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MONOLINGUAL AND BILINGUAL SPANISH-ENGLISH CHILDREN'S  
PHONOLOGICAL PRODUCTION ON RAPID AUTOMATIZED NAMING TASKS

by

Adriana M. Pennino

A Thesis

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Arts

Major: Speech Language Pathology

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August 2010

To the University Council:

The Thesis Committee for Adriana M. Pennino certifies that this is the final approved version of the following electronic thesis: “Monolingual and Bilingual Spanish-English Children’s Phonological Production on Rapid Automatized Naming Tasks.”

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To my family

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## Abstract

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Monolingual English and bilingual Spanish-English kindergarteners participated in rapid automatized naming (RAN) tasks with results quantified in terms of weighted phonological accuracy and accentedness. Fifty-six typically developing monolingual English children and 41 typically developing bilingual children were included in this study. Single-word speech samples were obtained to examine (a) total articulation time, (b) phonological accuracy, and (c) phonological transfer between L1 and L2. Findings indicated that similar phonological accuracy occurred in monolinguals and bilinguals in English, phonological transfer occurred between L1 and L2 in English and Spanish for bilinguals (resulting in accentedness in both languages), faster RAN was associated with higher phonological accuracy, and a significant difference occurred for phonological accuracy between object and color subtests. These findings indicate the need for longitudinal examination of monolingual and bilingual phonological development in RAN tasks.

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## Monolingual and Bilingual Spanish-English Children's Phonological Production on Rapid Automatized Naming Tasks

Spanish is the primary language spoken at home by over 34 million people (ages 5 and up) in the United States (U.S. Census Bureau, 2007). Children from these Spanish-speaking homes begin school in the U.S., often without knowing much English. Defined as English Language Learners (ELLs), these children begin their early years embedded in their home language. By 2015, it is estimated that 30% of the U.S. school-aged population will be ELLs (Francis, Carlo, August, Kenyon, Malabonga, Caglarcan, & Louguit, 2006). Because U.S. schools are accountable for each ELL's English proficiency and later language and literacy skills, it is crucial to understand the multidimensional nature of bilingualism.

The present study will add to the growing body of literature on a particular aspect of bilingualism, the relationship between Spanish and English phonology and subsequent literacy skills. Research suggests that slower times on RAN tasks are indicative of reading disorders, as rapid naming is a construct thought to measure general speed of processing (Catts & Kamhi, 2005a), which is crucial to reading. Literacy research's primary focus since the 1980s has been phonological processing. The current work seeks to clarify how phonology and naming speed interact. This relationship is important clinically, because an understanding of the interaction will help clinicians appropriately screen preschool children for potential literacy problems. Furthermore, children who are poor readers in early elementary school would benefit from strategic intervention in naming speed and phonology.

## Phonological Development in Monolingual Children

During the first year of life, children begin to learn and process the speech sound system of their native language. They acquire the perceptual sensitivity necessary to understand how they can manipulate sounds to change meaning in a language (Hoff, 2009). For example, the words *cat* and *bat* differ by only one sound in each word, [k] and [b]. A child learns to produce the acoustic differences in these phonemes in order to change word meanings. In contrast, *allophones* are context sensitive variants of phonemes of a language that do not change meaning. For example, in English, [p<sup>h</sup>in] as in *pin* and [p] as in *spin* are allophones for the phoneme /p/; they do not change the meaning of a word if utilized in absolute initial position as opposed to following an /s/ respectively. Native English speakers treat [p<sup>h</sup>] and [p] as the same functional unit in these contexts, although acoustically they are different. It is the ambient (i.e., native) language that determines phonological development and allophonic variation.

Because there are only a limited number of words that children produce during the RAN tasks used in this work (based on a set of objects and set of colors), the most pertinent allophonic variations in English to this study are the flap with /t/ and /d/ (when /t/ and /d/ occur after a stressed vowel and before an unstressed one), and the velar, syllabic [ɹ] for /l/ in word final position (e.g., [p<sup>h</sup>ensɹ]).

The lexicon (i.e., mental word bank) begins to emerge early in the second half of a child's first year of life (Hoff, 2009). English-learning babies start to segment sound sequences from the speech stream around 7.5 months of age (Jusczyk, 2002). In this early stage of language development, children start acquiring information about context-sensitive allophones and phonotactic constraints, which help them to determine word

boundaries in the language. Infants begin to remember sound sequence patterns that occur frequently, though memory is limited. By the age of 9 months, children can distinguish their native language from a foreign one based on sound patterns (Jusczyk, Friederici, Wessels, & Svenkerud, 1993). This suggests that the ambient language is shaping the phonological system. By one year, children begin to ignore potential phonemic contrasts of other languages, focusing instead on categories occurring phonemically in the ambient language. Children must mentally represent the speech system of their language so that they may learn, recognize, and produce words.

To produce words, a child must progress through stages of age-appropriate articulatory skills. A child's phonological repertoire increases in articulatory complexity with age. Shriberg (1993) categorized the development of English phonemes into groups of eight. English-speaking children produce the Early Eight (/m b j n w d p h/), Middle Eight (/t ŋ k g f v tʃ dʒ/), followed by the Late Eight phonemes (/ʃ θ s z l ɹ ʒ ð/).

Moreover, ME 3-year olds produce most vowels except rhoticized ones like /ɚ/. By the time a child reaches 4 to 5 years of age, fricatives (e.g. /s/, /f/), affricates (e.g., /dʒ/, /tʃ/), liquids (e.g., /l/, /ɹ/), velars (e.g., /k/, /g/) and many consonant clusters are part of the speech sound inventory. Knowledge of English phonology increases during kindergarten to include consonant clusters, final consonants, and unstressed syllables.

Spanish phonological development shares certain sounds and patterns with English phonological development. Acevedo (1993) categorized the acquisition of Spanish phonemes into groups comparable to Shriberg's Early-Middle-Late Eight: the Early Six (/p d n t j w/), Middle Six (/k g x m f ɲ/), and Late Six (/tʃ b l r r s/). Spanish-

speaking 4-year old children produce most consonants correctly, though they have some difficulty with fricatives, alveolar trill/tap (i.e., /r/, /r/), and velars (Acevedo, 1993). By the age of 5, most Spanish-speaking children produce all consonants except the trill and /s/.

Spanish phonological development also differs from English phonological development. For example, free variants (i.e., two or more sounds appearing in the same phonetic environment without a change in meaning) in Spanish include /i/ and /i/, and /e/ and /ε/. An example of allophonic variation in Spanish is [ɣ], which is the allophone for /g/, and [β] for /b/ when the elements are located between vowels (Goldstein, 2001). Other major differences between Spanish and English phonology are that in Spanish, alveolars are dentalized [in many dialects], and the voiceless aspirated stops of English (e.g., [p<sup>h</sup>] [k<sup>h</sup>]) do not occur in Spanish. Please see Table 1 for a list of similarities and differences between Spanish and English phonology.

### **Phonological Development in Bilingual Children**

This section reviews the similarities and differences among English and Spanish phonological development, in particular, how Spanish and English phonology interact in bilingual children. This section begins with similarities in babbling for Spanish-speaking and English-speaking infants, providing a foundation for phonological development in bilingual Spanish-English-speaking (BSE) and monolingual English-speaking (ME) children. Next, the similarities and differences between later English and Spanish phonological development are discussed. Finally, the importance of the amount of

Table 1

*Similarities and Differences between English and Spanish Phonologies*

Variable	English	Spanish
Early sounds	/m b j n w d p h/	/p d n t j w/
Middle sounds	/t ŋ k g f v tʃ dʒ/	/k g x m f ɲ/
Late sounds	/ʃ θ s z l ɹ ʒ ð/	/tʃ b l r r s/
Allophonic substitutions	[r] for [t] and [d] (when [t] and [d] follow stressed vowel and precede unstressed vowel)	[ð] for [d] (dentalized) intervocalically and after [s]
	[p <sup>h</sup> ] for [b] in word initial position	[ɣ] for [g] intervocalically
	[ɫ] for [l] in word final position or after stressed vowel	[β] for [b] intervocalically
Key differences	3 year-olds: most vowels except /ə/	2 year-olds: greater vowel accuracy than monolingual English peers
	5 year-olds: fricatives, affricates, velars, consonants acquired	4 year-olds: most consonants produced correctly (except fricatives, alveolar trill and tap, velars)
	5+: consonant clusters, final consonants, unstressed syllables Initial voiceless stops are aspirated	5-year-olds: all consonants except trill and /s/ Alveolars dentalized, Initial voiceless stops unaspirated

*Note.* Adapted from “Transcription of Spanish and Spanish-influenced English,” by Goldstein, B., 2001, *Communication Disorders Quarterly*, 23(1), 54-63. Copyright 2001 by Hammill Institute on Disabilities and Sage.

exposure to English—and how exposure is inversely related to phonemic error rates in English—is explored.

