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Cognate Facilitation Effects in Bilingual Children of Varying Language Dominance

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Cognate Facilitation Effects in Bilingual Children of Varying Language Dominance

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Abstract

Cognate Facilitation Effects in Bilingual Children of Varying Language Dominance

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A widely accepted theory is that bilinguals activate both of their languages regardless of which is in use. Though there is abundant research on this phenomenon in bilingual adults, less research has focused on bilingual children. Cognates (i.e., words that share meaning and sound across languages) have frequently been used to explore language co-activation. The present study investigates cognate facilitation effects in child bilinguals of varying language dominance. Spanish-English bilingual children between 6 and 10 years old performed a picture-naming task that included pictures of cognates and non-cognates. Children who were more English-dominant experienced larger cognate facilitation effects when producing words in their non-dominant language but not in their dominant language. In contrast, children with more balanced dominance did not experience cognate facilitation effects in either language. The findings from this study may have implications for the development of the bilingual lexicon.

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Chapter 1: Introduction

As the population of bilinguals and the number of bilingual education programs in the U.S. continue to increase, there is a growing need to understand how children learn and process two languages. Although the majority of research on bilingual language processing has been conducted with adult bilinguals, children present a unique case in that they are in the early stages of mastering two languages. One particular area in child bilingual development that has been understudied is the interplay between languages during language production.

The theory of language non-selectivity posits that bilinguals activate linguistic elements from both of their languages regardless of which is in use (de Groot, 2011). This co-activation results in cross-linguistic influences that are evident throughout a bilingual's development, from the early bilingual child's mixing of components from both languages (Kupisch, 2008), to the fully proficient bilingual's effortless switch from one language to the other either within or between utterances (Odlin, 2003). This phenomenon has been widely researched in an effort to understand how the parallel activation of both languages can either facilitate or impede processing and production in the target language.

A variety of measures have been used to investigate language co-activation in adult bilinguals including lexical decision tasks (Dijkstra, Van Jaarsveld, & Ten Brinke, 1998; Van Hell & de Groot, 2008; Van Hell & Dijkstra, 2002), picture naming (Costa, Caramazza & Sebastian-Galles, 2000; Hoshino & Kroll, 2008), and translation (Van Hell & de Groot, 2008; Sánchez-Casas, García-Albea, & Davis, 1992). This phenomenon has also been explored using eye-tracking (Duyck, Van Assche, Drieghe, & Hartsuiker, 2007; Libben & Titone, 2009; Marian & Spivey, 1999; Spivey & Marian, 1999) and event-related potentials (ERP; e.g., Christoffels, Firk & Schiller, 2007; Midgley, Holcomb & Grainger, 2011).

Studies on speech errors have also found evidence of cross-linguistic influence in adult bilinguals who unintentionally use their L1 during L2 production (Poulisse, 1994). Dewaele (1998) found cases in which bilinguals and trilinguals created "lexical inventions" by applying

the rules of their weaker language to words borrowed from one of their more dominant languages (trilinguals borrowing from their L2 during L3 production and bilinguals borrowing from their L1 during L2 production). For example, during production in French, one participant created the word "addicté" [adike] by borrowing the word 'addiction" from English and creating a past participle by adding the French past-tense conjugation [-ke]. Other studies using picture-word interference paradigms have found that bilinguals' production times of words in one language were affected by cross linguistic distractor words that were either phonologically related to the target word or phonologically related to its translation (Costa, Miozzo & Caramazza, 1999; Hermans, Bongaerts, De Bot & Schreuder, 1998). Marian and Spivey (1999) used eye tracking to find that when told in one language to pick up an object, bilinguals looked briefly at a distractor object that had a phonologically similar label in the non-targeted language.

Most relevant to the present study is research on cognate facilitation effects in word processing and production. Studies have revealed that adult bilinguals process cognates, or words that share semantic and phonological properties across languages (e.g., 'elephant' in English and 'elefante' in Spanish), more accurately and rapidly than non-cognates (e.g., Cop, Dirix, Van Assche, Drieghe & Duyck, 2016; Christoffels et al., 2007; Costa et al., 2000; Dijkstra, Miwa, Brummelhuis, Sappelli & Baayen, 2010; Hoshino & Kroll, 2008; Van Assche, Duyck, Hartsuiker & Diependaele, 2009; Van Hell & Djikstra, 2002).

This facilitation effect is proposed to be a result of the parallel activation of lexical items across languages and the activation of their corresponding phonological properties. The overlap between phonological properties results in a stronger activation that leads to faster retrieval and production (Costa et al., 2000). Most notably, cognate facilitation effects have been found to be more robust in bilinguals' non-dominant languages (but see Van Hell & Djikstra, 2002). In the non-dominant language, non-cognates may have much weaker activation compared to cognates that receive substantial support from the overlapping activation of the dominant language. In contrast, words in the dominant language may already have strong activation and thus the

overlapping activation of the weaker, non-dominant language during cognate production in the dominant language may not result in a strong cognate facilitation effect.

Though most studies have explored language co-activation in bilingual adults, there is limited research on this phenomenon in bilingual children. Furthermore, the majority of research on cognate effects in bilingual children has focused on comprehension, not production, and the findings are inconsistent. For example, Brenders, Van Hell, and Dijkstra (2011) found that child second language learners were faster at recognizing cognates compared to non-cognates in their L2 when performing a lexical decision task. Pérez, Peña, and Bedore (2010) also found cognate advantages in bilingual children when completing receptive vocabulary assessments, however, these advantages were dependent upon children's language exposure. In contrast, Umbel, Pearson, Fernandez, and Oller (1992) and Umbel and Oller (1994) did not find cognate advantages in bilingual children when performing similar tasks. To our knowledge, Poarch and Van Hell (2012) were the only to explore cognate effects during language production in child bilinguals. Consistent with findings in adult bilingual language production, results showed that bilingual children also experienced cognate facilitation effects when naming pictures.

A further exploration of this topic in bilingual children may uncover developmental differences in language co-activation. Furthermore, language processing in children provides a unique opportunity in that, as compared to adults, children are still in the process of developing connections between words and meaning. Consequently, Jescheniak, Hahn, Hoffman, and Wagner (2006) propose that children's performance in lexical tasks is slower than that of adults thus allowing for a larger window of time to detect influences on lexical retrieval. This is particularly applicable to children who are in the process of learning a second language given that they are forming connections between words and meanings both within and across their two languages.

As previously mentioned, the number of bilingual education programs continues to increase in response to the growing number of children who are bilingual or learning a second language (Wilson, 2011). A deeper understanding of the interaction between languages at

various stages of bilingual development may have significant implications for the structure of and teaching methods used in bilingual education programs. For example, despite a lack of empirical support, a long-held assumption in bilingual education programs is that in order to maximize L2 learning, bilingual classrooms must avoid the use of L1 (see Cummins, 2007 for a review; Palmer, Martínez, Mateus & Henderson, 2014). Considering the increasing number of studies supporting a parallel activation of targeted and non-targeted languages in bilinguals, this method may be more costly than beneficial (Scott & Fuente, 2008). Furthermore, studies have shown cognate advantages during second language vocabulary acquisition. Specifically, bilingual children are able to take their vocabulary knowledge from their stronger, dominant language to access or make inferences about vocabulary in their non-dominant language (i.e., bilingual bootstrapping; Gawlitzek-Maiwald & Tracy, 1996).

In this chapter, I will provide a brief overview of the theories and models of lexical access in bilinguals and monolinguals. I will then turn to language co-activation, specifically, the supportive findings from research on cognate processing. The subsequent sections will include an overview of lexical access in child bilinguals as well as defining bilingualism and the role of language dominance in lexical access and cross-linguistic interaction.

LEXICAL ACCESS IN MONOLINGUALS AND BILINGUALS

Lexical access primarily occurs in three stages: conceptualization, formulation, and articulation. The conceptualization stage involves the use of one's memory stores to decide on the intended message. This abstract, 'preverbal' message (lemma) is then transitioned into the formulation stage in which the preverbal message is translated into a linguistic structure (lexeme) through grammatical and phonological encoding. Once a phonetic plan has been created, the message can then be articulated (Levelt, 1989).

Various models have been proposed in regard to the flow of activation during lexical retrieval. According to the serial discrete model of lexical access, activation flows forward from the lemma to the lexeme, however, the activation of the lexeme can only occur

after the lemma process has been completed. Once the targeted lexeme has been activated, its corresponding phonological features can be accessed (Levelt et al., 1991). In contrast, cascaded models of lexical access assume that several lexical entries are activated and that all activated entries spread activation to their corresponding phonological components (Peterson & Savoy, 1998). Similarly, the interactive-activation model posits that multiple lexical entries are activated; however, this model assumes that activation is bidirectional (Dell, 1986).

Most research to date has provided support for cascaded and interactive-activation models (e.g., Costa, et al., 2000; Jescheniak & Schriefers, 1998; Morsella & Miozzo, 2002; Navarrete & Costa, 2005; Peterson & Savoy, 1998). Relatedly, Altenberg and Cairns (1983) proposed a theory, commonly known as "language non-selective lexical access," for bilinguals suggesting that both languages are activated, regardless of which is in use. Thus, for bilinguals, the activation of multiple lexical items results in lexical competition both within and across languages.

