to remediate communication disorders for children from linguistically diverse backgrounds. This lack of data highlights the need for investigators to conduct research in related areas, such as investigating effective treatment methods for children who are diagnosed with specific language impairment (SLI) with an emphasis on Spanish speaking populations.

SLI is diagnosed when children exhibit poorer language than their peers despite normal hearing abilities, typical nonverbal intelligence, and no behavioral problems or neurological impairments (Leonard, 1998). It is estimated that the prevalence of SLI is 7% in children enrolled in kindergarten (Tomblin et al., 1997). Grammatical morphology

is a problematic feature of the language production of English speaking children with SLI (see Leonard, 1998, for a review) as evidenced by inconsistent use in obligatory contexts when compared to both typically developing age matched children and children matched for mean length of utterance. These results suggest grammatical morphology as a clinical marker in English (Bedore & Leonard, 1998). Data on other Romance languages also indicate grammatical difficulties, such as problems with articles and clitics (Anderson & Souto, 2005; Bedore & Leonard, 2001; Bortollini, Caselli, & Leonard, 1997; Restrepo & Gutierrez- Clellen, 2001). In English, input of grammatical morphology increases the correct production of grammatical morphemes; however, it remains unknown how much input facilitates production. Thus, solid research is required to gain insight into the amount of input a child may need in order to acquire grammatical structures for both monolingual and bilingual children (Leonard, 2011; Proctor-Williams, 2009). This information is valuable to academic, social, and clinical domains (Proctor-Williams, 2009).

Input Dosage Studies

Clinical evidence available for dosage studies has focused on monolingual children with SLI (Leonard, Miller, Deevy, Rauf, Gerber, & Charest, 2002; Miller & Deevy, 2006; Proctor Williams, 2009); however, bilingual children use more than one language to communicate. This will inevitably result in differences in language exposure, context of exposure, and use. These factors result in fluctuating language exposure and opportunities for production relative to monolingual peers (Bedore and Peña, 2008;

Goldstein & Oller, 2011). Because of these differences, bilingual children may require different amounts of language input to produce challenging morphemes.

Monolingual English speaking children with language impairment improve their acquisition and generalization of grammatical morphemes given language intervention (Leonard, Camarata, Brown, & Camarata, 2004; Leonard, Camarata, Pawlowska, Brown, & Camarata, 2006). Increased language input provided during intervention results in an increased likelihood of acquiring language knowledge about morphemes, which leads to correct morpheme production. Leonard (2011) describes this as the input effect. Nonetheless, It is unclear how much input is required for this to occur (Proctor-Williams, 2009). Some literature suggests monolingual children with SLI require about three times more input than typical monolingual children (Proctor-Williams, 2001; Camarata et al., 1994).

Recent literature further suggests that dose frequency needs to be determined for specific morphemes (Leonard et al. 2004; Leonard et al., 2006; Yoder, Molfese, Gardner, 2011). Proctor Williams (2009) states that, " it [is] more beneficial to have a large number of encounters with a single morpheme than to have fewer encounters with each member of a set of … related morphemes" (p. 1375). For example, Leonard et al. (2004) addressed the following two types of morphemes in children with SLI using recast and expansion techniques: auxiliaries (e.g., is/are/was) and third person singular (3s). During the treatment sessions, the target morpheme was presented an equal number of times for each target; however, in the 3s condition there as only one overt morpheme was

addressed (i.e., -s) while in the auxiliary condition three morpheme forms served as targets (i.e., is/are/was). Post sessions, participants in both groups exhibited a significantly “modest" greater use of respective targeted morphemes compared to non-target control morphemes, but the children in the 3s condition exhibited a higher degree of production percentages on 3s. The authors posit that because auxiliaries contain three forms, is/are/was, whereas third person singular only consists of one form with two allophonic variants (i.e., /s/, /z/), various manifestations may require altered frequency input; in this case, morphemes that require tense and agreement may need more input to achieve the same benefits of less complex morphemes (e.g., 3s).

Although the complexity of morphemes alters the input required to produce a target, it is unclear whether massed or distributed focused stimulation of morphemes works best for children with SLI. The findings of Leonard et al. (2006) suggest that massed practice may be more beneficial. The authors addressed the morphological forms of Leonard et al. (2004) (e.g., auxiliaries and third person singular –s) providing the same input for an extended period of intervention. Results showed that even with extended sessions, most of the children’s forms did not reach mastery. The authors concluded that gains in tense and agreement morphology may be beyond the intervention employed and may depend to a greater extent on maturation rather than more treatment; however, as this study implemented the same level of input for target morphemes, it is not possible to determine whether increasing the level of input across studies would have influenced or increased mastery levels. Thus, further work is required to elucidate this question, which

opens the door to exploring whether an increase of input over the same period of time would increase mastery.

Overall, despite the fact that previous studies have identified a need to explore grammatical acquisition input for specific morphemes (Leonard et al., 2004; Leonard et al., 2006), some morphological treatment benefits have been identified. For example, children are most likely to produce problematic verb morphemes when provided with a model before an independent production (Leonard et al., 2002; Yoder et al., 2011; Proctor-Williams, 2009). Leonard (2011) suggests this aids grammatical development by influencing a child's language knowledge through increased amounts of input. Even considering these gained benefits, studies have only addressed a limited variety of forms (e.g., third person singular, auxiliaries) and have not addressed bilingual children with SLI.

Proctor-Williams (2009) suggests that future studies in this domain include standardized practices of intervention techniques, such as recasting/imitation and controlling levels of dosage. The present study will attempt to systematically elucidate the dosage of input needed for bilingual children to produce target morphemes in English and Spanish by implementing dosage definitions provided by Warren, Fey, and Yoder (2007). Warren et al. (2007) describes the dose frequency as, "the number of times a dose intervention is provided per day and per week" (p. 72). In this study, the dose frequency will consist of the participant's single participation in one experimental task. A

structured methodology borrowed from psycholinguistic literature called the structural priming paradigm is ideal for implementing these propositions.

Structural Priming and Language Theory

The structural priming paradigm implements grammatical modeling and has shown to facilitate the production of grammatical forms in monolingual adults (Bock, 1986, 1990; Bock, Loebell & Morey, 1992), monolingual English speaking children with and without SLI (Huttenlocher, Vasilyeva, & Shimpi, 2004; Leonard et al., 2002; Miller & Deevy, 2006; Savage, Lieven, Theakston, & Tomasello, 2006 as cited in Vasilyeva, Waterfall, Gámez, Gómez, Bowers, & Shimpi, 2009), and bilingual adults who were involved in the examination of cross-linguistic priming (Bernolet, Hartsuiker & Pickering, 2007; Desmet & Declercq, 2006; Loebell & Bock, 2003; Meijer & Fox Tree, 2003; Hartsuiker & Pickering, 2008; Hartsuiker, Pickering & Veltkamp, 2004; Salamoura & Williams, 2006, 2007; Schoonbaert, Hartsuiker & Pickering, 2007 as cited in Vasilyeva et al., 2009).

