Speaking Rate in the Child-Directed Speech of Native English-speaking and Native Spanish-speaking Parents

By Juliana Kalik McGanney

B.A. in Philosophy, May 2006, Tufts University

A Thesis submitted to

The Faculty of
Columbian College of Arts and Sciences
of the George Washington University
in partial fulfillment of the requirements
for the degree of Masters of Arts

May 19, 2013

Thesis directed by

Shelley Brundage
Associate Professor of Speech and Hearing Sciences
Acknowledgements

First, I would like to thank Dr. Shelley Brundage for her incredible help in researching, writing, and revising this thesis. She has provided me constant support and insight throughout this process. I am also grateful for all the help I received from the Professors on my committee, Dr. Sylvia Campbell and Dr. Cynthia Core. Both have been available with ideas and advice at all times. I appreciate the collaboration and help I received both from the members of Dr. Shelley Brundage’s lab at the George Washington University as well as individuals at the Florida Atlantic University, including Dr. Erika Hoff, Dr. Silvia Place, and Melissa Senor. I also want to acknowledge my family and friends for all their support. In particular, Ellen Conover, Meghan Faulkner, Josefina Fernandez, Alicia Neubig, and Adam Scott: thank you for lending both your ears and eyes.
Abstract of Thesis

Speaking Rate in the Child-Directed Speech of Native English-speaking and Native Spanish-speaking Parents

When parents speak to their children, they adjust both the form and content of their speech. This input that children receive can impact their language development. Little is known about child-directed speech (CDS) in second language (L2) speech, but it is clear that L2 adult-directed speech (ADS) varies from native speech in a variety of ways. Rate of speech is one of the characteristics that differentiates ADS from CDS in monolingual speakers. This thesis examines the rate of speech in a group of native English-speakers (NES) and a group of native Spanish-speakers (NSS). In this study, both groups of parents spoke to their 30-month old children in a natural play setting. A first investigation compared the rate of speech between the two groups of parents in an English-language sample. A t-test revealed that speaking rate did not differ when measured in words per minute (WPM), but did differ when measured in syllables per minute (SPM). The NES group spoke significantly faster in English syllables per minute. A second investigation compared the rate of speech within the group of NSS parents, examining the differences between their CDS in English and in Spanish. A t-test revealed that the NSS parents spoke significantly faster in English when measured in WPM and significantly faster in Spanish when measured in SPM. Finally, correlations were used to examine any relationships between parent speaking rate and child language outcomes at 30 months. Results indicate that there were no correlations between parent speaking rate and child language outcomes in either group for either language. The findings from our first investigation suggest that SPM is a more sensitive measure than WPM, and, thus, individuals should consider using SPM in future studies of rate when studying Spanish-English bilinguals. The findings from our
second investigation highlight the difficulties of studying rate across different languages.

The outcomes of our correlational studies indicate that parent rate of speech may not be relevant to language outcomes for bilingual children at 30 months.
# Table of Contents

Acknowledgments........................................................................................................... ii  
Abstract of Thesis ............................................................................................................... iii  
List of Figures ...................................................................................................................... vi  
List of Tables ....................................................................................................................... vii  
Chapter 1: Introduction .................................................................................................... 1  
Chapter 2: Methods .......................................................................................................... 12  
Chapter 3: Results ............................................................................................................ 20  
Chapter 4: Discussion ....................................................................................................... 33  
References ......................................................................................................................... 46
List of Figures

Figure 1 ..............................................................................................................26
Figure 2 ..............................................................................................................27
Figure 3 ..............................................................................................................29
Figure 4 ..............................................................................................................31
Figure 5 ..............................................................................................................32
List of Tables

Table 1.................................................................................................21
Table 2.................................................................................................21
Table 3.................................................................................................22
Table 4.................................................................................................22
Table 5.................................................................................................24
Table 6.................................................................................................28
Table 7.................................................................................................28
Chapter 1: Introduction and Literature Review

Background and Purpose

Child-directed speech (CDS) is the speech that parents use when speaking to their children. Research examining the differences between CDS and adult-directed speech (ADS) indicates that adults adjust both the form and content of their message when addressing children (Fernald, Taeschner, Dunn, Papousek, de Boysson-Bardies, & Fukui 1989; Green, Nip, Wilson, Mefferd, & Yunusova, 2010; Phillips, 1973; Remick, 1973; Snow, 1972). Studies of monolingual speakers show that the nature of the input that parents provide correlates to language outcomes for their children (Hart & Risley, 1992; Hoff, 2003; Huttenlocher, 1991). It is important to understand the specifics of how parents speak to their children in order to determine which particular parental speaking behaviors impact children’s language development.