LANGUAGE CO-ACTIVATION: EVIDENCE FROM COGNATES

Researchers have found that word retrieval and production are facilitated when a target word is preceded by a picture or word prime that is either phonologically related to the target word (e.g., count-couch) or phonologically related to a near-synonym of the target word (e.g., soda (for sofa)-couch; Peterson & Savoy, 1998; Jescheniak & Schriefers, 1998). These findings, particularly those found for items that are phonologically related to near-synonyms, are interpreted as support for cascaded lexical access, namely, the spread of activation to multiple lexical entries and their corresponding phonological features.

Costa et al. (2000) extended these findings to bilingual lexical access by comparing cognate and non-cognate production. Cognates are translated word pairs that share phonological features across languages. As previously discussed, the language non-selective access theory posits that activation is spread to lexical entries across languages. The activated lexemes in both languages spread activation to their corresponding phonological features. Processing cognates

presents a unique situation in that the semantically identical word pairs are both strongly activated and their corresponding phonological features are not only simultaneously activated, but are overlapping. As found in the aforementioned monolingual studies, overlapping phonological features are more strongly activated and result in a facilitated retrieval of the target word. Indeed, Costa et al. (2000) found that, when naming pictures, adult bilinguals were faster at naming cross linguistic cognates compared to non-cognates. Importantly, the study revealed that the magnitude of the cognate facilitation effect was dependent on the assigned response language. Bilinguals experienced a larger facilitation effect when naming pictures in their non-dominant language. This finding is interpreted as reflecting the asymmetrical strength of each language, specifically, the stronger connections between the semantic network and lexical entries in the dominant language. The stronger activation of the lexeme and its phonological features in the dominant language provide a significant amount of facilitation for cognate production in the non-dominant language. In contrast, the weaker activation of the non-dominant language does not provide the same magnitude of support for cognate production in the dominant language.

A study by Van Hell and Dijkstra (2002) found that trilinguals experienced cross-linguistic influences from their non-dominant languages when performing tasks in their L1, even when strictly in an L1 context. Dutch-French-English trilinguals who were dominant in Dutch but had varying proficiencies in French and English performed lexical decision tasks and word association tasks in Dutch. Participants exhibited faster responses for Dutch words that were phonologically similar to words in their non-dominant languages. However, the influence of the non-dominant language was contingent upon the level of proficiency in that language. Specifically, they did not experience facilitation effects for words in their L1 that were phonologically similar to their much weaker L3. This is consistent with previous findings of stronger cognate facilitation effects in L2 learners when performing linguistic tasks in their L2 but not in their L1.

Using a variety of paradigms, researchers have continued to explore cognate processing in adult bilinguals in an effort to understand how, and to what extent, non-targeted languages

may influence the comprehension and production of a targeted language. However, this phenomenon merits investigation in child bilinguals as well in order to understand the developmental trajectory of language co-activation. Few studies have explored this in bilingual child populations, and of the few, most have focused primarily on language comprehension.

Lexical Access and Cognate Effects in Child Bilinguals

A key component of language development is the formation of a rich lexical-semantic network. The connections between words and meanings strengthen with experience resulting in greater speed and accuracy of word retrieval (Roelofs, 1992). Children, as compared to adults, have significantly less experience with language and are still in early stages of vocabulary development.

Unlike monolingual children, bilingual children must form two vocabularies. The strength of each language is dependent upon multiple factors (e.g., age of acquisition and frequency of use) and is typically asymmetrical (i.e., one language is more dominant than the other; Sheng, Bedore, Peña & Fiestas, 2013). According to the Revised Hierarchical Model (Kroll & Stewart, 1994), words in the dominant language (L1) have a stronger direct connection to the semantic network. In contrast, the significantly weaker L2 has not yet developed such a stable connection and instead must rely on the L1 as a mediator.

As previously discussed, research on cognate comprehension and production has been widely used as a means of exploring lexical processing in bilingual adults; however, despite developmental differences in lexical networks, little research on this topic has focused on bilingual children. Of the few studies that have explored cognate effects in bilingual children, most have focused on language comprehension and have shown inconsistent findings between children of varying language backgrounds.

As with adult second language learners, some studies exploring language co-activation in child second language learners show findings in favor of a cognate advantage during language comprehension. For example, Brenders et al. (2011) compared Dutch children who were either in

the beginning or intermediate stages of learning English as a second language. During a lexical decision task, both beginner and intermediate L2 learners were faster at recognizing cognate than non-cognate English words. In contrast, when recognizing words in their L1, child L2 learners at either stage did not experience a cognate facilitation effect. The advantage experienced when recognizing cognate words in their second language, English, may have been especially pronounced in child L2 learners given the asymmetry in their language dominance. The activation of their stronger language may have facilitated retrieval in their weaker language whereas their weaker language would not have had the same impact on retrieval in their stronger language.

Pérez et al. (2010) found that cognate advantages in bilingual children were mediated by language exposure. Children were categorized as either High English Exposure, High Spanish Exposure, or Balanced Exposure and their performance on standardized English receptive vocabulary measures was compared across groups. The researchers found a significant interaction such that High Spanish Exposure children performed better on English cognates compared to English non-cognates whereas High English exposure children performed better on non-cognates compared to cognates. The authors argue that children with higher exposure to Spanish may use their vocabulary knowledge in Spanish to recall English cognate words. Interestingly, Balanced Exposure children did not show a cognate advantage but rather performed comparatively well on both cognates and non-cognates. Balanced Exposure children may have had sufficient dominance in both languages such that the co-activation of the non-target language did not have as significant of an impact if at all.

Similarly, Umbel et al. (1992) showed no cognate facilitation effects in child bilinguals from Spanish-English bilingual homes. However, unlike Pérez et al. (2010), the researchers found no cognate advantages for bilingual children from Spanish monolingual homes either. Children across groups performed equally well on cognates and non-cognates during a receptive vocabulary assessment. Umbel and Oller (1994) later replicated this finding with first-, third-, and sixth-grade Spanish-English bilingual children. Perez et al. (2010) argue that the absence of

a cognate advantage may have been attributed to the lack of control for item difficulty. In the assessments used by Umbel et al., cognates become progressively more difficult as the participant advances.

The large majority of studies on cognate advantages in children, including those described above, are aimed at exploring language comprehension. Although comprehension and production are two very distinct processes, the presence of cross linguistic influences may be similar. In comprehension, a listener must decode a steady stream of speech into word form and ultimately conceptual meaning. As speech progresses, listeners may activate multiple word candidates (Schiller & Meyer, 2003). A listener who is more dominant in one language may additionally activate word candidates in their stronger language to facilitate decoding speech in their non-dominant language. A reverse type of process is true for language production. Speakers must take conceptual items and activate the word form associated with that concept to communicate the intended message. According to the theory of language non-selectivity, word forms in the non-targeted language may also be activated (Altenberg & Cairns, 1983). To our knowledge, only one study has explored cross linguistic influences during language production in bilingual children. Poarch and Van Hell (2012) researched cognate facilitation effects in German children learning English (L2 learners), German-English bilingual children, German-English-language X trilinguals (who had higher proficiency in German compared to English), an German-English adult bilinguals. In line with the findings from Brenders et al. (2011), L2 learners showed robust cognate facilitation effects when producing words in their L2 (English), but not when producing words in their L1 (German). Surprisingly, bilingual children also showed facilitation effects when naming in their L2 (English) as well as significant, albeit small, facilitation effects when naming in their L1 (German). Trilingual, German-dominant children showed facilitation effects when naming in English (their least dominant language) but not when naming in German (their most dominant language). Thus, the authors make a similar argument to that in the adult bilingual literature, namely, that the weaker language does not have a significant influence on production in the stronger language. Interestingly, despite categorizing children as

"bilingual" given their similar levels of proficiency in both languages, the authors still referred to German as the bilingual children's "dominant" language or "L1" and English as their "non-dominant" language or "L2." Although this could simply be a choice of terminology to distinguish between the two languages it begs the question of whether proficiency alone can explain the strength of activation in each language.

DEFINING BILINGUALISM

The research described thus far, as well as many other bilingual studies, vary greatly in how bilingualism is defined and measured. As researchers, it is imperative that we underline how we each define bilingualism and why such a measure has been chosen as this may have implications for the generalization of our findings. Although a universal measure of bilingualism would be ideal, such a measure would be difficult to design given that there are numerous factors that can influence an individual's linguistic experience. Commonly considered factors include proficiency, age of acquisition, frequency of use, and exposure (Pienemann & Kessler, 2007). Factors that are potentially equally important but not as frequently used include language preference and language mode (see Grosjean, 2001 for details on 'language mode theory'). Furthermore, the relevance of each factor varies by population. For example, parental input and language use in the classroom are more pertinent to child bilinguals than to adult bilinguals (Bedore et al., 2012). The way in which bilingualism is measured is also dependent upon the research field, purpose, and methods (Pienemann & Kessler, 2007). Finally, despite an agreement that bilingualism is best measured on a continuum (Butler & Hakuta, 2004; Luk & Bialystok, 2013; van Hell & Tanner 2012), most studies classify bilinguals under discrete (typically dichotomous) categories. Only recently have studies begun to apply continuous measures of bilingualism.