Priming is based on the premise that speakers have a tendency to produce the syntactic structure of a sentence they have previously heard. The paradigm includes a priming sentence, or sentence that "primes" or pre-activates a syntactic form, and a target sentence or sentence that imitates the previously produced syntax. For example, during a picture description task, upon hearing the sentence, "The man is walking." (i.e., priming sentence), an individual is more likely to produce the same sentence structure, such as, "The dog is running" (i.e., target sentence). If the person's production imitates the syntax

of the priming sentence, the person has been successfully primed. This syntactic influence persists when words and thematic relationships between the priming sentence and the target sentences differ (Leonard, 2011). That is, nouns, prepositions, and/or verbs may change, but the syntactic structure is identical.

Levelt's (1990) modular incremental theory of language production accounts for priming syntactic effects (Leonard et al., 2002; Miller & Deevy, 2006). The formulation of a message occurs first, proceeded by the selection of lexical concepts. These are assigned syntactic functions (e.g., subject, verb, or object) whose constituents are assembled into the target sentence frame that determines the structure and word order of the sentence to be produced. Grammatical inflections and lexical items are then retrieved independently but in parallel and are further attached to the predetermined sentence frame (Bock & Levelt 1994; Levelt, 1990; Miller & Deevy, 2006). Upon hearing a particular sentence structure (e.g., hearing a passive sentence versus an active sentence), the sentence frame is pre-activated within the listener increasing the likelihood of a sentence production of the previously heard sentence structure. In other words, a speaker only has to retrieve grammatical and sentence items for production to insert them into a pre-activated frame. As a result, the speaker reduces sentence production processing time and therefore produces a more efficient output. Leonard, Miller, Grela, Holland, Gerber, & Petucci (2000) reported priming for the auxiliary "is" regardless of whether the priming sentences used the same structure (e.g., is) or not (e.g., are), thus, this provides support for activation of syntactic frames, not solely individual morphemes.

A theoretical model that can be applied specifically to bilingual populations is the weaker links hypothesis, which takes into consideration how frequency of language production may influence our linguistic representations. As previously referenced, bilingual children receive divided language exposure and produce each language less relative to monolinguals that only produce one language. This may result in "weaker links" of linguistic representations (Gollan, et al., 2008). By using this theoretical model, we can aim to increase the strength of a child's weak grammatical representations and increase accessibility to those syntactic pathways through increased syntactic input and production. The application of this model has been minimal. Employing this study with bilingual children will allow us to gain more insight into this input effect and its relationship to the weaker links hypothesis of language production.

Structural Priming and Children with SLI

Huttenlocher et al. (2004) and Savage et al. (2006), who conducted priming studies in monolingual children, provided evidence of the effectiveness of this methodology in young children without language impairment, and recent studies have applied this paradigm to monolingual children with language impairment (Leonard et al., 2000; Leonard et al., 2002; Miller & Deevy, 2006). The structure of the grammatical priming paradigm is appropriate for intervention studies as it imitates naturalistic productions of conversation, (i.e., complete sentences; Fey, Long, Finestack, 2003; Leonard, 2011). In fact, in van Kleeck et al. (2010) it was suggested that providing telegraphic input (or input that is ungrammatical, "baby crying") may be harmful to

children. Thus, imitating language structures of the naturalistic environments may contribute to cross-contextual generalization and facilitate the grammatical abilities of children (Leonard et al., 2002).

This paradigm is also informative to our understanding of input intervention. Findings of SLI priming literature holistically indicate that children with SLI produce target structures significantly more when the preceding sentence includes the target structures than when it is not included (Leonard et al., 2000; Leonard et al., 2002; Miller & Deevy, 2006). Priming occurs with independent grammatical frames (i.e., auxiliaries) and structures within grammatical frames (i.e., past tense –ed) (Leonard, Miller, Grela, Holland, Gerber, & Petucci, 2000). This is of importance because children with SLI exhibit problems particularly with grammatical morphology, such as past tense. In addition, Levelt's (1990) hypothesis of activation of morphological frames was supported in Leonard et al. (2000) as priming effects for the auxiliary "is" were present whether the priming sentences were the same (e.g., auxiliary "is") or different (e.g., auxiliary "are"). Further, according to Leonard et al. (2002), children are most likely to produce the target morpheme in subsequent productions when their immediate production of the target morpheme post prime sentence is correct. For example, Leonard (2002) found that children were most likely to produce the auxiliary "is" in future independent productions when they correctly imitated the prime sentence (e.g., the mouse is reading) than when they incorrectly repeated it (e.g., the mouse reading).

Overall results of available priming studies indicate that syntactic productions of children with language impairment can be influenced by sentence priming which includes grammatical structures that are independent or structures that are within a grammatical frame.

Structural Priming and Implicit Learnings

Important to the structural priming paradigm is its application to implicit learning, and its application to language intervention in order to contribute to evidence-based practice. According to Leonard (2011), this paradigm, "suggests ways in which language intervention activities can be modified to promote greater grammatical change in children with language impairments" (p. 608). Initially, structural priming was thought to be an evanescent process that temporarily pre-activated syntactic structures and increased the likelihood of a target production; however, investigators now consider structural priming as a type of priming that influences language knowledge and implicit learning (Leonard, 2011).

Previous studies have suggested that facilitation of grammatical acquisition may be increased by modeling and promoting production in preschool children with SLI (Fey & Proctor Williams, 2000; Leonard et al., 2002; Proctor Williams, 2009; Weismer & Murrray Branch, 1989;). However, studies have only recently implemented this paradigm to suggest implicit learning in typically developing children (Huttenlocher et al., 2004; Savage, Lieven, Theakston, and Tomasello, 2003, Savage et al., 2006). Nonetheless, it is

crucial to note that this lasting effect has possible implications of language learning (e.g., grammatical learning) and acquisition (Savage et al., 2006).

For example, Savage et al. (2006) investigated the role that structural priming may play in regards to implicit learning in typically developing four year-old children using a picture description task. The investigators employed a mixed design in which children were divided into three groups. Children in the control group received no primes and were asked to provide sentences for verb-action pictures without hearing primes. In experimental group one, children heard five identical primes and were required to produce five target structures, and in experimental group two, children heard five different primes and were required to produce five target structures. One finding was that children were primed during the varied and identical groups. The findings supported previous literature (Savage et al., 2003) indicating a priming effect in children at the sentence-level. Moreover, this study extended the findings in relation to duration, or persistence, of priming effects. Results indicated that "variation within a prime set" (Savage et al., 2006; p. 43) and "priming reinforcement across time" (Savage et al., 2006; p. 43) are two variables that significantly contribute to the strength and retention of the priming effect. To illustrate this, it was reported that the children retained the production of structures in the varied condition for weeks post study. Thus, Savage et al. (2006) provides support for long-term priming not just immediate priming. The authors argue that the retention of priming over time for the varied condition indicates that the linguistic representations are being modified as a result of the priming, suggesting active language

learning. Retention of these representations over time leads to the conclusion that these representations may consolidate, leading to learning (Leonard, 2011; Savage et al., 2006).