Many similarities exist between English and Spanish phonological development—even in infancy. Oller and Eilers (1982) compared English and Spanish phonological acquisition in order to view effects of phonetic environment on phonological development. It was found that babies from different linguistic backgrounds babble similarly. Despite phonetic differences between Spanish and English, both the Spanish and English babies produced, for example, predominantly CV syllables with voiceless, unaspirated plosive consonants.

Phonological development in English for BSE and ME children continues to develop similarly in English and Spanish. Fabiano-Smith and Goldstein (2010) compared Shriberg's Early-Middle-Late developing speech sounds in monolingual English-children to Acevedo's Spanish Early-Middle-Late speech sound pattern. The study found that both English and Spanish phonology follow similar patterns, with middle and late sounds in both languages developing at roughly the same times and in approximately the same groups. Of note is that the bilingual children treated the middle and late-developing sound groups as one, and had more difficulty on middle and late-developing sounds than the ME children did.

A study by Gildersleeve, Davis, and Stubbe (1996) showed that phonological production *in English* for 29 typically developing BSE 3-year-olds and 14 typically developing ME 3-year-olds differed significantly (as cited in Goldstein & Washington, 2001). An analysis of the phonology of BSE children indicated that the bilingual children had a lower intelligibility rating in English, more total consonant and vowel errors in



English, more distortions and uncommon error patterns in English, and a higher percentage of occurrence of phonological processes in English than ME children. A limitation to this study and the previous was that the authors did not study the bilingual children's productions in Spanish.

A study by Goldstein and Washington (2001) did look at BSE children's phonological accuracy in English and Spanish. They analyzed the phonetic inventory, percent consonant correct (PCC), place and manner of articulation, and percent of occurrence of phonological processes in 4-year-old BSE children and their monolingual peers. The authors found no difference between English and Spanish productions of bilinguals on PCC, place and manner of articulation, and percent occurrence of phonological processes. However, the speech sound patterns across the two languages differed compared to monolingual children's speech sound patterns. Bilingual Spanish-speaking children produced smaller percentages of the Spanish flap and trill and fewer liquids than their monolingual Spanish-speaking peers. Furthermore, PCC was higher in English than in Spanish for bilinguals, suggesting that the bilinguals' L2 was becoming more phonologically proficient than their native language, Spanish.

Other differences in phonological accuracy—with regards to amount of exposure—have been noted. Gildersleeve-Neumann, Kester, Davis, and Peña (2008) found slower phonological acquisition in English for both sequential and simultaneous bilinguals than for monolinguals. The same study showed that an increase in exposure to English was related to lower phonemic error rates in English; and inversely, children with more exposure to Spanish had more errors in English productions. In fact, children exposed the most to Spanish showed the greatest percent of occurrence of final consonant

deletion (e.g., /pæ/ instead of /pæt/ for *pat*), lowest PCC, and highest occurrence of consonant cluster reduction in English. This study also did not consider Spanish phonological development.

In sum, the research on phonological development in Spanish-English bilingual children is still in its early stages. In the U.S., there is more research on Spanish-English bilingualism within L2 than L1. Little research is available on BSE children's phonological productions in Spanish. The nature of the interaction between L1 and L2 phonologies in Spanish-English bilingual children may be explored more through the proposed study. The next section will address the following question: How does the amount of exposure to a second language affect L1 and L2?

### **Transfer and Cross-Linguistic Effects in Bilinguals**

The Unified Model of Language Acquisition describes the psycholinguistic mechanisms of first and second language acquisition (see MacWhinney, 2005 for a review). In particular, the model accounts for L2 learning in early sequential bilinguals, those children learning L2 before L1 prior to adolescence. According to the model, when children begin learning a second language, they do so through a process that requires *storage*, *chunking*, and *support* to create new mappings. A subprocess of the model, *transfer*, occurs when a speaker transfers L1 articulatory patterns to L2 (e.g., Spanish phonotactic properties transfer to English). In order to establish transfer, the learner perceives new L2 words as composed of L1 chunks, or "strings of articulatory units" (MacWhinney, 2005, p. 56). Using L1 repeatedly during the composition of L2 productions (as in the case of phonology) leads to *entrenchment*, a learned behavior where an L1 pattern is established in L2 and persists thereafter as a noticeably foreign

pattern. The strongest entrenchment, with respect to areas of lexicon, orthography, syntax, and pragmatics, occurs in phonology. This is why it is often difficult for ELLs to lose their accent even after years of exposure and speaking. Because older children learning a second language have more neuronal flexibility than adults, they may lose their accent more quickly (MacWhinney, 2005).

Transfer may also be represented by the Interactional Dual Systems Model of language representation in bilinguals (Paradis, 2001). In this model, the two languages of the child represent separate, but interacting systems; the languages blend, sharing aspects of each other. The two languages may blend in three different ways: *acceleration*, *deceleration*, and *transfer*. Acceleration occurs when L1 facilitates L2 acquisition and production. Deceleration occurs when L1 inhibits L2. For example, the American retroflex /r/ may be acquired later by a bilingual Spanish child than for a ME student, because the child cannot perceptually distinguish it from the Spanish trill or tap. Lastly, transfer occurs when linguistic aspects of one language color the other. This is a borrowing, and in children, is often temporary, fading as the child's phonological abilities become more similar to his or her monolingual peers. Transfer and cross-linguistic effects occur in the bilingual child's productions in L1 *and* L2 (Goldstein, 1995). In the proposed study, transfer of bilingual Spanish-English children's English phonetic and phonotactic properties to Spanish productions (and vice versa) will be evaluated.

During the learning process for L2, one may see *L1 loss*. In fact it is common to see a rapid shift from first language dominance to second language prominence (Anderson, 2004). The hallmark of the loss is that L1 expressive abilities over a period of a few years become weaker than L2 abilities, a pattern that often occurs in children.

According to Anderson, *L1 attrition* is a type of loss where a shift from L1 to L2 dominance occurs; however, in L1 attrition, L1 abilities remain stagnant (instead of decreasing over time) while L2 skills increase.

### **The Purpose of RAN Tasks**

The goal of this research is to examine phonological performance on RAN tasks. Early reading is dependent upon phonological processing and phonological awareness (Catts, 1993). However, studies have repeatedly shown that poor readers also do worse on RAN tasks than good readers (Catts, 1986; Denckla & Rudel, 1976; Scarborough, 1989; Wolf, 1984), as children with reading deficits (RD) perform more slowly on RAN tasks than typical children (Denckla & Rudel, 1976; Vellutino, Scanlon, & Speakman, 1995; Wolf, 1991). Furthermore, difficulty with RAN tasks during the preschool years predicts reading difficulty in the school years (Badian, 1994; Catts, 1993; Wolf, Bally, & Morris, 1996). Indeed, deficits in rapid serial naming account for unique variance in reading achievement, separate from phonological awareness (although early reading achievement is more affected by phonological awareness deficits than deficits in speed of naming).

RAN tasks measure the rate of naming visual stimuli (e.g., colors, objects, numbers). The child is shown a page with several rows of stimuli (e.g., a page of common objects, a series of colored squares), and asked to name them as quickly as possible from start to finish. A rapid naming deficit is said to occur when a child's time is one standard deviation or more greater than a presumed population mean (estimated by the mean of a sample; Catts & Kamhi, 2005a). RAN has been used as a test to locate children at risk for early literacy difficulties, as the consensus is that RAN tasks reflect

the child's ability to access and retrieve phonologically coded information from memory (Wagner & Torgesen, 1987). A RAN task is considered a reflection of nonphonological skills, like attending to task, visual, and information processing (Roth, 2004).