Although not a universal or definitive solution, one step towards obtaining a more accurate measure may be to incorporate multiple factors, particularly those most relevant to the study's population. Furthermore, these multifactor measurements of bilingualism would be best

quantified onto a continuous scale. Birdsong, Girtken, and Amengual (2012) developed a continuous measure of bilingualism including additional factors such as language history, frequency of use, proficiency, and attitudes toward each language. The present study used a modified version of this measure designed to assess bilingual children's language dominance.

CURRENT STUDY

The present study was aimed at exploring cross language activation in child bilinguals during language production as a function of language dominance. The methods used in this study are similar to those used in Costa et al. (2000) and Poarch and Van Hell (2012), however, this study is unique in that it explores this phenomenon in English-Spanish bilingual children and, rather than categorizing bilinguals into groups based on language proficiency, this study employed a continuous measure of bilingualism that included multiple factors believed to influence language experience. This continuous measure allowed us to more closely assess the incremental changes in cognate effects in each language. The primary questions of interest in the current study are 1) do English-Spanish bilingual children experience a cognate facilitation effect when producing words in each of their languages, and 2) if so, how does this effect change as language dominance shifts from being primarily dominant in one language to being fairly equally dominant in both?

At a general level, we expected that children who were more English dominant would name pictures in Spanish more slowly than those children who had more balanced English-Spanish dominance. Response times when naming pictures in English should be comparable for children across the language dominance scale. More importantly, if children, like adults, co-activated both languages during language production, we expected that children would show cognate advantages that would be mediated by language of response and language dominance. Specifically, children who are more dominant in English should experience a larger cognate facilitation effect when producing words in Spanish than when producing words in English. English dominant children should experience a large influence from English on production in

their weaker language, Spanish, resulting in faster response times for cognates and slower response times for non-cognates. In contrast, Spanish would not have as large of an influence on their production in English. In contrast, children who have more balanced dominance in English and Spanish should experience roughly equal influences from each language and therefore show cognate facilitation effects during production in English and Spanish. However, given that their overall performance in both languages should be high, the difference between non-cognate and cognate production times should not be as large as the difference between cognate and non-cognate production times for English dominant children producing Spanish.

Chapter 2: Methods

PARTICIPANTS

Eighty-four child participants were recruited for the current study from the local Austin community through the UT Austin Children's Research Lab participant pool as well as local elementary schools. At the time of recruitment, parents verified that their child was either an English-Spanish bilingual or a native English speaker learning Spanish as a second language. Child participants were excluded if they had speech impairments (n=1), if they chose not to complete the task (n=5), or if they did not meet the minimum correct response count criteria (n=18; see "Analyses" for details on correct response count criteria). Typically, those children who were omitted due to low correct response counts were not yet sufficiently proficient in Spanish to provide the minimum number of correct responses. Of the remaining 60 child participants, 36 were females and 24 were males. Child participants were 6 to 10 years old (range=6;2-10;10) with a mean age of 8 years 6 months (*SD*=1;5). Sixty percent of child participants were identified by their parents as White Hispanic, 30% as White Non-Hispanic, 3% as Mixed Hispanic, 2% as Mixed Non-Hispanic, 2% as Black Hispanic, and 3% as Other.

MATERIALS

Language dominance measure. In the current study, bilingualism was defined by a continuous measure of language dominance that was adapted from the Bilingual Language Profile dominance measure for adults (Birdsong et al., 2012) and modified for children. The majority of the modules in the measure were similar to those used in the original Bilingual Language Profile, however, questions pertaining to one's experience with language in work settings were substituted with questions pertaining to experience with language in school settings. Furthermore, a separate module was added to further assess children's history of language use in school. The measure was divided into two parts: a parent language questionnaire and a child language questionnaire. The parent language questionnaire consisted of four modules assessing children's language history (e.g., children's exposure to and first use of each

language), language use (e.g., average weekly percentage of use of each language), language proficiency (e.g., ability to speak or read in each language), and their experience with language in education (e.g., which languages are used in school and how often). This portion of the assessment was assigned to parents under the assumption that parents would be more accurate in reporting the child's language history and experience. The child language questionnaire assessed children's preference for each language in various contexts (e.g., when reading or counting.) This portion was assigned to the children under the assumption that the children would be more accurate in describing their personal preferences. The full assessment can be found in Appendix A.

Each module in the parent language questionnaire and the child language questionnaire produced a score for English and a score for Spanish. Scores in each module were multiplied by a factor to give equal weighting across sections. The composite score for Spanish was subtracted from the composite score for English to produce a final language dominance score. Final scores could range from -204 (Spanish monolingual) to 204 (English monolingual) with 0 representing a perfectly balanced bilingual; however, the present study included children who ranged from English-Spanish balanced bilinguals to English dominant. Participants' scores ranged from -29 to 156 with a mean of 70.8 (*SD*=43.1).

Stimuli. The stimuli consisted of 104 images of black on white line drawings of everyday, common objects (e.g., bird, cup) obtained from the CRL International Picture Naming Project (CRL-IPNP) database (Bates et al., 2000). Fifty-two of the images were assigned to the English block and fifty-two were assigned to the Spanish block. Within each block, half of the images represented cognate words and half represented non-cognate words (See Appendix B for a list of stimuli). Within each language, cognates and non-cognates were matched for length, frequency, name agreement, age of acquisition, and visual complexity (see Table 1). Stimuli were pseudo-randomized such that there were no more than three consecutive cognates or non-cognates within each language block. Language order was counterbalanced with half of the participants (n=26) beginning in English and half (n=26) beginning in Spanish.

Table 1. Stimuli properties and matching analyses

	English		Spanish	
	Cognates	Non-cognates	Cognates	Non-cognates
Length (in syllables)	1.85 *(0.73)*	1.81 *(0.80)*	2.5 *(0.71)*	2.3 *(0.60)*
	t(50)=0.18, p=.86		*t(50)=1.27, p=0.21*	
Frequency (5-point scale)	3.18 *(1.20)*	3.08 *(1.23)*	3.15 *(1.12)*	3.31 *(1.72)*
	t(47)=0.30, p=0.77[a]		*t(43.43)=-0.37, p=0.71*[ab]	
Name Agreement	0.97 *(0.05)*	0.95 *(0.07)*	0.91 *(0.12)*	0.94 *(0.07)*
	t(45.14)=0.92, p=0.36[b]		*t(41.5)=-1.15, p=0.26*[b]	
Age of Acquisition (3-point scale)	2.27 *(0.96)*	1.92 *(0.93)*	2.35 *(0.89)*	1.88 *(0.99)*
	t(50)=1.32, p=0.19		*t(50)=1.76, p=0.08*[c]	
Visual Complexity (file size in bytes)	18504.27 *(10162.59)*	16179.62 *(7386.45)*	17821.42 *(10892.15)*	15874.19 *(10411.24)*
	t(45.65)=0.943, p=0.35[b]		*t(50)=0.66, p=0.51*	

Note. Standard deviations are in parentheses; [a] Degrees of freedom were adjusted due to missing values for frequency in English (n=3) and Spanish (n=4); [b] Welch t-tests were used due to homogeneity of variance assumption violations; [c] Marginally significant, however, means for cognate and non-cognates do not work in favor of hypotheses. See Bates et al. (2000) for details on the units of measurement and calculation of measures.

Apparatus. The study was programmed using SuperLab software (Version 5; Cedrus Corporation), which presented trials and recorded response times (i.e., the time between the presentation of the stimulus and the time at which the child began to say the label). The software was run on an iMac computer. Stimuli were presented on 21-inch iMac screen placed approximately 24 inches from each participant. Participants wore a Cyber Acoustics headset microphone that was connected to the computer and SuperLab recorded response times.

PROCEDURE

Children were seated in front of the computer screen and told that they would be playing a picture-naming game in which they were to provide the names for a series of pictures as quickly and as accurately as possible. Instructions were given for each block in the

corresponding language. Following the instructions, children completed a practice session consisting of four black and white images of simple geometrical shapes (e.g., circle). Prior to each practice trial onset, a blank screen with a centered fixation cue was presented for 1000 ms. Each practice trial was presented for 5000 ms or until the child responded.

After the practice trials, children completed a familiarization session. During the familiarization session, all of the stimuli that were going to be presented in the following experimental block were shown to the child. The child was asked to first listen to the researcher say the name of the image and then repeat the name themselves. Each familiarization trial was presented until the child correctly repeated the name.

After the familiarization session, children completed the first language block. The children were told that they would now be naming the pictures on their own as quickly and as accurately as possible. A screen with a centered fixation point was presented before each experimental trial for 1000 ms. Each of the experimental trials were presented for 5000 ms or until the child responded (see Figure 1 for an example illustration of trial sequences). Following the completion of the first language block, the same procedure (i.e., instructions, practice session, familiarization session, and language block) was repeated in the other language.

As the child completed each block, the researcher recorded whether the child's responses were correct, incorrect, or if the child did not provide a response. Following the timed, picture-naming task, children completed the child language questionnaire through an oral interview with the researcher.