Speaking rate is just one of the elements of parent input that has been studied in relation to child language acquisition. Thus far, studies indicate that speaking rate in CDS differs from ADS. Green and colleagues (2010) found that speech rate is slower in infant-directed speech (IDS) than in ADS. This change in rate may influence the child as a listener; studies have found that young babies attend more to utterances spoken at a slower rate (Cooper, 2001, Cooper, Ostroff, & Panneton Cooper, 1998) and that speaking rate influences word-learning both in typically developing children and in those with language disorders (Weismer & Hesketh, 1993).

Although much is known about the input of monolingual parents to their children, far less is known about the input of non-native language input to children. When individuals speak a second language (L2), certain properties, such as phoneme accuracy,
rhythm, prosody, and speaking rate distinguish their speech from the speech of a native speaker (Chela-Flores, 1993; Lennon, 1990; Munro & Derwing, 2001; Schmidt & Flege, 1995). It is not yet clear if or how these properties modify and shape parents’ speech to their children. Yet, as the number of bilingual children in the United States continues to grow (U.S. Department of Education, National Center for Education Statistics, 2012), it becomes increasingly important to include bilingual participants in research on language input and development. By better understanding L2 parent input, it becomes easier to discover the factors that correlate to language outcomes in bilingual children.

The purpose of this thesis is to examine and describe the linguistic behaviors that occur in L2 CDS as compared to native (L1) CDS. Specifically, it will examine parent rate of speech in CDS, comparing native English-speakes and native Spanish-speakers during a play task with their children in a naturalistic setting. We will look at any differences in rate between the two groups and then look at any differences in rate across languages within the group of native Spanish-speakers. Finally, we will determine if there is a relationship between rate of speech in CDS and child language outcomes in children at 30-months of age.

**General Characteristics of CDS**

Little information exists on the characteristics of Spanish CDS. A description of monolingual English CDS, however, can help to demonstrate the ways in which speech to children can differ from speech to adults. Studies of English infant-directed speech (IDS) and CDS find that parents’ utterances are spoken at a higher pitch and with greater prosodic variation when they speak to their children (Fernald et al., 1989; Remick, 1973).
When compared to ADS, the vocabulary used in CDS is more concrete and less varied (Phillips, 1973). Overall, speech is more intelligible in CDS than in ADS. It also contains fewer disfluencies (Newport, Gleitman, & Gleitman, 1977) and its rate is generally slower (Green et al., 2010). Although some studies have found that sentences in CDS are shorter and syntactically less complex than ADS (Snow, 1972; Phillips, 1973), findings on grammatical differences between CDS and ADS are less conclusive than findings on differences in prosody, vocabulary, rate, and disfluency. For example, Newport et al. (1977) found conflicting information; although the mean-length of utterance was shorter in CDS, mothers used a larger variety of sentence types and less consistent productions when compared to ADS.

Although the evidence above suggests that input to children contains many consistent patterns, CDS is also influenced by factors such as the background of the parent, the age of the child, and the communication setting. Studies by Hoff-Ginsberg (1991) and Hart & Risley (1992) have found that parents from a lower socioeconomic status (SES) tend to provide different input to their children than do parents from a higher SES. Parents from low SES groups use a higher percentage of directives when communicating with their children, whereas those from high SES groups ask fewer questions and instead expand upon their children’s utterances. A study by Huttenlocher and colleagues (2007) confirmed this distinction in language input across SES, but found that differences in CDS were more highly associated with parent education level rather than income level alone. Specifically, higher levels of parent education correlated with a greater number of multi-clause sentences, more noun-phrases and verbs per clause, and a higher diversity of clause type in CDS. This same study, along with others, found that
CDS differs within individual parents as children age. The studies looked at different age groups, with children ranging in ages from 8 months through 10 years, and found that parents’ communication became increasingly complex, containing more words, verbs, verb forms, and clauses per utterance as children aged (Huttenlocher et al., 2007; Phillips, 1973; Snow, 1972). In Huttenlocher et al.’s study (2007), these changes occurred regardless of parent education level.

CDS also differs depending on the context of communication. Parents use more complex vocabulary and syntax and a faster rate of speech when engaged in reading activities, but more directives and a slower rate of speech when engaged in toy play (Hoff-Ginsberg, 1991).

**Role of CDS in Language Development**

Studies of variation in parent input, like the studies mentioned above, help to illustrate the significant role that CDS plays in language acquisition and development. A study by Hoff (2003), for example, demonstrated not only that parent input differs across SES but also that these differences correlate with children’s early language outcomes such as vocabulary development. In this study, mothers from high SES groups used longer sentences and more diverse vocabulary; their children’s vocabularies grew more quickly than the children of mothers from low SES groups. A study by Huttenlocher et al. (1991) supports this link between speech input and vocabulary. Hart & Risley (1992) found correlations between speech input and child IQ scores. Studies by Weizman & Snow (2001) and Rowe (2012) also corroborate these findings, pointing to the diversity
of vocabulary, rather than solely the amount of vocabulary, as a predictor of child language outcomes.