RAN tasks have been used to differentiate children with dyslexia into subgroups. Dyslexia is a specific learning disability, neurobiological in origin, characterized by difficulty decoding, recognizing and spelling words, resulting from deficits in phonological processing and retrieval (Catts & Kamhi, 2005b). Wolf and Bowers (1999) categorized children with dyslexia into three different groups: (1) children with only a phonological processing deficit, (2) children with only a naming speed deficit, and (3) those with a deficit in both phonological processing and naming speed. A deficit in both phonological processing and naming speed is the hallmark of the Double Deficit Hypothesis. These children have the most severe reading impairment of the three types.

Yet, when Vukovic and Siegel (2006) reviewed the literature on the Double Deficit Hypothesis, they found little support for keeping naming speed and phonological processing independent. Their meta-analysis showed a high positive correlation between the two. It has also been shown that phonological awareness intervention decreases naming speed deficits (Lovett, Steinbach, & Frijters, 2000). Though much more research will be needed to clarify the relationship between phonological processing and naming speed, it is clear that RAN tasks are directly related to phonological retrieval deficits and more broadly, general speed of processing.

RAN tasks have typically been measured in terms of the total time taken to name a set of stimuli. In other words, the children name all of the colors or objects on the presented sheets as quickly as possible, and the total time to completion is recorded. In a

recent longitudinal study by Georgiou, Kirby, and Stephenson (2008), the total amount of time taken for a group of first graders to complete a series rapid color stimuli was compared to reading ability. The researchers found that the total time it took to name a series of colors was highly correlated with reading in subsequent grades, including word reading efficiency in Grade 2 and word identification in Grades 2 and 3 (p. 348). Total amount of time taken to complete RAN tasks will be considered in this study.

However, it has been argued that the total performance time does not fully account for the nature of RAN tasks (Nehaus, Foorman, Francis & Carlson, 2001). Instead, two components, *articulation time* and *pause time*, should also be considered. Articulation time is the total amount of time it takes for a child to articulate the stimuli. Pause time is the total time between the articulated stimuli. Research has shown that pause time reliably differentiates dyslexic and normally developing readers. The construct that articulation time purports to measure is still ambiguous in the literature (Georgiou et al., 2008). In this study, only total time taken to name a set of stimuli will be considered. Thus, this study considers the sum of articulation and pause time.

### **Speed of Processing in Monolingual and Bilingual Contexts**

This section will examine speed of processing—how children manipulate language automatically—within monolingual and bilingual contexts. In order to speak a language, a child must know sounds, meaning, words, and syntactic devices, and then combine them all to function appropriately (Kohnert, 2008). They must then use the language dynamically in communicative interactions. This automatic nature of language, the “ability to quickly learn, recall, access, and deploy known linguistic forms” (Kohnert,

2008, p. 57) develops throughout adolescence. One way to measure the automaticity of language is through tasks said to measure speed of processing.

Processing-dependent tasks like rapid naming are designed to “assess the integrity of the underlying language learning system...minimizing the role of previous cultural or linguistic experiences” (Kohnert, 2008, p. 93). A test that does not rely on these previous cultural or linguistic experiences is important, because it allows children with different linguistic experiences, but intact underlying linguistic systems, to have similar speed of processing skills. Kohnert and Bates (2002) investigated speed of processing in bilingual Spanish-English children at the lexical level during a timed picture-word verification task. The researchers presented common nouns and verbs in English and Spanish to school-aged children. The tasks emphasized processing efficiency rather than knowledge of vocabulary, as the stimuli were high frequency items that school-age children knew well. The study found that the children’s accuracy and speed of processing in English (L2) continued to develop over time, while Spanish (L1) processing continued to increase, though at a slower pace. It is a goal of this thesis to portray this shift in dominance from L1 to L2, and in particular, to examine how the shift emerges in RAN tasks. By examining rapid naming responses in bilinguals, one gains further perspective on the interaction between phonology and rapid naming.

The previous sections reviewed how speed of processing, a construct thought to be measured by RAN tasks, is actualized in BSE children. The current work will explore RAN task performance in both bilinguals and monolinguals. The thesis will describe phonological accuracy under the time constraints required in RAN tasks, as this has never (to the researcher’s knowledge) been explored.

## **Hypotheses and Research Questions**

The research questions are as follows: 1) How do monolingual and bilingual kindergarten children perform on RAN tasks?, and 2) Do children who name in a foreign language show problems of negative transfer (accentedness) and phonological inaccuracies in L1 or L2? These questions will be tested with RAN tasks administered to two groups of children at kindergarten (K): one group of monolingual English speakers (MEs) and the other group of English-language learners of Spanish-language background, termed bilinguals (BSEs).

The hypotheses are the following: 1) On English RAN tasks, monolinguals will perform better than bilinguals on phonological accuracy and accentedness scores; and 2) Performance on color vs object tasks will differ. On the Spanish RAN tasks, the objective is to determine the degree of phonological accuracy and accentedness in the bilinguals. Because rapid naming has not been used widely in the bilingual population, one will gain insight into how the bilinguals' L1 and L2 phonological systems interact.

## **Methodology**

### **Participants**

The data were drawn from archived information from the Bilingualism Project at the University of Memphis. The participants were typically-developing bilingual (Spanish-English) Latino children (n = 41), and their monolingual English-speaking peers (n = 56). They were enrolled in kindergarten at two public schools in the Memphis, Tennessee school district. There were 61 female and 59 male participants with an average age of 5;9 (range: 5;0 to 7;1). The BSE children had an average age of 5;10 (range: 5;1 to 7;0), and the monolinguals had an average age of 5;9 (range: 5;0 to 7;1).



Proficiency in English and Spanish was determined by an expressive/receptive language composite score for each language. Receptive standard scores were from the *Peabody Picture Vocabulary Test-III* (PPVT; Dunn & Dunn, 1997) and the *Test de Vocabulario en Imágenes Peabody* (TVIP; Dunn, Padilla, Lugo, & Dunn, 1986). Expressive language skill in English and Spanish was determined by standard scores on the Picture Vocabulary subtest of the *Woodcock Language Proficiency Battery-Revised* (WLPB-R; Woodcock, 1991; Woodcock & Muñoz-Sandoval, 1994). The standard scores on the PPVT and WLPB-R (English) were averaged to determine English proficiency prior to testing. A composite standard score based on the TVIP and WLPB-R (Spanish) was calculated to gain insight on the bilingual children's receptive and expressive language abilities in Spanish.

If the children did not pass the trial portion of the rapid naming test (consisting of naming each color or object once with minimal assistance), they could not proceed and there were no RAN data to transcribe. None of the children unable to pass the trial portion of each RAN task was included in the study. None of the children had a diagnosis of a communication disorder.

## **Procedures**

The *Comprehensive Test of Phonological Processing* (CTOPP; Wagner, Torgesen & Rashotte, 1999) was administered to both ME and bilingual children, and the *Test of Phonological Processing in Spanish* (TOPPS; Francis et al., 2001) was administered to only the bilingual children. Though normative data on the CTOPP existed, there were no normative data on the TOPPS. There were two different types of rapid naming subtests of the CTOPP and TOPPS: a rapid color naming subtest (RAN-C) and a rapid object

naming subtest (RAN-O). The RAN-C contained a page with six blocks of colors (e.g., red, blue, green, yellow, etc.) randomly arranged in 4 rows, and the RAN-O was a page with six different common objects (e.g., boat, pencil, star, etc.) randomly laid out in 4 rows. Both the Spanish and English versions of the RAN-C and RAN-O were exactly the same, except that the children named the stimuli in Spanish or English, depending on the test. The children were asked to name every color or object as fast as possible. Only Form A of the RAN portion of the CTOPP or TOPPS was administered and recorded. Table 2 lists the stimuli of the color and object subtests of the CTOPP and TOPPS.