Limitations of Previous Investigations

Priming studies to date provide a methodology that allows investigators to quantitatively measure the input a child receives from a target morphological structure. While therapy implications in regards to this paradigm have been suggested, they have not been thoroughly addressed (Bock & Griffin, 2000; Miller & Deevy, 2006). For example, limitations of previous research include application of the paradigm to only a few grammatical structures (e.g., auxiliary "is", past tense "–ed") and lack of examination of grammatical deficits beyond the grammatical structures tested in children with language impairment. In particular, it is unknown to what degree children with SLI require models and imitations in order to produce and acquire grammatical structures. Previous studies have, for the most part, only investigated whether or not priming was possible. Currently, these studies do not address children of linguistically diverse backgrounds who are exposed to and produce more than one language. The present study attempts to bridge these gaps by implementing this paradigm to children who are bilingual Spanish-English speakers targeting a variety of morphemes in each language.

The Present Study

In order to target grammatical structures that are sensitive to bilingual children with suspected language impairment (BSLI), a bilingual language assessment currently in

development, the Bilingual English-Spanish Assessment (BESA) which measures language ability in bilingual children, will be used (Peña, Gutiérrez-Clellen, Iglesias, Goldstein, Bedore, in development). This test is designed to target morphosyntactic forms that are the most sensitive to language impairment in bilingual children (e.g., English copulas "is", Spanish subjunctive). The current study targets six sensitive morphological forms with the purpose of gaining insight into dose frequency of input BSLI and two groups of typically developing children need in order to produce certain grammatical forms. It will do so via the structural priming paradigm. Not only will the present study address a variety of functional morphemes that BSLI may not acquire at developmentally appropriate milestones, but it will also elucidate how much input BSLI require. The results obtained will extend the findings of current literature reported on English and Spanish speaking children.

The main question investigated is:

1. What dose frequency do bilingual Spanish-English children with typically developing language and SLI require to produce target morphological structures?

We hypothesize BSLI require a larger number of models to produce certain morphological structures than bilingual children without language impairment. Thus, we predict that in a grammatical priming task, in which children will be required to produce target grammatical morphemes, children with SLI will require more input than children without language impairment. This information will help us understand the amount of

input that typically developing bilingual children and BLSI may need in order to be able to produce grammatical forms in intervention contexts.

METHODOLOGY

This study was conducted as part of an ongoing study investigating language impairment in bilingual Spanish-English children with and without SLI. The design of the present study incorporated the following suggestions from Hoff (2012): 1) Prime targets can be expressed in two different forms (e.g., present progressive vs. third person) as this ability provides the experimenter with the flexibility to manipulate input and the participant a choice of which syntactic form to produce. 2) Picture stimuli were aimed to be easily identifiable by children, and all pictures include the same type of animacy (e.g., animate), which was implemented within tasks. 3) Actions depicted were different for the experimenter stimulus. In addition, the study followed the recommendations of Proctor-Williams (2009) that recommended that dose frequency be calculated for individual target morphemes.

Although most syntactic priming studies are between-subjects designs, this study was a within-subjects design, in that all participants received all conditions in both English and Spanish. Trials were blocked by the priming condition and language (i.e., English and Spanish).

Participants

A total of 10 bilingual Spanish-English children enrolled in either Kindergarten or 2nd grade participated in this study. The children were recruited from Texan school

districts located near the city of Austin, Texas. These school districts were chosen as recruitment sites because they provide educational services to a large number of Hispanic children that may have been bilingual and qualified for the study. Two children were in the SLI group and enrolled in 2nd grade (i.e., LI), 5 in the kindergarten typically developing group (i.e., TD), and 3 children in the 2nd grade typically developing group (i.e., 2G). Children were placed in the SLI group based on the following criteria a) received a score of -1z or lower on the BESA screener and children placed on the TD group received a score of -1z or higher. In the SLI group both children were 8;5, including 1 boy and 1 girl In the kindergarten control group the age range of children was 5; 8 to 6;2, including 4 boys and 1 girl. In the 2nd grade control group the age range of children was 7;10 to 8;4, including 1 boy and 2 girls. All of the children complied with the protocol. Table 1 presents the age and gender of participants within each group. The study protocol was conducted according the guidelines of the human protection services at the University of Texas at Austin.

Table 1: Description of Participants Including Age and Gender

Participant	Age	Gender
LI1	8;5	M
LI2	8;5	F
KG1	5;11	F
KG2	6;1	M
KG3	6;2	M
KG4	6;2	M
KG5	5;8	M
2G1	7;10	M
2G2	8;4	F
2G3	8;1	F

Note. LI refers to the 2nd grade language impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children. Note. M refers to male. F refers to female.

Stimuli

Sixty control items and 60 prime target-pairs were created for this protocol. Stimuli pictures for the controls and prime target pairs were chosen from Microsoft Clip art and Google Images to illustrate the controls, primes, and targets. Six prime-target sets were developed to target the 6 morphological structures. Three target structures were in

English; these included 3rd person singular (3P), past tense (PT), copulas (COP). The other three target structures were in Spanish, which were direct object (DO), Spanish subjunctive (SS), and imperfect (IMP). The target forms included in this study were found to be problematic for children with SLI to produce according to the BESA (Peña et al., in development). The pictures consisted of animate objects (e.g., dogs, cats, boy) and were presented in color.

Procedure

A qualified research assistant administered the priming task. Professionals included one teacher and one graduate student in the Communication Sciences and Disorders Program at the University of Texas at Austin. Experimenters were trained prior to administering the protocol. Testing in English and Spanish occurred across two sessions, order of language administration was counterbalanced across participants. Children were spoken to in the language of testing prior to the experimental task in that language; for example, if the testing language was English, children were spoken to in English prior to the task. The productions of children were transcribed verbatim for the analysis. The protocol was presented using DirectRT 2010, software that was created for psychology experiments, on a Dell Latitude E6420 laptop computer. The session was recorded using a portable recorder. The experimenter sat beside the child who was placed in front of the laptop at a comfortable visual distance. The experimenter made sure that the child could easily see the screen then pressed a laptop key to commence the program.

All task administration was conducted via DirectRT 2010, including the presentation of instructions, pictures, and protocol script. The protocol was recorded beforehand to ensure precise priming of morphological structures. The priming paradigm was cloze task for all morphological structures. The order of presentation of the sets was randomized across participants within languages and conditions. The presentations of control items and prime-target items within sets were also randomized to account for order effects. All of the conditions within each language were presented during the same session. The instructions presented by DirectRT 2010 for controls in English were as follows: "Now you are going to describe some pictures. Then we are going to take turns describing pictures. Finish my sentence. Don't start until I finish. Let's start. Ready? Look here." (i.e., Spanish translation: "Vas a describir unos dibujos. Luego vamos a tomar turnos describiendo dibujos. Termina mi oración. No empiezes hasta que yo termine! Vamos a empezar. Listo? Mira aquí!") Allowable prompts during the administration of controls included: "You say it", "Tell me" and "You are doing a great job." (i.e., Spanish translation: "Tú dime", "A ver" and "Sigue, que bien estás haciendo"). Experimenters clarified questions and pointed to pictures presented on the screen and waited expectantly for the child to produce a response. The child was randomly presented 10 cloze phrases, one at a time.