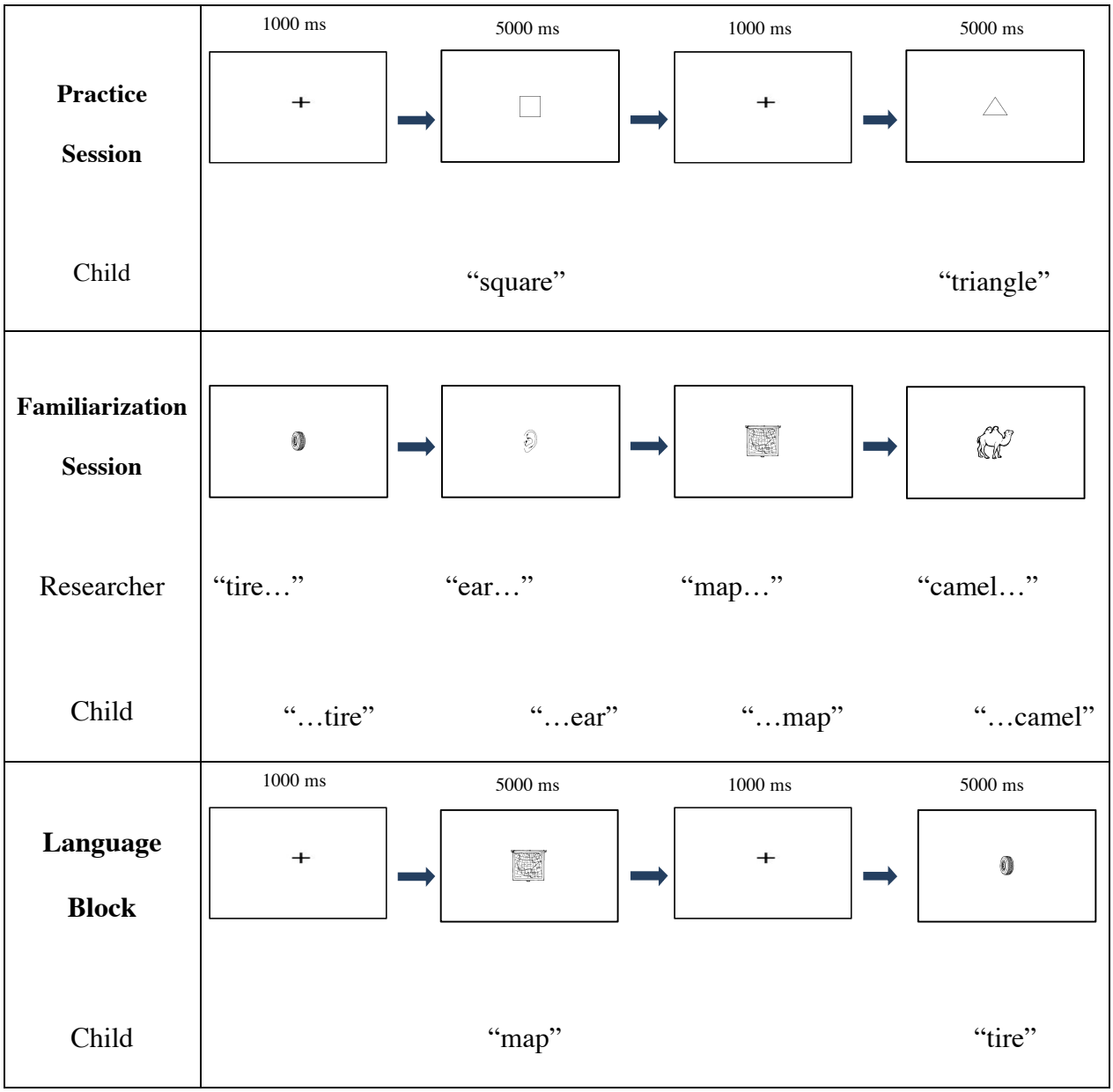

Figure 1. Subset example of trial sequences. Includes practice session (top row), familiarization session (middle row), and language block (bottom row). Following instructions, children completed the practice session followed by the familiarization session and finally the language block for the first language. This series was then repeated for the second language.

ANALYSES

Participants who had less than five correct answers in English cognate, English non-cognate, Spanish cognate, or Spanish non-cognate categories were excluded (n=18). The correct response count minimum was based off of the one used in Poarch and Van Hell (2012), however,

it was more stringent in that it applied to each word type (i.e., cognate or non-cognate) within each language as opposed to each language as a whole. Doing so guaranteed that participants would have correct answers for both cognate and non-cognate words. 60 participants remained for the analyses. On average, participants correctly named 22 out of 26 English cognates, 22 out of 26 English non-cognates, 18 out of 26 Spanish cognates, and 13 out of 26 Spanish non-cognates. Response times less than 500ms were omitted as well as response times that were 2.5 standard deviations above or below each participant's mean response time. Responses that included a speech disfluency (e.g., "um…dog") and those that encountered a technical issue (e.g., the microphone did not record the response) were counted as errors and removed from the analyses. After removing response times for non-target responses, outliers, and errors, 4,398 responses remained for analyses.

All statistical analyses were completed in R 3.3.2 (R Core Team, 2016). Using the lme4 package (Bates, Maechler, Bolker & Walker, 2015), response times were analyzed at the single trial level using a linear mixed effects model with item (word) and participant as random effects. Language (i.e., English or Spanish), status (i.e., cognate or non-cognate), language dominance and all of their interactions were included as fixed effects in the model. Age and language order ("order") were also included as fixed effects to control for their effects on reaction times, however, they were not included in the interactions.

Categorical variables were coded using dummy coding. In the variable "language," English was coded as zero and Spanish was coded as one. For "status," cognate was coded as zero and non-cognate was coded as one. For the variable "language order," English first was coded as zero and Spanish first was coded as one.

After comparing nested models including main effects of language, cognate status, language dominance, as well as higher order two-way interactions and a three-way interaction, the best fitting model was chosen based on the Akaike Information Criterion (AIC) of model selection (Akaike, 1974). A lower AIC score indicates a better fitting model. The comparison of

models can be found in Table 2. The parameters for the best fitting model as characterized by the lowest AIC score are summarized in Table 3.

Chapter 3: Results

We predicted there would be a three-way interaction between language, cognate status and language dominance. During production in Spanish, we expected the presence of a cognate facilitation effect (i.e., faster response times for cognates compared to non-cognates) that would become increasingly larger for children who were more English dominant. When naming pictures in English, children with more balanced language dominance should experience a small cognate facilitation effect. This effect would become smaller as children were more English dominant and essentially non-existent for those who were most dominant in English.

Our analyses indicated that the best fitting model included a significant three-way interaction between language, status, and language dominance ($t(54)=2.245$, $p<.05$; see Figure 2). To interpret this three-way interaction, the data were subset by language. In line with our predictions, when naming pictures in Spanish, the interaction between cognate status and language dominance was significant ($t(55)=2.996$, $p<.01$). Cognate facilitation effects became larger for participants who were objectively more English dominant. Interestingly, children who had the most balanced language dominance (closest to a score of 0 on the dominance scale) did not experience a cognate facilitation effect. Furthermore, when naming pictures in English, there was no significant interaction between language dominance and cognate status, ($t(55)=0.094$, $p>.05$). Thus, although we predicted a small cognate advantage when producing words in English for children with more balanced dominance, our results showed that children across the language dominance scale showed no cognate facilitation effect.. Instead, there was a marginally significant main effect of language dominance ($t(55)=-1.932$, $p=.059$) such that children with higher English dominance were faster at naming pictures in English compared to children with more balanced language dominance. In contrast, there was no effect of cognate status during English production ($t(55)=1.816$, $p>.05$).

Table 2. Comparison of linear mixed effects models

Model	Random Effects	Fixed Effects	AIC
1	Participant+Item	Age+Order+Lang + Stat + Dom	63659.34
2	Same as model 1	Model 1 + (Lang x Stat)	63648.32
3	Same as model 1	Model 1 + (Lang x Dom)	63566.86
4	Same as model 1	Model 1 + (Stat x Dom)	63661.99
5	Same as model 1	Model 1 + (Lang x Stat) + (Lang x Dom)	63554.62
6	Same as model 1	Model 1 + (Lang x Stat) + (Stat x Dom)	63650.80
7	Same as model 1	Model 1 + (Stat x Dom) + (Lang x Dom)	63566.77
8	Same as model 1	Model 1 + (Lang x Stat) + (Stat x Dom) + (Lang x Dom)	63553.99
9*	Same as model 1	Model 8 + (Lang x Stat x Dom)	63550.65

Note. Lang, language (English or Spanish); Stat, cognate status (cognate or non-cognate); Dom, language dominance; *best fitting model

Table 3. Parameters for best fitting linear mixed effects model

	Parameter	β	*SE*
1	Intercept	1402.965	110.476
2	Age	-2.017	1.064
3	OrderSpanFirst	59.745	35.731
4	LangSpan	70.546	33.705
5	StatNonCog	-37.516	33.157
6	Dom	-0.929	0.460
7	LangSpan x StatNonCog	20.993	48.699
8	LangSpan x Dom	1.883	0.309
9	StatNonCog x Dom	0.026	0.293
10	LangSpan x StatNonCog x Dom	1.043	0.465

Note. OrderSpanFirst, Order Spanish first; LangSpan, Spanish; StatNonCog, non-cognate; Dom, language dominance