Table 2

*Rapid automatized naming (RAN) subtest stimuli of CTOPP<sup>a</sup> and TOPPS<sup>b</sup>*

Test	RAN Color Stimuli	RAN Object Stimuli
CTOPP	blue (purple), red, green, black, brown, yellow	boat, star, pencil, chair (seat), fish, key
TOPPS	azul (morado), rojo, verde, negro, café, amarillo	barco (bote), estrella, lápiz, silla, pez (pescado), llave

*Note.* Items in parentheses were accepted word substitutions

<sup>a</sup> Comprehensive Test of Phonological Processing (Wagner, Torgesen, & Rashotte, 1999)

<sup>b</sup> *Test of Phonological Processing in Spanish* (TOPPS; Francis et al., 2001)

## Data Analyses

The study analyzed the phonological accuracy of the children's responses to the stimuli in two ways. The first calculation was a weighted reliability measure (Oller & Ramsdell, 2006) calculated in a Logical International Phonetics Programs (LIPP, Oller &

Delgado, 2006) analysis file. Phonological accuracy was measured by quantifying feature differences among segments. The difference between each segment and its target was weighted, depending on the segment's distance from the target. For example, a child's substitution of /s/ for /t/ is less of an error than if the child were to substitute /l/ for /t/. This is because the voiceless alveolar fricative /s/ has more features (e.g., voicing, place of articulation) in common with the voiceless alveolar stop /t/ than the liquid /l/ does. The /s/ substitution was weighted less, and subsequently counted as less of an error. The sum of these substitution errors was calculated as a measure of phonological accuracy.

The first purpose of the phonological accuracy measure was to describe in detail how accurate the children's phonological productions were when compared to a target. The second purpose of the weighted measure was to compare ME and BSE children's ability to accurately articulate a series of verbalized responses when placed under the time constraint of the RAN task.

The second measure, *accentedness*, was a subset of the weighted phonological accuracy, taking into consideration the phonetic relation between the two languages. *Accentedness* measured deviation beyond normal variation for an element in one of the languages in such a way that the element showed a feature or features of the other language. It was thus a particular error type that reflected an exchange in phonology between the target language and the other language. *Accentedness* was calculated by designating features of L1 that may intrude into L2 or vice versa. For example, dentalized alveolars (common in Spanish) may occur in a BSE child's production of English colors (e.g., /d/ would be dentalized in the English production of "red": [ɹɛd̪]).

This exchange in phonology could have also occurred from English to Spanish. For example, BSE children may produce the Spanish trill in “rojo” as [ɻoxo] instead of [roxox], indicating a transfer of L2 phonology to L1.

In order to account for differences between the tests in the two languages (in terms of number of target phonemes in the stimuli), a proportion of accentedness value per 100 segments (AV100) was calculated. First, the total number of feature errors in each RAN task for each language was determined (i.e., the raw accentedness score). Then, a proportion was determined by dividing the raw accentedness score by the total number of target segments on the task in question. For example, on the Spanish color task, 5 errors per 180 target segments would yield 2.78 errors per 100 segments. The AV100 score allowed one to compare accentedness tasks that differed in the number of total segments.

Lastly, dialect variant elements were taken into consideration in this analysis and were not scored as errors. The stimuli and acceptable productions not scored as errors are located in the *Appendix*.

### **Transcription Procedures and Reliability Measures**

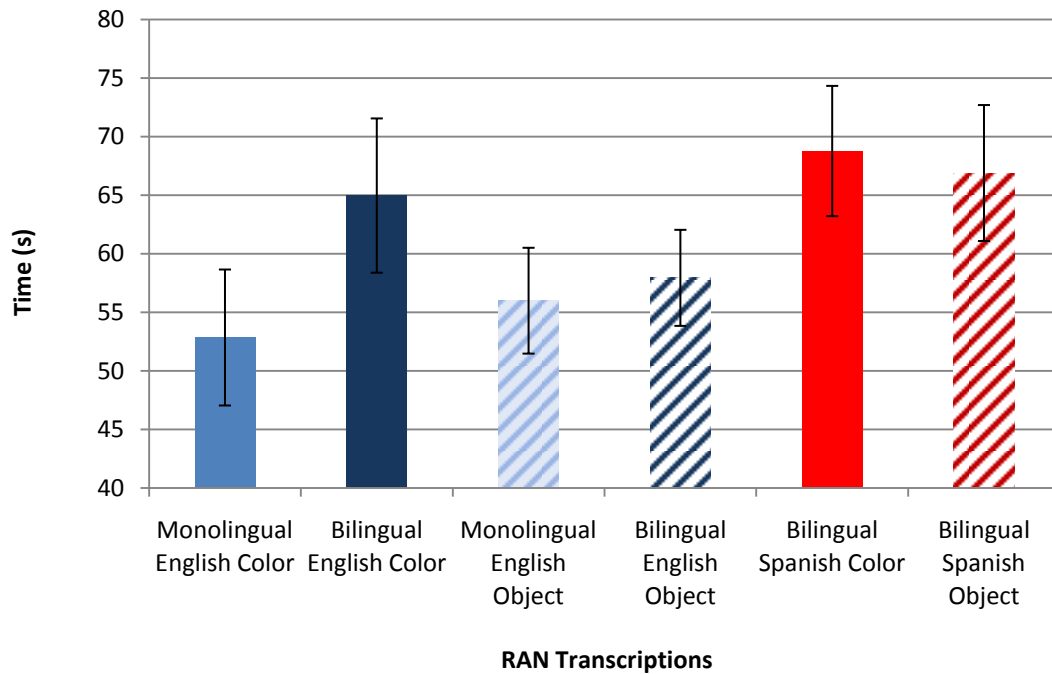
Transcriptions of the children’s verbalized responses to the stimuli were performed by four Master’s level graduate students (including the author) trained in LIPP. All transcriptions used the conventions of the International Phonetic Association (IPA), and data analyses were performed in LIPP as indicated above. Training was systematic and progress was monitored by an experienced phonetician faculty member. At the end of the 6-week training session, the students were tested and deemed proficient transcribers. The students then transcribed all of the RAN tasks. Out of all of the rapid

naming tests the students transcribed, four were chosen from each transcriber (i.e., RAN-C, RAN-O in English and Spanish). The experienced phonetician had also transcribed these tests independently. Each of the students' transcriptions were placed on the target row in LIPP for a particular file, and the experienced phonetician's transcriptions were placed on the transcription row of that same file, so that targets (student transcriptions) could be compared with gold standard transcriptions (the experienced transcriber's transcriptions) using the LIPP analysis. Phonological accuracy values for each student exceeded 95% on English and Spanish RAN tasks, indicating the transcriptions of the students agreed strongly with those of the experienced transcriber.

## **Results**

### **RAN Total Time**

Total time (T) to completion on RAN color and objects subtests was calculated for ME and BSE children (Figure 1). Monolinguals (mean T = 52.9 s.) were significantly faster than bilinguals (mean T = 65.0 s.) on the English color subtest, and there was a medium effect size ( $t(95) = 2.94, p = 0.01, d = 0.61$ ). While the monolinguals were faster (mean T = 56.0 s.) than bilinguals (mean T = 58.0 s.) on the objects subtest in English, this difference was not statistically significant and the effect size was very small ( $t(95) = 0.615, p = 0.27, d = 0.13$ ).



*Figure 1.* RAN Total Time to Completion on RAN Tasks. Time is measured in seconds. English RAN tasks are represented by blue bars and Spanish RAN tasks by red bars. Colors are designated by solid bars and objects by diagonally-lined bars. Lighter shaded bars are monolingual participants' scores and darker bars and bilingual participants' scores. Error bars are two standard errors.

Total time on the colors (mean  $T = 68.8$  s.) was greater than for the objects (mean  $T = 66.9$  s.), and the effect size was very small ( $t(80) = 0.46, p = 0.41, d = 0.10$ ). The monolinguals performed faster on the colors subtest than the objects one, but again the difference was nonsignificant with a small effect size ( $t(105) = 0.85, p = 0.28, d = 0.16$ ).

### **Phonological Accuracy Values for Monolingual and Bilingual Speakers**

One of the objectives of the study was to quantify RAN tasks in terms of a weighted phonological accuracy measure, and to compare the measure between ME and BSE children. Results for the phonological accuracy values did not reveal significant differences between ME and BSE children's responses on colors and objects. Table 3

contains the means and standard deviations for the phonological accuracy weighted measure of both RAN color and objects subtests in English and Spanish. While the mean phonological accuracy (PPA) values for ME children on the colors subtest (mean PPA = 0.92) did exceed that of their bilingual peers' English PA value (mean PPA = 0.91), this difference was not statistically significant with a small effect size ( $t(95) = 1.0811, p = 0.14, d = 0.22$ ). Similarly, the PPA values did not display significant differences on the RAN objects subtest between ME speakers (mean PPA = 0.91) and their BSE peers (mean PPA = 0.90), as indicated by a non-significant contrast and small effect size ( $t(95) = 1.1421, p = 0.12, d = 0.23$ ).