For the English COP task, because children were asked to describe the color of some pictures, the first sentence was modified and read, "We are going to take turns describing the color of the pictures." Other sentences remained the same. Because the

COP task required children to name colors, a color-naming task was administered to ensure the child colors. Children were required to name the color on the screen. If they did not know the color or were unsure of the color, the experimenter provided the name of the color. This task was presented before the administration of the controls. The script for color naming was as follows: “Name the color you see!”

For the prime-target sets administration, children heard the following instructions in English, “Very good! Now we are going to do the same. We are going to take turns. I’m going to say one first then you are going to finish my sentence. Remember don’t start until I finish! Ready?” (i.e., Spanish translation: “Muy Bien! Ahora vamos a hacer lo mismo. Vamos a tomar turnos. Yo voy a decir una oración, luego tu vas terminiar mi oración. Listo?). During the prime-target sets, no verbal prompts were allowed between the prime sentence and the production of the child. After the administration of the set, examiners were allowed to redirect the participant towards the format of this task by saying, ““Remember, we are going to take turns! I’m going to say one first, then you are going to finish my sentence. Ready?” (i.e., Spanish translation: “ Recuerda, vamos a tomar turnos. Yo voy a decir algo primero, luego tú vas a terminar mi oración! Listo?”). Again, the experimenter pointed to appropriate pictures on the screen and waited for the child to respond. The children were encouraged to respond to all of the items. If the child was not confident in the target language, he was asked to do his/her best in that language.

Analysis

This study aimed to measure the dose frequency (as described by Warren, 2007) that a child required to a child to produce a target morpheme. The children's responses were transcribed on-line, recorded, analyzed for accuracy, and then scored. Responses were scored as correct (i.e., 1) if the children produced the target in a "grammatical argument structure" (Miller & Deevy, 2006, p. 393), regardless of correct morphological productions. At times, children produced the target morpheme but not the target verb. For example, if the target was "licked" in the sentence "The girl licked the lollypop.", the words, "sucked" would be an acceptable response because it contained the correct target morphological structure; thus, a substitution was considered acceptable if the child produced a "grammatical argument structure" (Miller & Deevy, 2006). Utterances were classified as 1 for correct or 0 for incorrect. Sentences that were scored as 0 included if the child inserted a false start or reformulated his or her utterance. Only the first production was accepted. (Miller & Deevy, 2006, p. 394). They were also counted as incorrect if "the child chose a verb with another argument structure" (Miller & Deevy, 2006 , p.394). For example, if the target structure was third person and the child produced a present progressive form, the result was scored as incorrect because the child produced a verb that was not the target grammatical structure. Finally if the production was in the non-target language it was counted as incorrect.

The present document provides descriptive information due to the low number of participants. For each target structure, the number of correctly produced responses within

the control conditions was added to serve as a baseline for the production of the target structure. For the prime target sets, participants were required to produce the target grammatical structure three times consecutively in order to reach priming criterion and be considered syntactically primed. In this case, the lower number indicates a higher priming response and a higher number indicates a lower priming response. For example, if a participant scored a 10 in the DO condition, this indicates that this child did not produce the grammatical target consecutively three times after 10 models; thus, this child was not primed according to our criterion. However, if a participant scored a 7, this indicates that this participant produced the target grammatical structure 3 times consecutively after 7 models and was considered primed according to our criterion. See the following section for results.

RESULTS

The purpose of this study was to determine the amount of input (i.e., models) needed for children to consistently produce target grammatical structures. This purpose analysis was twofold: 1) Investigate the amount of input (i.e., modeling) necessary for bilingual Spanish-English children to consistently produce a target response, measured as producing at least three correct consecutive responses in the prime-target condition; 2) To compare performance across bilingual groups, particularly the performance of 2nd grade children diagnosed with LI compared to the performance of the typically developing groups of children in kindergarten and 2nd grade. Performance on the controls condition is presented; however, performance on those tasks is beyond the scope of this paper and should be examined in the future. To examine performance on control conditions refer to Appendix A.

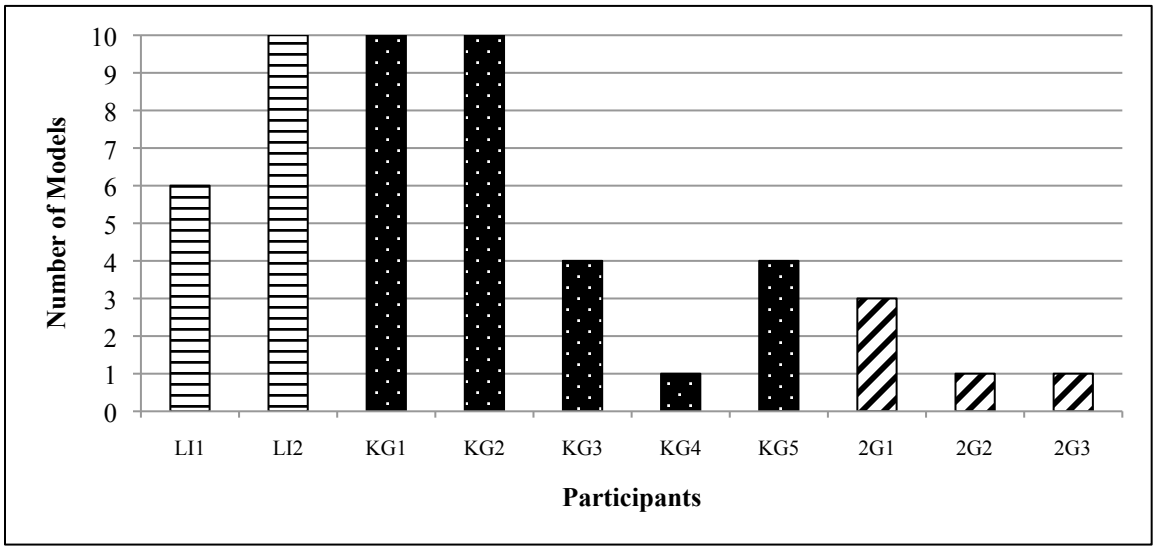
Due to the limited number of participants within each group, descriptive information about the data is reported. The data for this analysis are presented on figures 1, 2, and 3 for each age group in Spanish on figures 4, 5, and 6 for English. For data reported on the figures, a higher performance requires less prompts to reach criterion. For example, requiring two prompts to reach criterion is better than requiring 7 prompts to reach criterion.

Spanish

Spanish Subjunctive

In regards to SS, participants were primed across all groups, meaning that there was at least one participant in each group who was primed (e.g., LI1). LI participants scored similar to their younger kindergarten peers in that some participants met criteria while others did not. For the LI group, one met the criteria (LI1) and another did not (i.e., LI2; 50%), for the kindergarten group 60% of participants met were primed (KG3, KG4, KG5) but the other 40% were not (KG2, KG1). Although the percentages of individuals who were primed were similar, the amount of input needed for priming was different. The LI individual required 6 prompts, while the kindergarten group only required 1 to 4. Even the highest number of prompts within the kindergarten group was lower than the amount of input the LI participant required to meet criteria. Participants in the 2nd grade group all met priming criteria and required less modeling overall, with one participant (i.e., 2G1) requiring 3 primes while the other two (i.e., 2G2, 2G3) immediately using the target structure. Thus, they required half as much priming as their LI peers.