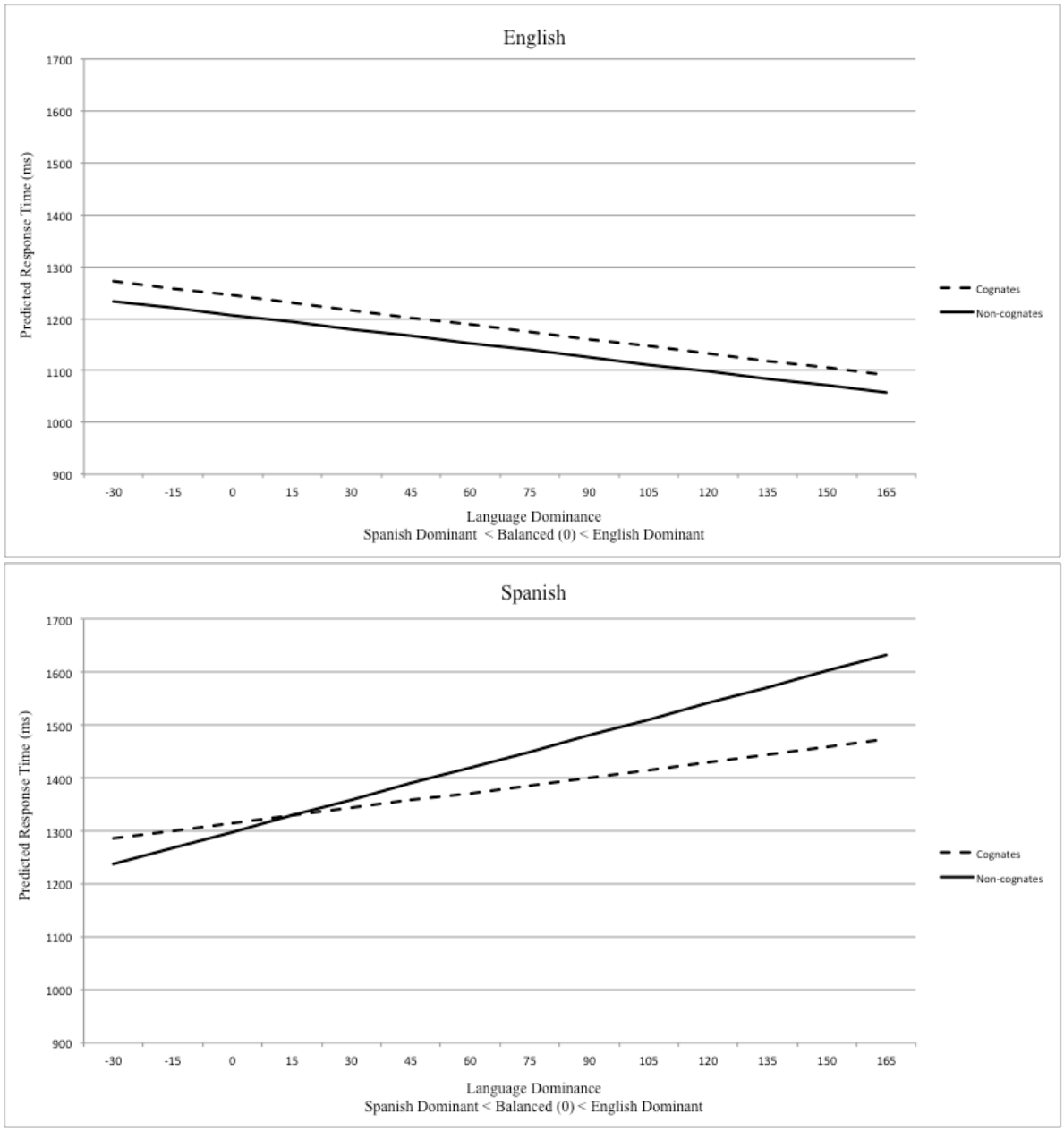

Figure 2. Predicted response times based on the best fitting model. Language dominance scores closer to zero represented more balanced bilinguals whereas scores closer to 204 represented more English-dominant bilinguals.

Chapter 4: Discussion

The present study adds to the body of research on cognate advantages in bilingual children. In addition to being one of the few studies to investigate cognate facilitation effects in bilingual children during a lexical production task, it is the first (to our knowledge) to directly compare these effects between children who range on a continuous scale of language dominance. Previous studies have investigated cognate facilitation effects exclusively in child L2 learners (Brenders et al., 2011) or child bilinguals (Pérez et al. 2010; Umbel et al., 1992; Umbel and Oller, 1994). Poarch and Van Hell (2012) examined both child L2 learners and bilingual children; however, each group was tested in separate experiments and therefore were not statistically compared. A unified linear comparison of cognate effects in children with varying levels of language dominance is warranted to examine how lexical retrieval mechanisms may incrementally change between children as a function of language dominance. Overall, we found that children did in fact experience varying magnitudes of cognate facilitation effects depending upon their language dominance as well as their language of response. We propose these findings may be due to differences in the strength of activation in each language. Furthermore, the inconsistencies between the findings in this study and those in adult bilingual studies may suggest developmental differences in the bilingual lexicon and lexical retrieval or differences in measures of bilingualism.

All children in our study had substantial experience in English but differed in their experience in Spanish. They ranged from having fairly balanced dominance in English and Spanish to being predominantly English dominant. Unsurprisingly, children who were more English dominant were faster at naming pictures in English than in Spanish whereas children who had balanced dominance showed comparable response times in both languages. Consequently, we took this finding as support for the reliability of our dominance measure.

In line with our predictions, we found that cognate facilitation effects were mediated by language of response and language dominance. When naming pictures in Spanish, children who were more English dominant showed larger cognate facilitation effects than children who had more balanced English-Spanish dominance. In contrast, when naming pictures in English, no children, regardless of language dominance, showed a cognate facilitation effect.

The finding that during Spanish production, cognate facilitation effects were largest for children who were English dominant is consistent with previous findings in adult L2 learners (e.g., Costa et al., 2000; Van Assche et al., 2009; Van Hell & Djikstra, 2002), in child L2 learners (Brenders et al., 2011; Poarch & Van Hell, 2012) and in High Spanish Exposure children in Pérez et al. (2010). An interesting finding, though not the focus of this paper, is that the more English dominant children oftentimes produced neologisms that suggested they may be consciously using their vocabulary knowledge in English to attempt to name pictures in Spanish. For example, some children named the picture of a basket (Spanish- *canasta*) "basketa." This is similar to findings in Pérez et al. (2010) in which children were able to bootstrap from their L1 (Spanish) to their L2 (English). An example from that study is when a child was asked why she/he pointed to a picture representing the English word "floral," the child responded "porque es una flor" (English- *because it's a flower*). Thus, the cognate facilitation effect for children who were more English dominant may be reflective of a conscious reliance on their dominant language to then bootstrap to their non-dominant language. When naming pictures in English, children who were more English dominant did not need to rely on their non-dominant language and therefore did not show a cognate facilitation effect.

Although previous studies have found that highly proficient adult bilinguals experience cognate facilitation effects (though considerably smaller than those found in adult L2 learners) during production in both of their languages (e.g., Costa et al 2000; Van Hell & Djikstra, 2002), children in our study who had more balanced language dominance did not experience a facilitation effect in either language. This result is consistent with findings from studies on language comprehension in bilingual children (Umbel et al., 1992; Umbel & Oller, 1994) as well

as with Balanced Exposure bilingual children (Pérez et al., 2010). However, it is inconsistent with findings on language production in bilingual children (Poarch & Van Hell, 2012). The inconsistencies between the findings for language production in adult bilinguals and children in our study may reflect a developmental difference in lexical retrieval and production or may be a result of our use of a continuous measure of bilingualism. Similarly, the inconsistency between our results and those found in bilingual children in Poarch and Van Hell (2012) may also be due to the difference in bilingual measures. Poarch and Van Hell (2012) categorized children in their study as "L2 learners" or "bilinguals" according to their proficiency in each language. Furthermore, each group was tested and analyzed separately and thus, could not be compared directly.

IMPLICATIONS FOR DEVELOPMENTAL DIFFERENCES IN BILINGUAL LEXICAL ACCESS

Research on language processing in adult bilinguals shows consistent findings of cognate facilitation effects (Cop et al., 2016; Christoffels et al., 2007; Costa et al., 2000; Dijkstra et al., 2010; Van Assche et al., 2009; Van Hell & Djikstra, 2002). Cognate advantages support the theory of language non-selectivity (i.e., the simultaneous activation of targeted and non-targeted languages during language processing) and cascaded models of lexical access (i.e., the activation of multiple lexical entries and the spread of activation to each of their corresponding phonological components). Costa et al. (2000) propose that the facilitated retrieval of cognates is due to the overlapping, and thus stronger, activation of shared phonological features from cognates across languages.

Bilingual children, like adults, may experience language non-selective access as well (e.g., Brenders et al., 2011; Perez et al., 2010; Poarch & Van Hell, 2012). Given that children are generally slower in lexical retrieval tasks compared to adults (e.g. Berman, Friedman, Hamberger, & Snodgrass, 1989; Jescheniak et al., 2006), they may have a larger time window in which the weaker activation of the non-targeted language may decrease. This would explain the absence of a cognate facilitation effect for children with more balanced language dominance in

the present study. Despite having comparable strength in each language, balanced bilingual children may experience slightly higher activation in the targeted language. Given slower response times compared to adults, balanced bilingual children may then have more time in which the activation of the non-targeted language can decrease. In contrast, when more English-dominant children are naming pictures in their non-dominant language, their much stronger, dominant language could maintain activation throughout this time lapse despite being the non-targeted language. Thus, English-dominant children would experience substantial support from their dominant language when naming phonologically similar words in Spanish.