Figure 2 illustrates the ME and BSE children's phonological accuracy values and two standard errors for each group. It should be noted that the bilingual phonological accuracy scores *in Spanish* on the colors and objects subtests cannot be directly compared to the bilinguals' phonological accuracy scores *in English* on the colors and objects subsets. English and Spanish differ in terms of the number of phonemes in the languages, and thus the number of opportunities to make errors, as well as in the number of ways that coders might notice and transcribe them.

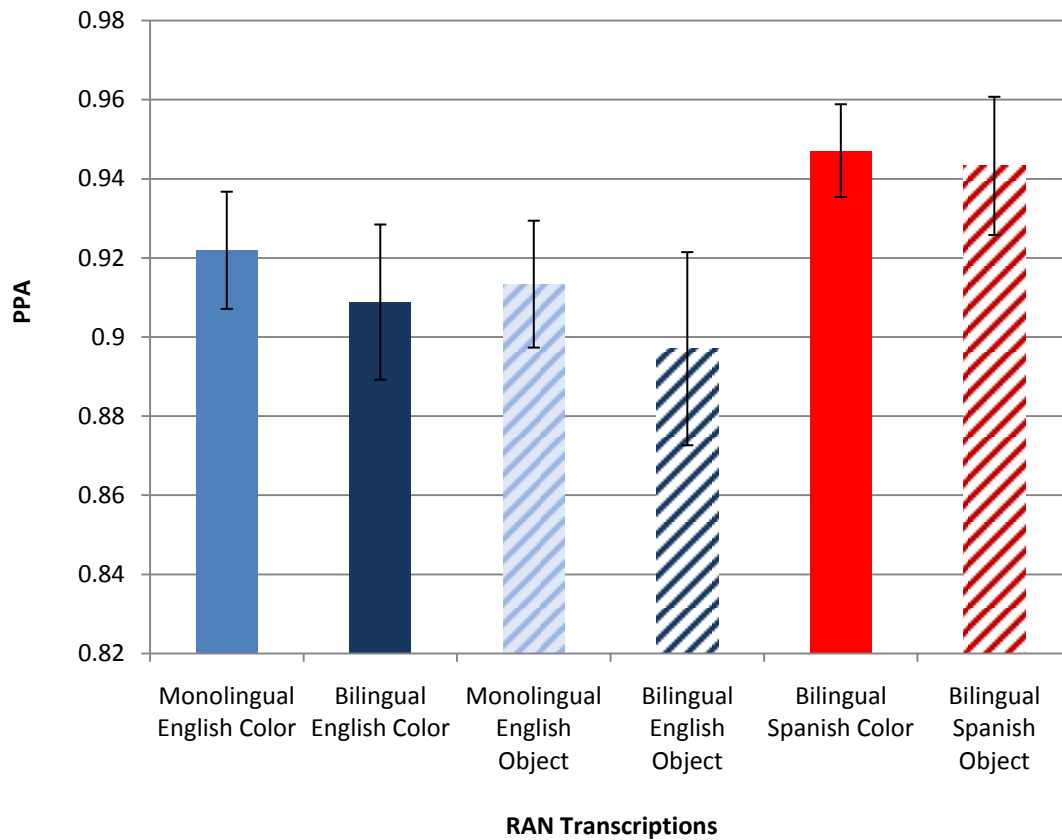
Within the ME group, pronunciation of color names was slightly more phonologically accurate (mean PPA = 0.92) than objects (mean PPA = 0.91), but the difference was non-significant with a small effect size ( $t(110) = 0.83, p = 0.23, d = 0.16$ ). Within the BSE group, colors appeared more phonologically accurate (mean PPA = 0.91) than objects (mean PPA = 0.90), but again the difference was non-significant with a small effect size ( $t(80) = 0.77, p = 0.42, d = 0.17$ ). Likewise, the results of the color and object

Table 3

*Phonological Accuracy (PA) and Accentedness Values for Monolinguals and Bilinguals on Colors and Objects Subtests*

Subtest	Mean			Standard Deviation			n
	Time (s)	PA	Accentedness	Time (s)	PA	Accentedness	
Monolingual English Color	52.0	0.92	3.6	21.7	0.06	4.1	56
Bilingual English Color	65.0	0.91	3.9	17.5	0.06	4.5	41
Monolingual English Object	56.0	0.91	2.1	16.9	0.06	2.5	56
Bilingual English Object	58.0	0.90	4.6	13.1	0.08	4.6	41
Bilingual Spanish Color	68.8	0.95	7.7	17.8	0.04	5.0	41
Bilingual Spanish Object	66.9	0.94	7.1	18.6	0.06	6.1	41





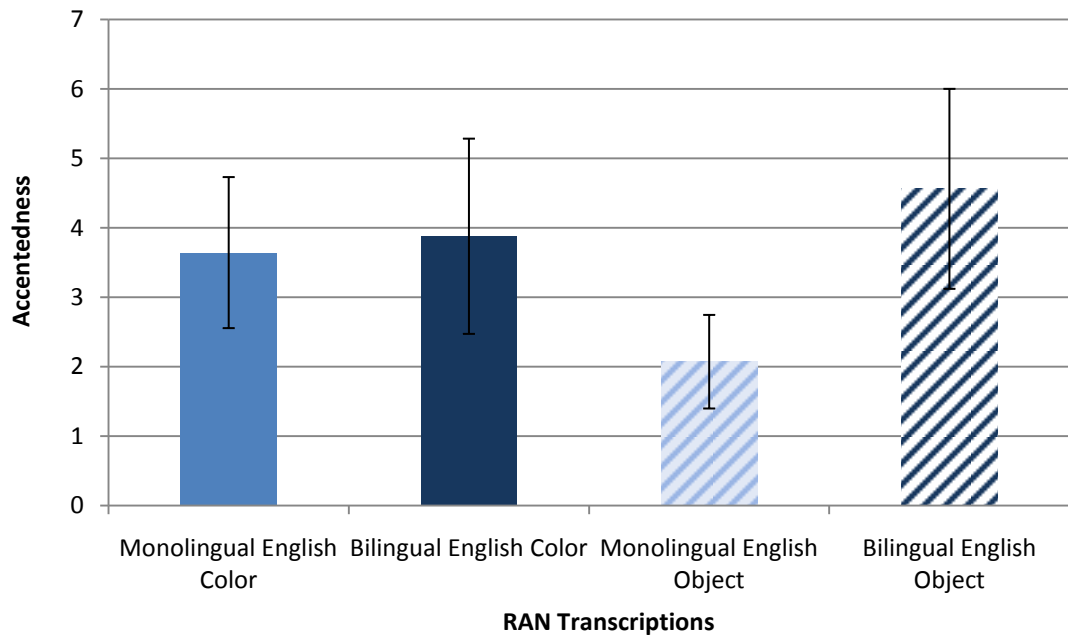
*Figure 2.* Proportion of phonological accuracy on objects and colors subtests of RAN tasks for monolinguals and bilinguals in Spanish and English. English RAN tasks are represented by blue bars and Spanish RAN tasks by red bars. Colors are designated by solid bars and objects by diagonally-lined bars. Lighter shaded bars are monolingual participants' scores and darker bars and bilingual participants' scores. PPA = Proportion of phonological accuracy. Error bars indicate two standard errors.

subtests *in Spanish* did not display significant differences. These two subtests were completed by the BSE speakers. The mean phonological accuracy value on the color subtest in Spanish (mean PPA = 0.95) was higher than the object subtest in Spanish (mean PPA = 0.94) for bilingual speakers, but not significantly so ( $t(80) = 0.47, p = 0.63, d = 0.08$ ). Overall, though both monolingual and bilingual speakers exhibited a trend such that phonological accuracy was better for colors than for objects, the difference

between groups on phonological accuracy measures did not display significant differences regarding these comparisons.