CDS is at least one of the factors that impacts childhood language acquisition. By better understanding the specific features of CDS, why it differs from one caregiver to another, and how it may affect child language outcomes, we can better understand what to expect children’s language development and how best to bolster their learning.

**Speaking Rate in CDS**

There is a small body of research examining the rate characteristics of CDS in monolingual English speakers. Green et al. (2010) found that monolingual mothers lengthened their vowel productions when speaking to their infants. Lengthened vowels resulted in a slower rate of speech, demonstrating that rate differs between infant directed speech (IDS) and ADS. It is important to note that the infants in this study were 9-10 months old and that the study does not provide evidence that mothers lengthen their vowels when speaking to older children. Green et al.’s results, however, indicated a statistically significant difference in rate when measured in words per minute (WPM) with a mean rate of 107.11 WPM for IDS and a mean rate of 122.53 WPM for ADS.

While speaking rate in CDS is thought to be slower than speaking rate in ADS, speech rate also differs within CDS across caregivers and communication contexts. A study by Hoff-Ginsberg (1991) found speech rate differences in CDS within individual parents based on communicative context. Speech was faster during book reading and dressing. It was slower during play and mealtime conversations. A study by Meyers & Freeman (1985) examined maternal speech rate in the context of stuttering. They found
that mothers of children who stutter spoke faster than those whose children did not stutter. The average rates of speech during toy play were measured in syllables per second (SPS) and were found to be 5.48 SPS [328.8 SPM] for mothers of children who stuttered and 4.96 SPS [297.6 SPM] for mothers of children who did not stutter.

**Speech Rate & Its Effect on the Listener**

Some studies of adults provide evidence that a speaker’s rate of speech affects the listener’s comprehension. A study by Wingfield, Peelle, & Grossman (2003) found that listeners had more difficulty comprehending complex speech when it was produced at a rapid rate rather than a typical rate. A few individuals have applied this concept in studies of child listeners, finding that very young infants (1, 3 and 4 months of age) attend more to utterances spoken at a slower rate (Cooper, 2001; Cooper et al., 1998). Cooper et al.’s 1998 study found that 1-month olds preferred normal IDS as compared to IDS presented at an increased rate. They noted that the rate of the fast IDS was similar to that of ADS. In 2001, Cooper examined 3 and 4-month old infants and found that they preferred slowed IDS to normal IDS. A 2006 study by Panneton, Kitamura, Mattock, & Burnham also examined infants’ attention to normal and slow IDS. They suggest that young infants (18 weeks) attended more to a slow rate of speech because it conveyed more emotion. They found that slightly older infants (32 weeks) did not show this same preference for slowed IDS. Their study, however, did not compare infant preference to IDS versus ADS.

Weismer & Hesketh (1993) examined the influence of speaking rate on novel-word learning in kindergarteners with typically developing language and specific
language impairment (SLI). They found that a slowed rate of presentation was advantageous both for comprehension and production of the novel words in both groups. This effect, however, was more pronounced for the group with SLI.

Several authors posit that slowing speech rate results in other changes to speech, including linguistic changes, such as shorter utterances and decreased syntactic complexity (Bernstein Ratner, 1992; Snow, 1986), changes at the level of speech production, such as exaggerated lip movements (Green et al., 2010) and changes in voice onset time (Magloire & Green, 1999). Some theorize that changes in rate and other subsequent areas may allow children additional processing time either as listeners (Green at al., 2010) or as speakers (Stephenson-Opsal & Bernstein Ratner, 1988). In either case, the general consensus is that a reduced rate of speech is, in some way, beneficial to the child listener.

**Speech Rate in CDS: Conclusions and Implications for Our Study**

Based on the current evidence related to CDS and speaking rate, we expected the parents in our study to use a slow rate of speech compared to published norms for ADS. We hypothesized that if children attend more to a slower rate of speech, then children of parents with a slower rate of speech may acquire vocabulary more readily. We predicted that there would be an inverse relationship between parent rate of speech and child vocabulary and language outcomes both for children of native English-speakers and for children of non-native English-speakers. When studying rate in speakers of a second language (L2), it is helpful to first understand general properties of L2 speech. We turn now to this subject.
Properties of Second Language Speech

Individuals who speak a second language are a heterogeneous group. Speech patterns of L2 speakers differ depending on many factors including the age of language acquisition, the method of language acquisition (e.g. learning from a native speaker or a non-native speaker), the native language of the speaker (Major, 2001), and the amount the speaker uses her L1 (Guion, Flege & Loftin, 2000a). Although they are a diverse group, L2 speakers make errors that generally fall into two basic categories: transfer of linguistic rules from a native language or use of generalized language rules that do not apply during specific language exceptions (e.g. irregular verb forms; Major, 2001). Regardless of the reason behind the errors, L2 speech can be distinguished from L1 speech on a variety of parameters such as word use, stress, and phoneme accuracy (Hansen Edwards & Zampini, 2008).