Jescheniak et al. (2006) claim their findings contradict this theory and that instead, children may maintain activation of distractors due to their immature inhibitory mechanisms. In their study, monolingual children were presented with various auditory distractors during a picture-naming task. Distractors included words that were phonologically related but semantically unrelated to the target word (e.g., target word *bett* [bed] and distractor word *berg* [mountain]) as well as distractors that were phonologically similar to a semantically related word (category coordinates; e.g., target word *bett* [bed] and distractor word *sosse* [sauce] which is phonologically similar to *sofa* [sofa]). They found that children and adults experienced facilitation effects for phonologically similar distractors, but, only children experienced facilitation effects from category coordinates. Despite the similar age range used in Jescheniak et al. (2006); 7 to 10-years old) and the present study (6 to 10 years old), the theory proposed by the researchers may not generalize to the findings in our study given that a) their study employed cross-modal distractors, which have been shown to be more markedly distracting to children compared to unimodal distractors (Hanauer & Brooks, 2003) and b) the present study focused on bilingual children who may have more mature inhibitory mechanisms given their experience controlling their two languages (Emmorey, Luk, Pyers & Bialystok 2008).

IMPLICATIONS FOR MEASURES OF BILINGUALISM

There is currently no universal measure of bilingualism and given the differences in bilingual research areas, study purposes, and even populations studied; there is an inevitable variability in the categories used to measure bilingualism. Although the measures of bilingualism within each study may be adapted to capture the particular topic of interest, there are at least two points that must be considered: 1) bilingualism cannot be determined by one single variable and 2) bilingualism is not categorical (De Cat & Serratrice, 2017; Kaushanskaya & Prior, 2015; Luk & Bialystok, 2013; Treffers-Daller, 2011). A majority of research has used arbitrary cutoffs to group bilinguals of varying language experience into discrete, typically dichotomous, categories. These categories are often given broad labels such as "bilingual" and "monolingual" or "bilingual" and "L2 learner." Furthermore, the factors used to measure bilingualism are often underreported. This ambiguity may be a contributing factor into the inconsistencies found in bilingual studies (for a review, see Treffers-Daller, 2011).

The present study used a multi-factor continuous measure of bilingualism to provide a more accurate representation of the incremental changes of cognate facilitation effects in bilingual children as a function of language dominance. Using a linear mixed effects model, we were able to explore this phenomenon as a function of this continuous measure of bilingualism. Van Hell and Tanner (2012) emphasized the need for such an approach in bilingual research as it would "more accurately model the continuous nature of individual differences" (p. 166).

We propose that future studies investigating this topic should utilize similar measures and regression based analyses so as to better capture individual variation within a heterogeneous population of bilinguals.

LIMITATIONS

One limitation of this study is that we did not include children who were more Spanish dominant. We limited our participants to children who ranged from balanced dominance to English dominant given the limited population of Spanish dominant children (compared to balanced bilingual and English dominant children) in our surrounding area. Another limitation is that we did not include monolingual children. Doing so would have allowed us to ensure that cognate effects were not simply due to item differences. Nevertheless, we did match our stimuli across multiple characteristics (e.g., frequency, age of acquisition, etc.) Finally, we did not include adult bilinguals in our study either. If we had included adults, we would have been able to perform a direct comparison to children; however, the intended focus of our study was on the variability between child bilinguals.

CONCLUSION

The aim of the present study was to explore how cognate facilitation effects differ among children of varying language dominance. This paradigm has been widely used as a measure of cross-linguistic influences due to language co-activation. We found that children who were more dominant in English experienced larger cognate facilitation effects when naming pictures in their non-dominant language (Spanish), but not when naming pictures in their dominant language. This parallels findings in adult L2 learners (e.g., Cop et al., 2016; Costa et al., 2000). Although previous studies with adult bilinguals have found significant (albeit, smaller) cognate facilitation effects when bilinguals are processing their dominant language (e.g., Costa et al., 2000; Van Hell & Djikstra, 2002), our study did not reveal cognate facilitation effects for balanced child bilinguals in either language. This inconsistency may be evidence of either a developmental difference in lexical retrieval or could perhaps be due to the use of a multi-factor, continuous

measure of bilingualism in our study compared to the categorical measures of bilingualism typically used in adult bilingual studies of cognate facilitation effects.

We propose that English dominant children activate English while processing Spanish so as to use their vocabulary knowledge in English to bootstrap into Spanish. Having overlapping phonological features in English, Spanish words are more easily and rapidly retrieved. Post-hoc observations of English-dominant children's use of English to create neologisms for words they did not know in Spanish may be further support for this idea. However, these data need to be formally analyzed in order to properly assess whether or not they may support this theory.

As previously noted, the absence of cognate facilitation effects in balanced bilingual children compared to those previously found in adult bilinguals may be reflective of a developmental difference in lexical retrieval or due to the different measure of bilingualism used in this study. When retrieving lexical items, balanced bilingual children may have a larger time window during which the activation of the non-target language can decay. Alternatively, our findings could be more comparable to those in highly proficient adult bilinguals than we think. It is difficult to determine where the bilingual categories defined in adult studies fall on our language dominance continuum. Replicating these studies with a multi-factor continuous measure of bilingualism may be more reflective of the incremental changes in lexical access within adult bilingual populations. These results may then be more reliably compared to those in child bilinguals.

The results from the present study may have implications for language policy in bilingual education. Traditional methods in bilingual education maintain a strict rule of separating languages, be it by day, class, or instructor so as to avoid "cross-language contamination" (Garcia, 2011; Gorter & Cenoz, 2017; Odlin, 1989). However, the present study provides further

support for language co-activation in bilingual children, particularly, those of varying language dominance. Therefore, treating each language as an isolated entity would go against bilingual children's natural processing of two languages. One study even found that bilingual teachers would often mix languages despite being instructed to maintain them as separate (Palmer, Martínez, Mateus & Henderson, 2014). Depending on the context, teachers and students would switch between languages for various reasons such as emphasizing topics or redirecting attention. Thus, a more flexible approach to language use in the bilingual classroom may be more natural, appropriate, and beneficial for bilingual language development.

In an attempt to more precisely determine whether or not there may be a developmental difference in bilingual lexical retrieval, future studies on cognate facilitation effects should directly compare bilingual children and adults. Furthermore, these and future studies should continue the movement towards the development and utilization of multi-factor, continuous measures of bilingualism. Measures of this kind can more accurately capture the incremental variability in our heterogeneous bilingual population.

Appendix A

Bilingual Language Profile Modified for Children

Parent Language Questionnaire

I. Language history

In this section, we would like you to answer some factual questions about your child's language history by circling the appropriate number.

1. At what age was your child first **exposed** the following languages?

English	Less than 1	1	2	3	4	5	6	7	8	9	10+	Never
Spanish	Less than 1	1	2	3	4	5	6	7	8	9	10+	Never

2. At what age did your child **start using** the following languages?

English	Less than 1	1	2	3	4	5	6	7	8	9	10+	Never
Spanish	Less than 1	1	2	3	4	5	6	7	8	9	10+	Never

3. How many years has your child spent in **a program** that regularly uses the following languages? (Preschool through elementary)

English	Less than 1	1	2	3	4	5	6	7	8	9	10+	Never
Spanish	Less than 1	1	2	3	4	5	6	7	8	9	10+	Never

4. How many years has your child spent living in a **country/region** where the following languages are widely used? For example, it is the official language of the nation/region or it is used by the majority of the population in that area (e.g., Spanish is used by the majority of the population in the Rio Grande Valley in Texas).

English	Less than 1	1	2	3	4	5	6	7	8	9	10+	Never
Spanish	Less than 1	1	2	3	4	5	6	7	8	9	10+	Never

5. How many years has your child spent in a **family** where the following languages are spoken?

English	Less than 1	1	2	3	4	5	6	7	8	9	10+	Never
Spanish	Less than 1	1	2	3	4	5	6	7	8	9	10+	Never

II. Language use

In this section, we would like you to answer some questions about your child's language use by circling the appropriate number.

Total use for all languages in a given question should equal 100%.

1. In an average week, what percentage of the time does your child use the following languages **with friends**?

English	0%	10	20	30	40	50	60	70	80	90	100%
Spanish	0%	10	20	30	40	50	60	70	80	90	100%
Other: _____	0%	10	20	30	40	50	60	70	80	90	100%

2. In an average week, what percentage of the time does your child use the following languages **with family**?

English	0%	10	20	30	40	50	60	70	80	90	100%
Spanish	0%	10	20	30	40	50	60	70	80	90	100%
Other: _____	0%	10	20	30	40	50	60	70	80	90	100%

3. In an average week, what percentage of the time does your child use the following languages **at school**?

English	0%	10	20	30	40	50	60	70	80	90	100%
Spanish	0%	10	20	30	40	50	60	70	80	90	100%
Other: _____	0%	10	20	30	40	50	60	70	80	90	100%

4. What percentage of the time would your child choose to **read** in the following languages? (Assuming text available in all following languages

English	0%	10	20	30	40	50	60	70	80	90	100%
Spanish	0%	10	20	30	40	50	60	70	80	90	100%
Other: _____	0%	10	20	30	40	50	60	70	80	90	100%

5. What percentage of the time would your child choose to **count** in the following languages?

English	0%	10	20	30	40	50	60	70	80	90	100%
Spanish	0%	10	20	30	40	50	60	70	80	90	100%
Other: _____	0%	10	20	30	40	50	60	70	80	90	100%

III. Language Proficiency

In this section, please rate your child's proficiency by circling the appropriate number from 0-6.