### Accentedness Values for Monolingual and Bilingual Speakers

This research also focused on evaluating accentedness in bilingual children's rapid naming responses in order to explore whether children naming in a foreign language show problems of phonological transfer from L1 to L2 or vice versa. It was predicted that accentedness values would differ in English for BSE and ME children's responses. The measure of accentedness represents the raw number of target segments that showed accentedness. Figure 3 demonstrates the trends found when analyzing this measure.



*Figure 3.* Spanish accentedness values on RAN Tasks for monolinguals and bilinguals in English. Light blue bars denote monolingual English-speakers, and dark blue bars denote bilingual English-speakers. RAN-Colors subtest is represented by solid bars, and RAN-Objects subtest is represented by striped bars. Error bars indicate two standard errors.

The first prediction cannot be tested with BSE children only. The reason is that the process of phonetic transcription is itself subject to error. Consequently even ME children will show some tendency to make errors that will inevitably be transcribed in such a way that they could be interpreted as representing Spanish accentedness, even though the children are English monolinguals. Thus, the test of the prediction requires that pronunciations in the RAN tasks be evaluated in both ME and BSE groups, and a significant Spanish accentedness effect in English for the BSE children requires that it be significantly larger than the same effect in the ME children.

The first prediction, more Spanish accentedness in English for bilinguals than in English for monolinguals, was explored by comparing the accentedness values in English on RAN color and object tasks (i.e., monolingual vs. bilingual). Though the ME children appeared to exhibit less accentedness on the RAN colors subtest than the BSE children, the mean ME accentedness value (AV) for colors (mean AV = 3.6) and BSE accentedness value for colors (mean AV = 3.9) did not differ significantly with a very small effect size ( $t(95) = 0.3692, p = .39, d = 0.05$ ). However, the difference between the object subtests means for ME speakers (mean AV = 2.1) and BSE speakers (mean AV = 4.6) was statistically significant with a medium effect size ( $t(95) = 3.4087, p = .0004, d = 0.67$ ). These findings indicate that the Spanish-speaking children exhibited more Spanish accentedness in English than the monolingual English-speaking children when naming objects, but not colors.

The second prediction, a difference in mean accentedness values between the colors (mean AV = 3.6) and objects subtest (mean AV = 2.1) for ME speakers was confirmed, as noted by a significant difference and medium effect size ( $t(110) = 2.46, p =$

.01,  $d = 0.46$ ). In other words, the monolingual children exhibited more errors that could be interpreted as Spanish accentedness (i.e., phonological inaccuracies with a Spanish flavor) on the RAN colors subtest than the objects subtest. A more detailed account of accentedness for ME speakers is provided in the discussion.

Next, English accentedness in Spanish for BSE speakers was explored through the Spanish colors and objects subtests. Larger English accentedness values for bilinguals in Spanish were obtained on the colors subtest (mean AV = 7.7) than objects subtest (mean AV = 7.1), though not significantly so and the effect size was very small ( $t(80) = 0.47$ ,  $p = 0.63$ ,  $d = 0.10$ ). However, because this study did not have monolingual Spanish-speakers with which to compare BSE speakers' accentedness values, these values cannot by themselves indicate whether the accentedness was significant.

### **Correlation between RAN Time and Phonological Accuracy**

The relationship between rapid naming and phonology was also explored in ME and BSE children by comparing RAN time (i.e., total time taken to finish an object or color subtest) to phonological accuracy (Table 4). Time is the first measure and phonological accuracy is the second. A significant negative correlation occurred in two instances, indicating that when time decreased, phonological accuracy actually increased. The highest negative correlation in this sample was between the bilinguals' phonological accuracy on Spanish colors and the total time taken to articulate the stimuli ( $r = -0.37$ ,  $p < .025$ ). That is, as time to completion on RAN colors (Spanish) decreased, the BSE children's phonological accuracy increased.

The bilinguals' phonological performance on the RAN-C subtest in English was also nearly significantly related to RAN time ( $r = -0.263$ ,  $p < .10$ ). Again, as time to

completion on the colors subtest (English) decreased, phonological accuracy increased. This pattern is not what would have been predicted given prior research results. Typically, the RAN literature has portrayed faster times leading to less accurate verbal responses (e.g., Vukovic & Siegel, 2006). In contrast, whether the ME children answered quickly or slowly did not strongly affect how accurately they approximated the target phonemes. Overall, the low  $r$  values suggest a weak relationship between phonological accuracy and RAN time; when the bilingual children had faster times on the colors subtests in English and Spanish, phonological accuracy increased.

Table 4

*Correlations between Phonological Accuracy and RAN Time*

Groups	Phonological Accuracy	
	Color	Object
Monolingual English (n=56)	0.192	0.057
Bilingual English (n=41)	-0.263 $\diamond$	-0.224
Bilingual Spanish (n=41)	-0.374*	-0.109

$\diamond p < .10$ . \* $p < .025$ .

**Post-hoc Analyses: Correlation between Phonological Accuracy and Language Score**

A lack of significant results between mean phonological accuracy and accentedness values in bilinguals and monolinguals evokes the question: Are the RAN transcriptions sensitive enough to detect any interesting differences? In order to investigate the value of the transcriptions, the relationship between phonological

accuracy and a receptive/expressive composite language score (CLS; used to determine English and Spanish proficiency, based on the PPVT/TVIP; Dunn & Dunn, 1997; Dunn et al., 1986) for receptive and the WLPB expressive picture naming scores (in both languages; Woodcock, 1991; Woodcock & Muñoz-Sandoval, 1994) for expressive was investigated to show that the resolution of the transcriptions was not so low that it was impossible to detect any important relations between phonological accuracy and other factors. Certainly, the phonological accuracy value is a more pure measure of phonology, whereas the CLS is a receptive and expressive vocabulary measure. Nevertheless, a positive correlation between the two would suggest that the transcriptions accurately reflected real group differences.

Table 5 presents the correlations between the measures of phonological accuracy and those of language proficiency. Generally, the correlations were modest with the highest positive correlation being between the bilinguals' phonological accuracy in Spanish and their receptive vocabulary score ( $r = .405, p < .01$ ) in Spanish. The bilinguals' phonological accuracy on the English colors was not related to the CLS. The CLS was more significantly related to the groups' phonological accuracy scores than the expressive or receptive language measures individually. The correlations between the receptive language scores and phonological accuracy for bilinguals in Spanish were stronger than the correlations between the expressive language scores and phonological accuracy. In sum, high phonological accuracy scores were generally associated with high language scores, suggesting that the phonological accuracy measure was sensitive enough to detect differences.

### Post-hoc Analyses: English Accentedness Values for RAN Tasks in Spanish

Unfortunately, the current study did not have monolingual Spanish-speakers with which to compare the bilingual children's responses, so it was not possible to directly test for degree of phonological accuracy or accentedness as was done in English. To compensate for this absence, accentedness scores on the RAN tasks were compared to accentedness values from a similar, though more phonologically complex, Phonological Skills Study, conducted with the same BSE children and where monolingual Spanish