Figure 1: Number of Models Required to Meet Criterion for Spanish Subjunctive

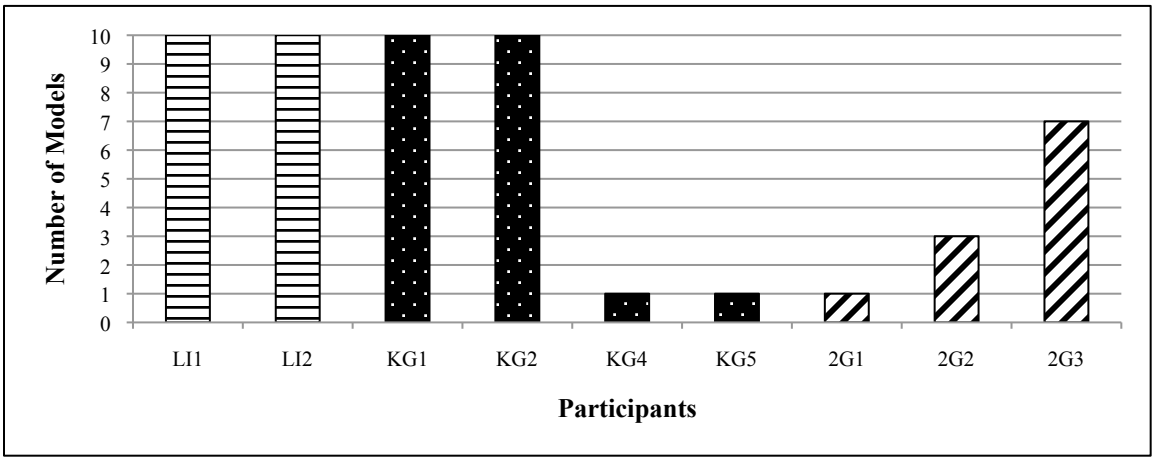


Note. LI refers to the 2nd grade Language Impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children.

Direct Object

In the DO condition, priming was only observed in the kindergarten and typically developing 2nd grade group. Within the LI group, both participants did not meet criterion and required at least 10 models. This is similar to 50% of the kindergarteners (i.e., KG1, KG2). However, the other half of kindergarten children (i.e., KG4, KG5) immediately responded in the target condition and requiring only one additional model. Similar to the SS conditions, although the percentages of individuals who were primed were similar, the amount of input needed for priming was different. All the children in the 2nd grade group met the DO criteria. 66% of the 2nd grade group required 3 models or less (i.e., 2G1, 2G2) while only 1 required 7 models (i.e., 2G3).

Figure 2: Number of Models Required to Meet Criterion for Spanish Direct Object

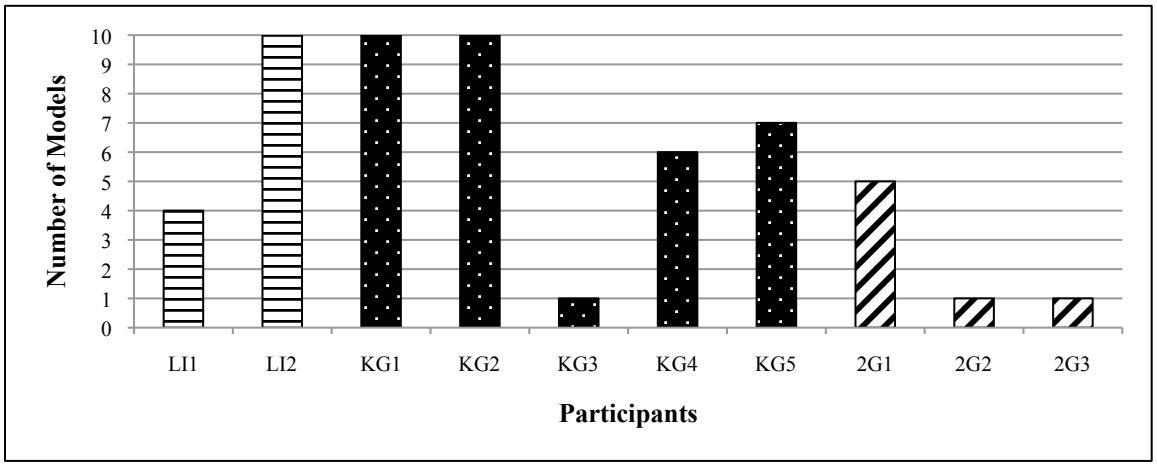


Note. LI refers to the 2nd grade Language Impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children.

Imperfect

In the IMP condition priming was observed across groups. Participant LI2 required 4 models to reach criterion while LI2 did not reach criterion by 10 models. Consistent with the previous patterns, this mirrors the production of children in the kindergarten group with 40% not reaching criterion after 10 models (i.e., KG1, KG2) and the other 60% reaching criteria after 1 to 7 models. Again, all children in the 2nd grade group reached criterion, requiring 1 (i.e., 2G2, 2G3) to 5 (2G1) models. The amount of input required to meet criteria across groups were mixed, so at this point it is unknown how many models are needed for the kindergarten and LI groups to reach criteria; however, for the TD 2nd grade group, the lowest performing participant performs equally to the highest performing LI participant.

Figure 3: Number of Models Required to Meet Criterion for Spanish Imperfect



Note. LI refers to the 2nd grade Language Impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children.

Summary

Priming was observed across all language groups for SS and IMP conditions, but not for DO in which the LI group did not meet criterion. With the exception of results for the IMP condition, the LI group performed below children in the kindergarten and TD 2nd grade groups. For the SS condition the LI child who reached priming criteria required more input than the lowest performing kindergarten child who reached criteria, requiring 6 and 4 models, respectively. For this condition, the TD 2nd grade group required at least half the amount of input to produce the correct target structure, with some immediately producing the target structure. Thus, the amount of input is higher for LI children in this condition. Results for amount of input for the IMP condition were

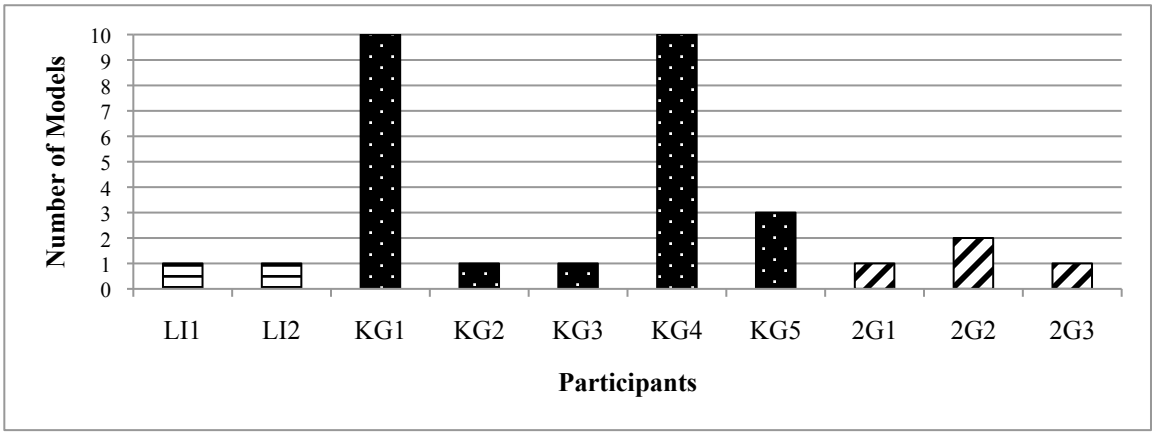
mixed so could not be determined for individual groups. For DO, none of the LI children met criteria indicating that they may require more than 10 trials to reach criterion contrary to children in other groups, again indicating that they may require double or more input relative to peers, who reached criteria between 1 and 5 models.