	0=not well at all						*6=very well*
12. a. How well does your child speak **English**?	0	1	2	3	4	5	6
b. How well does your child speak **Spanish**?	0	1	2	3	4	5	6
13. a. How well does your child understand **English**?	0	1	2	3	4	5	6
b. How well does your child understand **Spanish**?	0	1	2	3	4	5	6
14. a. How well does your child read **English**?	0	1	2	3	4	5	6
b. How well does your child read **Spanish**?	0	1	2	3	4	5	6
15. a. How well does your child write **English**?	0	1	2	3	4	5	6
b. How well does your child write **Spanish**?	0	1	2	3	4	5	6

IV. Education: *In this section, please describe your child's language experience in school.*

Current Program:

1) Please indicate the type of school program your child is *currently* enrolled in:
   a. English based program
   b. English-Spanish Dual Language Program
   c. Spanish Immersion Program
   d. Other _____

2) Length of duration in current program: _____years _____months

3) The program is divided into **(per week):**
   Total percent must equal 100%

Language	Percentage

4) If multiple languages are used, how are they separated? (select all that apply)
   a. By time of day
   b. By day of week
   c. By subject
   d. Languages are not separated
   e. Other _____

Additional Comments *(e.g., language tutors, afterschool programs, language camps/workshops):*

_____

_____

_____

Bilingual Language Profile Modified for Children

Child Language Questionnaire

. What languages do you speak with your friends/classmates?

English	Spanish	Both

a. Do you speak another language with your **friends/classmates**?
   i. What language? _____

2. In which language do you prefer to read?

English	Spanish	Both

a. Do you like to read in any other languages?
   i. What language? _____

3. In which language do you prefer to count?

English	Spanish	Both

a. Do you like to count in any other languages?
   i. What language? _____

4. Which language do you feel more comfortable using?

English	Spanish	Both

5. Which is your favorite language?

English	Spanish	Both

Appendix B

List of Stimuli

English Word (*Spanish translation)*			
Cognates		Non-cognates	
Boot	*(Bota)*	Airplane	*(Avíon)*
Button	*(Botón)*	Balloon	*(Globo)*
Camel	*(Camello)*	Bone	*(Hueso)*
Cannon	*(Cañón)*	Book	*(Libro)*
Car	*(Carro)*	Butterfly	*(Mariposa)*
Carousel	*(Carrusel)*	Comb	*(Peine)*
Castle	*(Castillo)*	Cow	*(Vaca)*
Chimney	*(Chimenea)*	Doll	*(Muñeca)*
Dinosaur	*(Dinosaurio)*	Drum	*(Tambor)*
Dolphin	*(Delfín)*	Duck	*(Pato)*
Elephant	*(Elefante)*	Ear	*(Oreja)*
Flower	*(Flor)*	Envelope	*(Sobre)*
Giraffe	*(Jirafa)*	Feather	*(Pluma)*
Harp	*(Harpa)*	Glasses	*(Lentes)*
Lemon	*(Limón)*	Iron	*(Plancha)*
Lion	*(León)*	Leg	*(Pierna)*
Map	*(Mapa)*	Pencil	*(Lápiz)*
Mask	*(Mascara)*	Pumpkin	*(Calabaza)*
Pear	*(Pera)*	Rabbit	*(Conejo)*
Pirate	*(Pirata)*	Shark	*(Tiburón)*
Radio	*(Radio)*	Shell	*(Concha)*
Salt	*(Sal)*	Sock	*(Calcetín)*
Sandwich	*(Sándwich)*	Strawberry	*(Fresa)*
Tomato	*(Tomate)*	Tire	*(Llanta)*
Train	*(Tren)*	Watermelon	*(Sandia)*
Unicorn	*(Unicornio)*	Window	*(Ventana)*

Spanish Word (*English translation)*			
Cognates		Non-cognates	
Bebe	*(Baby)*	Buzón	*(mailbox)*
Bicicleta	*(Bicycle)*	Canasta	*(Basket)*
Bomba	*(Bomb)*	Casa	*(House)*
Botella	*(Bottle)*	Casco	*(Helmet)*
Canguro	*(Kangaroo)*	Curita	*(Band-Aid)*
Cebra	*(Zebra)*	Escalera	*(ladder)*
Cruz	*(Cross)*	Espejo	*(Mirror)*
Dentista	*(Dentist)*	Flecha	*(Arrow)*
Doctor	*(Doctor)*	Foco	*(Lightbulb)*
Dragón	*(Dragon)*	Galleta	*(Cookie)*
Espagueti	*(Spaghetti)*	Gancho	*(Hanger)*
Flauta	*(Flute)*	Hongo	*(Mushroom)*
Guitarra	*(Guitar)*	Huevo	*(Egg)*
Lámpara	*(Lamp)*	Mesa	*(Table)*
Medalla	*(Medal)*	Mochila	*(Backpack)*
Montana	*(Mountain)*	Moño	*(Bow)*
Piano	*(Piano)*	Nopal	*(Cactus)*
Pingüino	*(Penguin)*	Pájaro	*(Bird)*
Pizza	*(Pizza)*	Paraguas	*(Umbrella)*
Plato	*(Plate)*	Perro	*(Dog)*
Robot	*(Robot)*	Pulpo	*(Octopus)*
Rosa	*(Rose)*	Rana	*(Frog)*
Tigre	*(Tiger)*	Taza	*(Cup)*
Violín	*(Violin)*	Uvas	*(Grapes)*
Yoyo	*(Yoyo)*	Vela	*(Candle)*
Zipper	*(Zipper)*	Zapato	*(Shoe)*

References

Akaike, H. (1974). A new look at the statistical model identification. *IEEE Transactions on Automatic Control*, *19*(6), 716-723.

Altenberg, E. P., & Cairns, H. S. (1983). The effects of phonotactic constraints on lexical processing in bilingual and monolingual subjects. *Journal of Verbal Learning and Verbal Behavior*, *22*(2), 174-188.

Bates, D., Maechler, M., Bolker, B., & Walker, S. (2015). Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software, 67*(1), 1-48. doi:10.18637/jss.v067.i01.s

Bates, E., Federmeier, K., Herron, D., Iyer, G., Jacobsen, T., Pechmann, T., … Pléh, C. (2000). Introducing the CRL International Picture Naming Project (CRL-IPNP). *Center for Research in Language Newsletter, 12*(1). La Jolla: University of California, San Diego.

Bedore, L. M., Pena, E. D., Summers, C. L., Boerger, K. M., Resendiz, M. D., Greene, K. A. I., & Gillam, R. B. (2012). The measure matters: Language dominance profiles across measures in Spanish–English bilingual children. *Bilingualism: Language and Cognition*, *15*(3), 616-629.

Berman, S., Friedman, D., Hamberger, M., & Snodgrass, J. G. (1989). Developmental picture norms: Relationships between name agreement, familiarity, and visual complexity for child and adult ratings of two sets of line drawings. *Behavior Research Methods, Instruments, & Computers, 21*(3), 371–382.

Birdsong, D., Gertken, L. M., & Amengual, M. (2012). Bilingual language profile: An easy-to-use instrument to assess bilingualism. *COERLL, University of Texas at Austin*.

Brenders, P., van Hell, J. G., & Dijkstra, T. (2011). Word recognition in child second language learners: Evidence from cognates and false friends. *Journal of Experimental Child Psychology*, *109*(4), 383-396.

Butler, Y. G., & Hakuta, K. (2004). Bilingualism and second language acquisition. *The Handbook of Bilingualism*, 114-144.

Christoffels, I. K., Firk, C., & Schiller, N. O. (2007). Bilingual language control: An event-related brain potential study. *Brain Research*, *1147*, 192-208.

Costa, A., Caramazza, A., & Sebastian-Galles, N. (2000). The cognate facilitation effect: implications for models of lexical access. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26*(5), 1283.

Costa, A., Miozzo, M., & Caramazza, A. (1999). Lexical selection in bilinguals: Do words in the bilinguals two lexicons compete for selection? *Journal of Memory and Language, 41*(3), 365–397

Cop, U., Dirix, N., Van Assche, E., Drieghe, D., & Duyck, W. (2016). Reading a book in one or two languages? An eye movement study of cognate facilitation in L1 and L2 reading. *Bilingualism: Language and Cognition, 20*(4), 747-769.

Cummins, J. (2007). Rethinking monolingual instructional strategies in multilingual classrooms. *Canadian Journal of Applied Linguistics/Revue Canadienne de Linguistique Appliquée*, *10*(2), 221-240.

. Dell, G. S. (1986). A spreading-activation theory of retrieval in sentence production. *Psychological Review*, *93*(3), 283.

De Groot, A. M. (2011). *Language and cognition in bilinguals and multilinguals: An introduction*. New York, NY, US: Psychology Press

De Groot, A. M., Delmaar, P., & Lupker, S. J. (2000). The processing of interlexical homographs in translation recognition and lexical decision: Support for non-selective access to bilingual memory. *The Quarterly Journal of Experimental Psychology: Section A*, *53*(2), 397-428.