Table 5

#### *Correlations between Phonological Accuracy and Language Scores*

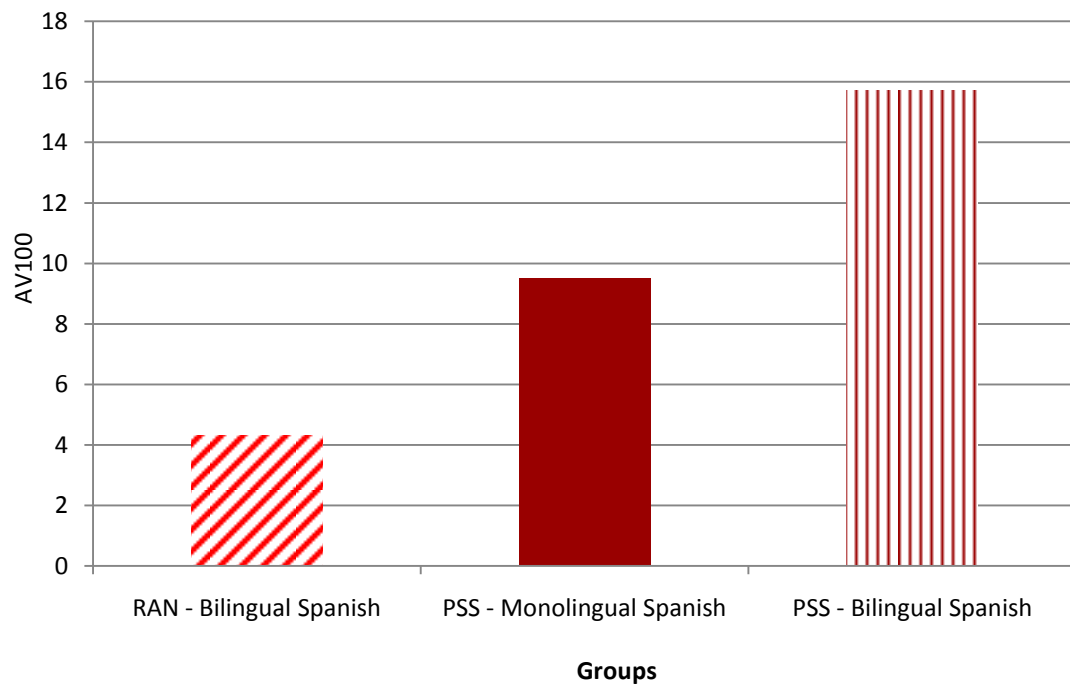
Subtests	Measures		
	CLS	Expressive	Receptive
Monolingual English Color	0.305***	0.276***	0.296***
Monolingual English Object	0.293***	0.287**	0.254*
Bilingual English Color	0.145	0.136*	0.141
Bilingual English Object	0.331**	0.330**	0.301*
Bilingual Spanish Color	0.346***	0.178***	0.405***
Bilingual Spanish Object	0.326**	0.163	0.387***

*Note.* CLS = Composite Language Score (expressive/receptive); Expressive = *Woodcock Language Proficiency Battery* standard score in both languages; Receptive = *Peabody Picture Vocabulary Test* standard score (for English), and *Test de Vocabulario en Imágenes Peabody* standard score (for Spanish)

\* $p < .05$ . \*\* $p < .025$ . \*\*\* $p < .01$ .

speakers from Mexico were also included (PSS; Oller, Powers, & Jarmulowicz, 2010, April 10). A RAN accentedness value per 100 segments (AV100) was calculated (mean AV100 = 4.3) and compared to the same value from the PSS for the monolingual (mean

AV100 = 9.5) and bilingual (mean AV100 = 15.7) Spanish-speaking participants. Figure 4 illustrates the comparisons between the different AV100 scores. The data suggest that the bilingual children produced less English accentedness in Spanish on the RAN tasks than the bilinguals did on the PSS speech tasks in Spanish. Moreover, the RAN bilingual group produced *less* English accentedness in Spanish than the monolingual



*Figure 4.* Accentedness values per 100 segments on Rapid automatized naming and Phonological Skills Study tests in Spanish. Striped bars denote bilingual Spanish-speaking accentedness values, and solid bars denote monolingual Spanish accentedness values. Lighter red represents rapid naming subtest scores and darker red represents Phonological Skills Study scores. AV100 = accentedness value per 100 segments; RAN = Rapid Automatized Naming colors and objects subtests in Spanish; PSS = Phonological Skills Study (Oller, Powers & Jarmulowicz, 2010, April 10)

Spanish participants on the PSS. The comparison of RAN to PSS data are thus surprising, because they suggest that the BSE children performed so well on RAN that they had



lower error rates. These lower error rates could be attributed to an influence of English than monolingual Spanish speaking children. The results suggest that the rapid naming task did not impose significant phonological stress on the children, but that the PSS task did.

## **Discussion**

The present results indicate minimal differences on total time to completion, phonological accuracy and accentedness values on rapid naming tasks between ME-speaking participants and BSE-speaking participants. Monolinguals were significantly faster than bilinguals on the colors subtest, and bilinguals named objects significantly faster than colors. Colors were named with significantly less accent than objects for ME speakers, and ME speakers had less Spanish accentedness than BSE speakers on the objects subtest. Tests of the relationship between phonological accuracy and vocabulary proficiency (on receptive and expressive tasks) showed that the transcriptions had sufficient resolution to reflect between-group and within-group differences for monolinguals vs bilinguals. Overall, the data indicate that bilingual and monolingual kindergarteners had similar proficiency on RAN tasks.

### **Total Time vs. Phonological Accuracy**

Why did the bilingual children have higher phonological accuracy scores when they named faster? Perhaps it is that the children who articulated faster were the same children who had firmer knowledge of the words. If so, this could account for the difference between this outcome and that of prior rapid naming literature. Only the BSE children showed this pattern, and they may have been especially differentiated (more than monolinguals) in terms of how well they commanded the words in the RAN tests.

Another issue to evaluate is that this study considered total time in naming but did not break the time down into pause time and articulation time. It seems possible that BSE children might have been distributing their time differently during the RAN task than ME children did. It will be possible in future work to evaluate this possibility using acoustic analysis of the recordings.

### **Phonological Accuracy**

The significant positive relationship in most cases (see Table 5) between phonological accuracy and language proficiency helps justify the exploration of patterns of differences and similarity in phonological accuracy in monolinguals and bilinguals during the rapid naming tasks. Phonological accuracy values did not differ between ME and BSE speakers' responses on both RAN colors and objects subtests. The findings suggest that when rapid naming in English, monolinguals had similar levels of phonological accuracy. It seems surprising that the BSE speakers did so well on this English task after only a few months of being in school, and in many cases only a few months of being regularly exposed to English. It could be that RAN tasks have a leveling effect on differences in linguistic experiences among bilingual children (Kohnert, 2008). According to Kohnert (2008), the RAN tasks should allow children with different levels of linguistic experience, but intact underlying linguistic capabilities, to show similar performance, assuming their speed of processing is similar. Like the Kohnert and Bates (2002) study, these RAN tasks may have emphasized processing efficiency rather than knowledge of vocabulary, as the stimuli were high frequency items that kindergarteners may have known well.

Regarding within-group comparisons (e.g., colors vs objects in ME speakers, colors vs objects in BE speakers), phonological accuracy was similar for colors and objects, irrespective of the language spoken. However, comparing across groups, English colors were articulated faster in monolinguals than bilinguals. Perhaps colors are particularly well known by the ME children, but we might ask why a similar difference favoring color naming was not found in the BSE children in their first language, Spanish.

It seems possible that color names could be retrieved more quickly than object names from memory because color words are semantically related to a greater extent (i.e., they pertain to a restricted semantic set; for a discussion, see Nelson, McKinney, Gee & Jancurza, 1998). This may play some role in the extent of their ease of pronunciation. It has been proposed that smaller semantic sets encourage denser connections between words, enabling more efficient semantic organization and faster word retrieval (Nelson, Bennett, Gee, Schreiber, & McKinney, 1993).

Object and color sets may also differ in their frequency of occurrence. Colors may be taught in a more intensive or a more structured way in school, and perhaps even at home. Color naming is a typical educational activity and it often involves contrasting various color names from the small set used in the RAN task. Object naming is also a common activity in education, but it is hard to imagine how this particular set would have been selected in any setting other than the CTOPP/TOPPS. Lastly, performance on color and object subtests could differ simply because the two sets do not have the same phonological characteristics. For example, the English colors subtest contains more bilabial and velar stops (e.g., [blæk], [blu]) than the English objects subtest. The Spanish color subtest has three words containing nasals in initial position (e.g., [moráðo],

[marón], [néyro]), while the object test has none. These differences in phonological composition may affect how accurately the monolingual and bilingual children articulated the words in the subtests.

### **Accentedness**

The BSE speakers had more Spanish accentedness in English than the ME speakers on the objects subtest only. There are numerous models that could explain accentedness. For example, Paradis' Interactional Dual Systems model could help explain the larger Spanish accentedness scores in English for BSE children. Greater accentedness values for BSE than ME children is evidence of an interaction between the children's language systems. According to Paradis' construct, as the BSE speakers borrowed articulatory elements of Spanish and transferred them to English, the distance of the each child's production to the target increased in ways specific to L1 intrusion. The intrusion of L1 articulatory elements into L2 led to a larger Spanish accentedness score in English for BSE speakers than for ME speakers.