English

Copulas

In regards to copulas, participants were primed across groups, and the LI participants performed similarly to the TD group in terms of amount of input required. Participant in the LI group only required 1 or less models; in fact both participants performed better than 60% of the kindergarten group (i.e., KG1, KG4, KG5) and similar to the typically developing group (i.e., 2G1, 2G3). Only 1 participant in the TD group required 1 more model than the highest number of models needed for the LI group (ie. 2G2). Children in the kindergarten group required a wider range of modeling, from 1 to 10.

Figure 4: Number of Models Required to Meet Criterion for English Copula

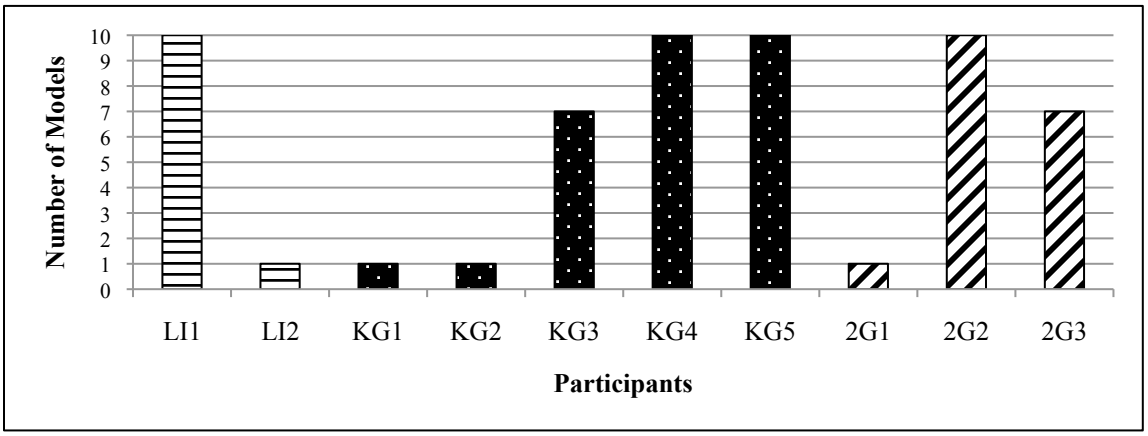


Note. LI refers to the 2nd grade Language Impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children.

Third Person

Participants were primed across groups. During the 3P condition, there was a disparity within the LI group, with one participant requiring minimal models to reach criterion (i.e., LI2) and the other requiring maximum models (i.e., LI1). This disparity resembled results within the kindergarten group, in which 2 participants required minimum models (i.e., KG1, KG2), and two requiring 10 models (i.e., KG4, KG5). The remaining participant required 7 models to reach criterion (i.e., KG3). This pattern is further reflected in the 2nd grade TD group for which one participant required only one model (i.e., 2G1), another reached maximum models (i.e., 2G2), and the third participant needed 7 models to reach criterion (i.e., 2G3). All groups perform similarly, with some reaching criterion and others requiring maximum cures.

Figure 5: Number of Models Required to Meet Criterion for English Third Person

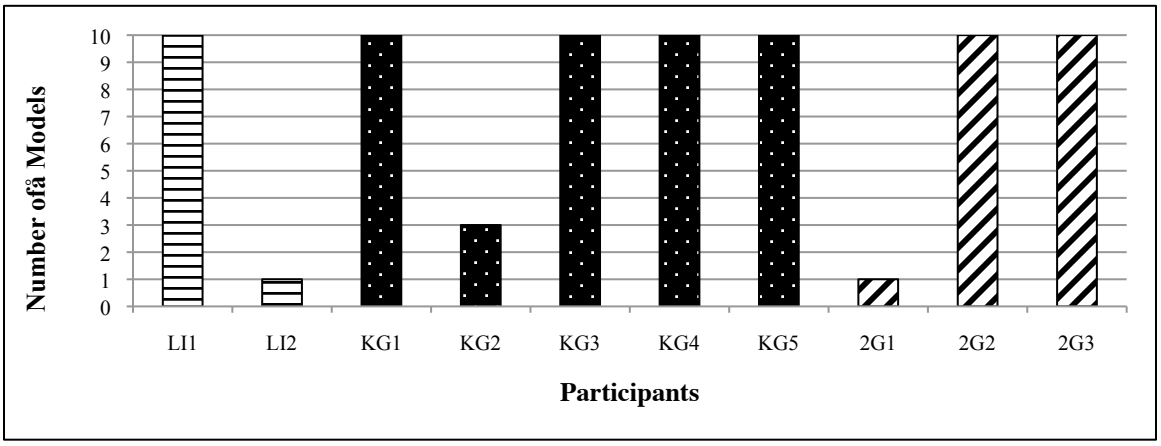


Note. LI refers to the 2nd grade Language Impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children.

Past Tense

Again, participants were primed across language groups. The PT condition further reflected the disparity within the LI group. One participant required minimal models (i.e. LI2) while the other required maximum models (i.e., LI1) and did not reach priming criterion. The kindergarten group performed similar than the TD group, with 80% requiring 10 models to attempt criterion. However, one participant (i.e., KG2) required 3 models. PT patterns for TD 2nd grade was also similar to LI group in that 66% required all models in an attempt to reach criterion, while one participant required the minimal amount of models. Groups perform similarly, with some reaching criterion and some not. However, LI and TD children that reached criteria required 1 input, while the kindergarten children required 3 models. Thus, when children are primed, they TD and LI required similar amounts of input, while the kindergarten children required more input.

Figure 6: Number of Models Required to Meet Criterion for English Past Tense



Note. LI refers to the 2nd grade Language Impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children.

Summary

In the COP condition, the LI group required less input than over 50% of the kindergarten group and more closely mirrored the performance of the TD 2nd grade group. In the 3P and PT condition, results were similar across all groups. Each group contained participants that required minimal cues, and some that required maximum cues. However, in the PT condition, the LI participant who reach criterion paralleled the input of the TD peers and required less input that the KG participant that reached criteria.

Interrater Reliability

Interrater reliability was conducted on 30% (e.g., 3) of the participants.

For Spanish grammatical targets, the total interrater reliability was 92%. For each grammatical target the individual percentages for interrater reliability were as follows: Spanish Subjuntive 90%, DO 92%, IMP 93%. For English grammatical targets, total interrater reliability was 99%. For each grammatical target the interrater reliability were as follows: COP 100%, 3P 100%, PT 98%. In sum, within languages and tasks, there was high interrater reliability.