Dewaele, J. M. (1998). Lexical inventions: French interlanguage as L2 versus L3. *Applied Linguistics*, *19*(4), 471-490.

Dijkstra, T., Van Jaarsveld, H., & Ten Brinke, S. (1998). Interlingual homograph recognition: Effects of task demands and language intermixing. *Bilingualism: Language and Cognition*, *1*(1), 51-66.

Dijkstra, T., Miwa, K., Brummelhuis, B., Sappelli, M., & Baayen, H. (2010). How cross-language similarity and task demands affect cognate recognition. *Journal of Memory and Language*, *62*(3), 284-301.

Duyck, W., Van Assche, E., Drieghe, D., & Hartsuiker, R. J. (2007). Visual word recognition by bilinguals in a sentence context: evidence for nonselective lexical access. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *33*(4), 663–79.

Emmorey, K., Luk, G., Pyers, J. E., & Bialystok, E. (2008). The source of enhanced cognitive control in bilinguals: Evidence from bimodal bilinguals. *Psychological Science*, *19*(12), 1201-1206.

García, O. (2011). *Bilingual education in the 21st century: A global perspective*. Malden, MA: Wiley-Blackwell

Gawlitzek-Maiwald, I., & Tracy, R. (1996). Bilingual bootstrapping. *Linguistics*, *34*(5), 901-926.

Gort, M., & Pontier, R. W. (2013). Exploring bilingual pedagogies in dual language preschool classrooms. *Language and Education*, *27*(3), 223-245.

Gorter, D., & Cenoz, J. (2017). Language education policy and multilingual assessment. *Language and Education*, *31*(3), 231-248.

Grosjean, F. (2001). The bilingual's language nodes. In J. Nicol (Ed.), *One mind, two languages: Bilingual language processing* (pp. 1-22). Oxford: Blackwells.

Hanauer, J. B., & Brooks, P. J. (2003). Developmental change in the cross-modal Stroop effect. *Perception & Psychophysics*, *65*(3), 359-366.

Hermans, D., Bongaerts, T., De Bot, K., & Schreuder, R. (1998). Producing words in a foreign language: Can speakers prevent interference from their first language?. *Bilingualism: Language and Cognition*, *1*(3), 213-229.

Hoshino, N., & Kroll, J. F. (2008). Cognate effects in picture naming: Does cross-language activation survive a change of script?. *Cognition*, *106*(1), 501-511.

Jescheniak, J. D., Hahne, A., Hoffmann, S., & Wagner, V. (2006). Phonological activation of category coordinates during speech planning is observable in

children but not in adults: Evidence for cascaded processing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *32*(2), 373.

Jescheniak, J. D., & Schriefers, H. (1998). Discrete serial versus cascaded processing in lexical access in speech production: Further evidence from the coactivation of near-synonyms. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *24*(5), 1256.

Kaushanskaya, M., & Prior, A. (2015). Variability in the effects of bilingualism on cognition: It is not just about cognition, it is also about bilingualism. *Bilingualism: Language and Cognition*, *18*(1), 27-28.

Kupisch, T. (2008). Dominance, mixing and cross-linguistic influence: On their relation in bilingual development. In P. Guijarro-Fuentes, M. P. Larrañaga, & J. Clibbens (Eds.), *First language acquisition of morphology and syntax: Perspectives across languages and learners* (pp 209-234). Philadelphia, Pennsylvania: John Benjamins Publishing Company.

Kroll, J. F., & Stewart, E. (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, *33*(2), 149.

Levelt, W. J. M., Roelofs, A., & Meyer, A. S. (1989). A theory of lexical access in speech production. *Behavioral and Brain Sciences, 22*(1), 1-38.

Levelt, W. J. M., Schriefers, H., Vorberg, D., Meyer, A. S., Pechmann, T., & Havinga, J. (1991). The time course of lexical access in speech production: A study of picture naming. *Psychological Review, 98*(1), 122-142.

Libben, M. R. & Titone, D. A. (2009). Bilingual lexical access in context: Evidence from eye movements during reading. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 35*(2), 381–390.

Luk, G., & Bialystok, E. (2013). Bilingualism is not a categorical variable: Interaction between language proficiency and usage. *Journal of Cognitive Psychology*, *25*(5), 605-621.

Marian, V. & Spivey, M. (1999). Activation of Russian and English cohorts during bilingual spoken word recognition. In M. Hahn & S. C. Stoness (eds.), *Proceedings of the twenty-first annual conference of the cognitive science society*, pp. 349-354. Mahwah, NJ: Lawrence Erlbaum.

Midgley, K. J., Holcomb, P. J., & Grainger, J. (2011). Effects of cognate status on word comprehension in second language learners: an ERP investigation. *Journal of Cognitive Neuroscience, 23*(7), 1634–1647.

Morsella, E., & Miozzo, M. (2002). Evidence for a cascade model of lexical access in speech production. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *28*(3), 555.

Navarrete, E., & Costa, A. (2005). Phonological activation of ignored pictures: Further evidence for a cascade model of lexical access. *Journal of Memory and Language*, *53*(3), 359-377.

Odlin, T. (1989). *Language transfer: Cross-linguistic influence in language learning*. New York, NY: Cambridge University Press.

Odlin, T. (2003). Cross-linguistic influence. In K. Doughty & M. Long (Eds.), *The handbook of second language acquisition* (pp. 436–486). Oxford: Blackwell.

Palmer, D. K., Martínez, R. A., Mateus, S. G., & Henderson, K. (2014). Reframing the debate on language separation: Toward a vision for translanguaging pedagogies in the dual language classroom. *The Modern Language Journal*, *98*(3), 757-772.

Pérez, A.M. Peña, E.D., & Bedore, L.M. (2010). Cognates facilitate word recognition in young Spanish-English bilinguals' test performance. *Early Childhood Services, 4(1)*, 55-67.

Peterson, R. R., & Savoy, P. (1998). Lexical selection and phonological encoding during language production: Evidence for cascaded processing. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 24*(3), 539-557.

Pienemann, M., & KeBler, J. U. (2007). Measuring bilingualism. In P. Auer & Li Wei (Eds.), *Handbook of multilingualism and multilingual communication* (pp. 247-275). Berlin: Mouton de Gruyter.

Poarch, G. J., & Van Hell, J. G. (2012). Cross-language activation in children's speech production: Evidence from second language learners, bilinguals, and trilinguals. *Journal of Experimental Child Psychology*, *111*(3), 419-438.

Potapova, I., Blumenfeld, H. K., & Pruitt-Lord, S. (2016). Cognate identification methods: Impacts on the cognate advantage in adult and child Spanish-English bilinguals. *International Journal of Bilingualism*, *20*(6), 714-731.

Poulisse, N., & Bongaerts, T. (1994). First language use in second language production. *Applied Linguistics*, *15*(1), 36-57.

R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Roelofs, A. (1992). A spreading-activation theory of lemma retrieval in speaking. *Cognition, 42*(1-3), 107-142.

Sánchez-Casas, R., & García-Albea, J. E. (2005). The representation of cognate and noncognate words in bilingual memory. *Handbook of Bilingualism: Psycholinguistic Approaches*, 226-250.

Schiller, N. O., & Meyer, A. S. (2003). *Phonetics and phonology in language comprehension and production*: *Differences and similarities*. Berlin: Mouton de Gruyter.

Sheng, L., Bedore, L. M., Peña, E. D., & Fiestas, C. (2013). Semantic development in Spanish–English bilingual children: Effects of age and language experience. *Child Development*, *84*(3), 1034-1045.

Scott, V. M. & Fuente, M. J. D. L. (2008). What's the problem? L2 learners' use of the L1 during consciousness-raising, form-focused tasks. *The Modern Language Journal*, 92: 100–113.

Spivey, M. J., & Marian, V. (1999). Cross talk between native and second languages: Partial activation of an irrelevant lexicon. *Psychological Science*, *10*(3), 281-284.

Treffers-Daller, J. (2011). Operationalizing and measuring language dominance. *International Journal of Bilingualism*, *15*(2), 147-163.

Umbel, V. M., & Oller, D. (1994). Developmental changes in receptive vocabulary in Hispanic bilingual school children. *Language Learning*, *44*(2), 221-242.

Umbel, V. M., Pearson, B. Z., Fernandez, M. C., & Oller, D. K. (1992). Measuring bilingual children's receptive vocabularies. *Child Development*, *63*(4), 1012-1020.

Van Assche, E., Duyck, W., Hartsuiker, R. J., & Diependaele, K. (2009). Does bilingualism change native-language reading? Cognate effects in a sentence context. *Psychological Science*, *20*(8), 923–927.

Van Hell, J. G., & De Groot, A. M. (2008). Sentence context modulates visual word recognition and translation in bilinguals. *Acta Psychologica*, *128*(3), 431-451.

Van Hell, J. G., & Dijkstra, T. (2002). Foreign language knowledge can influence native language performance in exclusively native contexts. *Psychonomic Bulletin & Review*, *9*(4), 780-789.

Van Hell, J. G., & Tanner, D. (2012). Second Language Proficiency and Cross-Language Lexical Activation. *Language Learning*, *62*(2), 148-171.

Wilson, D. M. (2011). Dual language programs on the rise. Harvard Educational Letter, 27(2). Retrieved from http://www.hepg.org/hel/article/496.