The trend toward larger accentedness values found in the BSE children's speech would also support MacWhinney's Unified Model of Language Acquisition, in particular regarding phonological transfer from L1 to L2. MacWhinney's theory, when applied to second language acquisition, accounts for phonological transfer from L1 to L2 for these children in rapid naming. According to the model, the bilingual children created new phonological mappings by transferring specific articulatory patterns (common to their native language, Spanish) to English (L2). The fact that the accentedness difference between ME and BSE children occurred only for the object names might be attributable to a more effective learning of the color words in English by the BSE children. For

example, if color words were more intensively taught at school, the instruction might have reduced any possible difference between BSE and ME children for naming of colors to a greater extent than for naming of objects.

How could the monolingual English speakers have a Spanish accentedness value in English? One possibility is that the bilingual children are “rubbing off on” the native English speakers with their Spanish phonology. Another, more plausible, reason is that the monolingual children are making phonological errors that may be transcribed in such a way that they could appear to be Spanish-influenced (e.g., an [i] vowel might be substituted for an [ɪ]) because they are speaking quickly and simply make a mistake that is a part of the normal variation in native speaker pronunciations or in interpretations by transcribers of native speaker pronunciations). It is thus important to keep in mind that the mean ME speakers’ English accentedness values provide a baseline against which to compare the BSE speakers’ accents.

When comparing within-groups on accentedness, the results indicated that bilinguals had less Spanish accentedness when naming English colors than when naming English objects. This fact may be related to more effective or intensive teaching of color names in English at school.

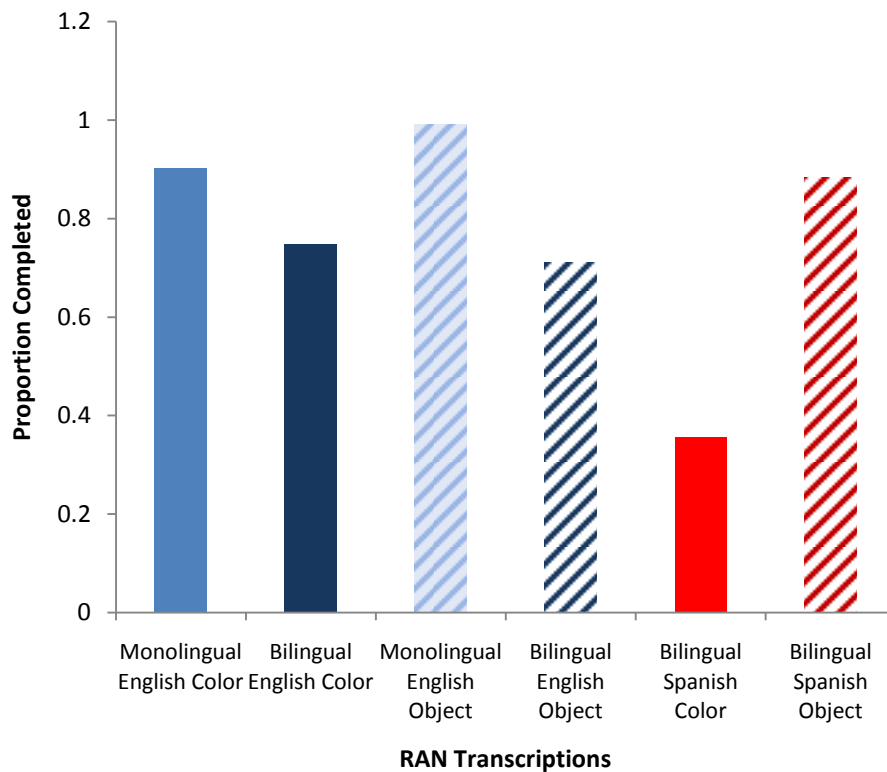
When compared to the PSS data, the RAN data for the BSE speakers showed the least accentedness in Spanish, followed by the monolinguals on the PSS in Spanish, and then the BSE speakers in Spanish. How can the bilingual children have *less* English accentedness than the monolingual-Spanish speaking children? These data suggest that the RAN task is easy from a phonological perspective. It does not impose particular phonological stress.

Overall, the data suggest that RAN tasks in English and Spanish are not particularly difficult for bilingual children. In fact, the BSE speakers were highly phonologically accurate. However, they appeared to produce some accentedness in both Spanish and English, with values that differed significantly from their English-speaking monolingual peers only on object stimuli.

### **Limitations of Study**

The most notable limitation of the study was the absence of monolingual Spanish speakers with which to compare the bilingual children's responses in Spanish. The BSE children's English productions could not be compared directly to their Spanish productions on rapid naming tasks, because the phonologies of Spanish and English are different. Without Spanish monolingual productions, the BSE children's Spanish productions could only be compared to the Phonological Skills Study's transcriptions of monolingual-Spanish speakers, which is an indirect measure at best.

Another limitation is that the study could not consider the children who were unable to pass the pretest of the CTOPP or TOPPS (see Figure 5). The absence of these children may well have skewed the results, because only the productions of the children who passed the pretest on the names of the colors or objects were recorded and transcribed. This may have led to higher phonological accuracy scores (and lower accentedness scores) than would have occurred had the children who failed the pretest been included.



*Figure 5.* Proportion of children who passed the pretest trials. English RAN tasks are represented by blue bars and Spanish RAN tasks by red bars. Colors are designated by solid bars and objects by diagonally-lined bars. Lighter shaded bars are monolingual participants' scores and darker bars and bilingual participants' scores.

### Conclusion

In sum, two phonological measures (weighted phonological accuracy and accentedness) were used to investigate the accuracy of monolingual English- and bilingual Spanish-English-speaking kindergarteners in a RAN task. Monolingual and bilingual children did not differ significantly in English on the phonological accuracy measure. Bilingual children showed more Spanish accentedness in English than monolinguals on the objects subtest, but not the colors test. These findings lead one to conclude that, while bilingual children did have slightly poorer phonological accuracy

and more accentedness on RAN tasks, there seemed to be a consistent level of approximation to the target phonemes in English. It seems that rapid naming tasks did not impose significant stress on the bilinguals' abilities to produce common words accurately.



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Appendix. Stimuli and Accepted Phonetic Substitutions

Subtest	Stimuli	Acceptable Substitutions			
English					
Color	black	[blæk]	[płæʔ]		
	blue	[blu]	[plu]		
	purple*	[p <sup>h</sup> ɜːpət]	[p <sup>h</sup> ɜːpʔ]		
	brown	[bɹ̥ɔwn]	[pɹ̥ɔwn]		
	green	[gɹ̥ɪn]	[kɹ̥ɪn]		
	red	[ɹ̥ɛd]	[ɹ̥ɛɔd]	[ɹ̥ɛɔt]	[ɹ̥ɛː t]
	yellow	[jɛłow]	[jɛłɔw]		
Object	boat	[bowt]	[powt]	[bɔɹt]	
	chair	[tʃ <sup>h</sup> ɛɹ]	[tʃ <sup>h</sup> ɛə]		
	sit*	[sit]			
	fish	[fɪʃ]	[fɪɔʃ]		
	key	[k <sup>h</sup> i]	[k <sup>h</sup> ij]		
	pencil	[p <sup>h</sup> ɛ̃nsət]	[p <sup>h</sup> ɪnsət]	[p <sup>h</sup> ɛ̃nsʔ]	[p <sup>h</sup> ɛ̃ntsʔ]
	star	[staɹ]	[staə]	[stɔɹ]	
Spanish					
Color	amarillo	[amarijo]	[amarijə]		
	azul	[asúl]			
	morado*	[moráðo]	[mɔrãðə]		
	marrón	[marón]	[mazòn]		
	café*	[kafé]	[kafè]		
	negro	[néɣro]	[néɣrə]		
	rojo	[róxo]	[zəhə]		
	verde	[bérðe]	[vézðe]		
Object	barco	[bárko]	[bárkə]	[bázkə]	
	bote*	[bóte]	[bóte]		
	estrella	[estréja]	[estréja]		
	lápiz	[lâpis]	[lâpi]		
	llave	[jàβe]	[jàve]		
	pes	[pes]	[pɛs]		
	pescado*	[pɛskãðo]	[pɛskãðə]		
	silla	[sija]			

*Note.* An asterisk after a word denotes that the word is an acceptable substitution for the stimuli directly preceding it.