DISCUSSION

The purpose of this study was to gain insight into the amount of grammatical modeling Spanish-English bilingual children with and without language required in order to produce grammatical targets consistently. Targets for this study have been identified as challenging for children with language impairment to master (Peña, et al., in development). The hypothesis of the present study was that children with LI would require more models than typically developing peers in order to produce target morphological structures. This hypothesis was supported in Spanish, but results were inconclusive for English. For SS and DO grammatical structures children with LI required more priming than the peer group of typically developing children. In English, children with SLI performed similarly to typically developing peers in the COP condition. For 3P and PT, the present study was unable to determine amount of models due to the ceiling of 10 models

Our main question for this study was to gain insight into how many models bilingual Spanish-English children with typically developing language and SLI require in order to produce target morphological structures. For now, data suggests that LI children perform similar to kindergarten children in that they require varying degrees of modeling to reach criterion. Moreover, in Spanish they require at least double, and at times triple amounts of priming relative to peers in order to reach criterion for each structure presented. These results provide cross-linguistic support for input findings reported in the English language (Proctor-Williams 2001, Proctor-Williams, 2009, Camarata et al.,

1994). Available findings for English report that monolingual children with LI may require three or more times the modeling needed for children with typical developing monolingual children to acquire challenging grammatical structures.

Results of the present study confirm the findings of previous studies that children show a sentence-level priming effect in children with (Miller & Deevy, 2006, Leonard et al., 2002) and without language impairment (Savage et al, 2006, Huttenlocher et al., 2004) as well as in priming in bilingual children (Vasilyeva, 2009). All grammatical structures in English (i.e., COP, 3P, PT) and two of the grammatical structures in Spanish (i.e., SS, IMP) revealed priming for all language groups. The Spanish DO condition did not produce priming effects for the LI group, but produced priming in both typically developing language groups. It further included bilingual children with language impairment, a population for which this paradigm has not been reported in previous literature.

Specific Findings

In Spanish, the input required for SS is at least 6 models to not reaching criteria for children with LI. This is double or more models than bilingual TD peers required in this task, which ranged from 1 to 3; however, it is similar to kindergarten children whose data indicate they require 1 model or do not reach criteria. For DO, children with LI did not meet criteria. Typically developing peers, on the other hand, only required 1 to 7 models. It likely that for this structure, children with LI may require at least double the models than their peers. Children with in kindergarten ranged from needing 1 model to

not meeting criteria, which again more closely relates to the performance of the LI group. Finally, for the IMP condition, LI children required at least 4 models and some did not reach criteria, similar again to the kindergarten group that required 1 model to not meeting criteria, but more than peers who required 1 to a maximum of 5 models. Again, for some LI children this is may be more than double.

In English, results were mixed, with the COP condition requiring similar inputs for LI and TD children and the other two providing unclear results. In the COP condition LI and TD children required similar amounts of input with children in the LI group requiring 1 model, and children in the TD group requiring 1 to 2 models. Kindergarten children varied, needing 1 model to not meeting criteria. For 3P, all groups varied and required 1 model to not meeting. For PT, TD and LI groups required 1 model up to not meeting criteria, while the kindergarten group required 3 models to not reaching criteria. Thus, for these groups it is difficult to estimate a baseline of priming needed within each group.

Discussion of Results by Grammatical Structure

The English language as this language showed the least transparent results across the two languages. Overall, it seems as though the English language may require more cues to produce priming effects than the Spanish, with Spanish revealing the most robust differences between children with LI and TD peers; however, A reason as to why may be due to linguistic factors. Phonetic salience is a factor that influences the difficulty in acquisition of grammatical structures in English (Bedore & Peña, 2008; Goldstein &

Oller, 2011; Leonard, 1998). First of all, these forms are less salient because they are manifested as unstressed final consonants (Bedore & Peña, 2008). Further, there is a difference in phonetic salience within English past tense morphemes /d/ and /t/ (e.g., as in danced and talked), where English /t/ is less salient due to its shorter duration time (Goldstein & Oller, 2011). Thus, this structure may be more difficult to prime and require more input. This logic can also apply to the 3P targets, where the /s/ sound may not be sufficiently salient for children at this age.

Further, the past tense forms may be more difficult to prime for due to lack of concrete meaning within a context, otherwise referred to as the transparency of the form (Goldstein & Oller, 2011). Forms that do not have concrete meaning, such as marking for time in past tense morphemes are more difficult to learn. These forms may require more input, exposure, or concept awareness in order to be learned effectively and primed easier. As a result, all groups of children may need more input for this condition. Because the present study only provided 10 models, all participants were not provided enough opportunity to show priming responsiveness.

Lastly, not only did the PT condition included both /t/ and /d/ verb endings, those of which differ in phonetic salience, it also included irregular past tense verbs (e.g., fell) In the Leonard et al. (2006) experiment, authors found evidence for the need to investigate priming effects for morphological structures with different phonetic representations (e.g., auxiliaries is/are/was); thus, it may be necessary to not include irregular forms when searching for grammatical input for past tense regular forms that are

already produced with allophonic variants. Future studies should include conditions to target each PT structure: /d/ and /t/ regular past tense verbs and irregular verbs separately.

The English language COP condition revealed priming differences not observed in Spanish in that children with LI and TD peers performed the same. A possible reason for the probable facilitation to produce this structure can be due to cross-linguistic syntactic bootstrapping. According to Goldstein & Oller (2011) and Bedore & Peña (2008), overlapping language forms may facilitate production in other languages, or cross-linguistic facilitation. Functionally, children may be exposed to these more due to their occurrence in each language, indicating more frequent exposure (Bedore & Peña, 2008). In this case English, the manner in which the English copulas were elicited parallels the Spanish language production. For example, this task required children to describe the color of pictures. Thus the response would be, "The frog is green." Cross-linguistically, in Spanish these structures can be produced as, "La rana es verde." Thus, the sharp priming effect could be due to cross-linguistic factors. This form, however, can elucidate differences between acquisition of morphemes that are similar and dissimilar cross-linguistically as distinct input dosages for these types of morphemes are currently unavailable.

A characteristic that was not addressed was the role of language experience as the differences in amount of modeling needed for priming can be due to children belonging to different places along the bilingualism continuum (Grosjean, 1989); that is, they have different experiences with language, such as varied language exposure and divided

opportunity for language use (Bedore & Peña, 2008). Thus, bilingual typically developing children may still require distinct amounts of input due to their degree of bilingualism.

Limiting Factors of the Present Study

Limitations of the present study should be considered. This study included a limited number of participants. This leads to a second limitation, which is the limited number of data. Thus, it is important to increase the number of participants in order for the results to be representative of a large population and statistically significant.

Future Studies

Future analyses of similar studies should take into consideration accuracy of controls produced correctly in the control condition relative to successful priming in the prime target condition. The present study only took into consideration whether or not priming occurred and quantified those modeling responses. It is unclear what relationship accuracy in the performance in the control condition influenced readiness for priming in the prime-target condition. In regards to the number of trials to reach criterion, at times participants reached criterion, then discontinued the use of target form. Future studies should account for discontinued productions post-meeting criterion. For children that reached a maximum criterion, it is unknown how many models are required in order to reach criterion, so additional studies should consider including more models of targets in order to allow for priming effects to be observed, particularly for the English language.

Lastly, Grammaticality errors may occur beyond the target morpheme; for example, one child produced the sentence “se la come”. In this case, the item was classified a correct because the target morpheme was Spanish DO; however, the cloze phrase indicated a male gender (i.e., “Hay un helado y ella ___.”). Although the child received credit for the correct grammatical structure, the gender discrepancy was not accounted for in the present scoring criteria. Thus, there may be a need to account for these types of errors in prospective studies.

Future studies can also modify and extend the present study to further elucidate the promise of the structural priming paradigm for monolingual and bilingual children with and without language impairment. Within the research domain, it should be investigated whether priming can occur over several trials as in Savage et al. (2006) and Huttenlocker et al. (2004) or not as in the analyses of Miller and Deevy (2006). This can further elucidate whether massed or distributed practice may lead to language learning. Childers and Tomasello (2002) reported that for children with typical development that distributed practice is more beneficial than massed practice. Specifically, investigators can address this question by presenting priming protocols over periods of time and analyzing whether children spontaneously produce target forms during a play session with probing.

Additionally, similar studies should investigate how many grammatical models a child would need in order to produce a grammatical morpheme when participants are provided explicit grammar rules and grammatical models (e.g., deductive treatment)

versus when only provided the grammatical model (e.g., inductive treatment). This was explored in Finestack and Fey (2009) where children learned pseudo grammatical inflections. One group was provided with rules of the inflections while the other group was only provided the grammatical models. Results showed that deductive group acquired the novel morphemes significantly more than the inductive group. However, it remains unknown how many teaching probes and grammatical modeling children need in order acquire morphemes. In this case, future studies should use morphemes of the language targeted in therapy in order to more directly contribute to evidenced-based treatment.

Clinical Implications

In regards to clinical domains, this study suggests that some children are more susceptible to priming than others, but that children with SLI may require at least three times more modeling than peers, supporting English results. Spanish structures seem to have robust effects, so clinicians can confidently address this language during intervention contexts knowing that priming occurs in both languages. Although language learning was not directly addressed, previous studies indicate that through modeling children have an increased chance producing these structures. Evidence from priming during a limited number of models suggests promising implications for language learning. Lastly, it is important for SLPs to take into consideration that sentence priming should not be the only method of intervention used with children in order to facilitate grammatical

acquisition; thus, it should be used within the context of meaningful communication (Einsberg, 2006).

Conclusion

With an increasing number of bilingual children entering the school system in the United States, SLPs can expect to provide intervention services to bilingual children. The purpose of this study was to gain insight into the dose frequency that bilingual children with and without SLI require in order to produce grammatical forms that are difficult to acquire. This amount of input may elucidate input needed in intervention contexts; thus, this protocol is directly related to the clinical practice in the field of speech-language pathology because it may provide insight into evidence-based treatment of bilingual children with SLI. The present study provided cross linguistic evidence for level of input required, suggesting that children with SLI may require 3 or more times the input than typically developing bilingual children. Current studies have indicated that input may be different for each grammatical structure, which is supported by the current findings (Leonard et al., 2006). In addition, recent literature indicates that syntactic priming can lead to language learning (Leonard, 2011); as a result, it is worthwhile to explore the promise that syntactic priming may serve during intervention.

Appendix A

Performance Across Conditions

Table 2.A: Performance of Participants Across Conditions for Spanish Subjunctive

	Experimental Condition		
Participant	Control	Prime-Target Set	Priming
LI1	3	6	Yes
LI2	0	10	No
KG1	6	10	No
KG2	0	10	No
KG3	6	4	Yes
KG4	10	1	Yes
KG5	6	4	Yes
2G1	6	3	Yes
2G2	7	1	Yes
2G3	9	1	Yes

Note. LI refers to the 2nd grade language impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children

Table 2.B: Performance of Participants Across Conditions for Spanish Direct Object

	Experimental Condition		
Participant	Control	Prime-Target Set	Priming
LI1	1	10	No
LI2	0	10	No
KG1	1	10	No
KG2	0	10	No
KG3	No Data	No Data	No Data
KG4	8	1	Yes
KG5	0	1	Yes
2G1	2	1	Yes
2G2	4	3	Yes
2G3	0	7	Yes

Note. LI refers to the 2nd grade language impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children.

Table 2.C: Performance of Participants Across Conditions for Spanish Imperfect

	Experimental Condition		
Participant	Control	Prime-Target set	Priming
LI1	0	4	Yes
LI2	0	10	No
KG1	0	10	No
KG2	1	10	No
KG3	0	1	Yes
KG4	0	6	Yes
KG5	1	7	Yes
2G1	0	5	Yes
2G2	0	1	Yes
2G3	0	1	Yes

Note. LI refers to the 2nd grade language impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children.

Table 2.D: Performance of Participants Across Conditions for Copulas

	Experimental Condition		
Participant	Control	Prime-Target Set	Priming
LI1	5	1	Yes
LI2	10	1	Yes
KG1	4	10	No
KG2	10	1	Yes
KG3	0	1	Yes
KG4	0	10	No
KG5	0	3	Yes
2G1	10	1	Yes
2G2	8	2	Yes
2G3	4	1	Yes

Note. LI refers to the 2nd grade language impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children.

Table 2.E: Performance of Participants Across Conditions for Third Person

Experimental Condition			
Participant	Control	Prime-Target Set	Priming
LI1	0	10	No
LI2	0	1	Yes
KG1	0	1	Yes
KG2	0	1	Yes
KG3	0	7	Yes
KG4	0	10	No
KG5	0	10	No
2G1	1	1	Yes
2G2	4	10	No
2G3	0	7	Yes

Note. LI refers to the 2nd grade language impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children.

Table 2.F: Performance of Participants Across Conditions for Past Tense

	Experimental Condition		
Participant	Control	Prime-Target Set	Priming
LI1	1	10	No
LI2	10	1	Yes
KG1	0	10	No
KG2	3	3	Yes
KG3	0	10	No
KG4	0	10	No
KG5	0	10	No
2G1	0	1	Yes
2G2	1	10	No
2G3	5	10	No

Note. LI refers to the 2nd grade language impaired children, KG refers to the kindergarten typically developing children, while 2G refers to the second grade typically developing children.

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Vita

Keila Gutierrez was born in Hermosillo, Sonora, México on February 27th, 1988. She was the third child of Daniel and Ana I. Gutierrez. Her parents immigrated to the United States that same year she was born, relocating to the city of Tucson, Arizona. After graduating from Sunnyside High School in 2006, she attended the University of Arizona where she graduated in 2010 with a Bachelor's of Science in Speech, Language, and Hearing Sciences with magna cum laude academic standing. She subsequently began graduate school at the University of Texas at Austin Communication Sciences and Disorders in 2010 where she received a Diversity Recruitment Fellowship and was also appointed as a bilingual research assistant to Lisa Bedore and Elizabeth Peña. Ms. Gutierrez will receive her Master of Arts degree in Communication Sciences and Disorders in Speech and Language Pathology in May of 2012.

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