Studies of L2 speech have focused on a number of linguistic themes, including differences in consonant production, vowel production, and overall prosody. Schmidt and Flege (1995) found that voice onset time (VOT) deviated from native-like production for less proficient L2 speakers of English. More proficient speakers, however, produced VOT similar to that of L1 speakers.

Rate in L2 Speech

In addition to the above-mentioned changes that occur during L2 speech, several studies have examined the link between L2 production and speaking rate. A paper by Chela-Flores (1993) emphasized that native speakers of a variety of different languages demonstrate difficulty acquiring native-like rate in English as an L2. Adams and Munro
(1978) highlighted this difficulty in their study of L2 English-speakers whose L1s had a different rhyming pattern. They found that these L2 speakers tended to maintain stress patterns similar to their native languages, shortening stressed syllables and lengthening unstressed ones as compared to native English-speakers.

Overall, speaking rate of L2 speakers is slower than L1 speakers. Evidence of this has been found in a range of communicative settings including reading and extemporaneous speech (Munro & Derwing, 1994) and narrative retell (Lennon, 1990). Munro & Derwing (2001) corroborated these findings in their experiment where participants read sentences aloud; the mean speaking rate was 3.52 SPS (211.2 SPM) for L2 speakers and 4.55 SPS (273 SPM) for native English speakers.

Munro & Derwing (2001) note, interestingly, that unlike many other L2 errors, rate changes do not reflect errors of transfer or irregular language rules. Rather, rate changes appear to be related to difficulty in processing, including selection of lexical items, encoding of syntax, and production of phonemes. Studies of rate differences across proficiencies of L2 speakers confirm this idea by demonstrating that rate increases as a product of improved language proficiency. Lennon (1990) found that most speakers increased their rate of speech after several weeks learning a second language. Hilton (2008) examined young-adult L2 speakers of English, Italian, and French. Speakers’ language knowledge was examined in relation to their speech productivity. It was found that better vocabulary knowledge correlated to speech productivity; speakers with larger vocabularies spoke more quickly, had longer lengths of fluent speech runs and produced fewer hesitations. Guion, Flege, Liu, & Yeni-Komshian (2000b) also found differences across proficiency levels. They looked within a group of L2 speakers and found that
individuals who immigrated to a country later in life had a slower rate of speech. They then examined the reason behind the difference in duration and found that the individuals with a later age of arrival lengthened vowels and sonorant sounds.

Miller, Heilmann, Nockerts, Iglesias, Fabiano, & Francis (2006) used this finding that speaking rate correlates with L2 proficiency in a study of Spanish-English bilingual children. They used speaking rate as one of several measures of oral language skills and examined its relationship to literacy across the children’s L1 and L2. They found that oral language skills, including speaking rate, predicted children’s reading abilities. This relationship occurred across languages as well as within.

**L2 and Speaking Rate: Summary**

The literature shows that, generally, speaking rate is slower in L2 speakers than in L1 speakers (Lennon, 1990; Munro & Derwing, 1998; Munro & Derwing, 2001). Additionally, within groups of L2 speakers, speaking rate differs as a result of L2 proficiency; more proficient speakers speak more quickly (and more similarly to native speakers) and less proficient speakers speak more slowly (Guion, et al., 2000b; Hilton, 2008).

**L2 CDS and Its Impact on Child Outcomes**

Given the findings discussed above, it is possible that speaking rate is one of the features of CDS that can impact language outcomes for bilingual children. Rate appears to bear at least a minor relation to vocabulary learning for monolingual children (Cooper, 2001; Cooper et al., 1998; Weismer & Hesketh, 1993). Additionally, there is some
evidence of rate’s importance in second language acquisition in adults. Sommers and Barcroft (2007) found that adult speakers learned vocabulary more readily in a new language when words were presented at variable rates of speech (i.e. some words were presented slowly and some were presented quickly). When all words were presented at the same speed, however, those who heard a slower rate of speech performed better on subsequent vocabulary tests. These results should be applied to bilingual children cautiously, as the adults in the study had no prior knowledge of a second language and were learning words in isolation. Yet, in conjunction with evidence from other studies, it seems likely that a slower rate of speech may be beneficial to vocabulary learning.

Summary

Child-directed speech has properties that distinguish it from adult-directed speech. In monolingual adults, CDS has been shown to impact child language outcomes. Rate is one of many properties that change from ADS to CDS in monolingual English. Currently, there is limited knowledge of the characteristics of L2 CDS, however, it is apparent that in ADS, L2 speakers speak more slowly than L1 speakers do. In addition, slowed rate in L2 speakers may be tied to language proficiency in L2. Because speaking rate is one of the variables that may matter in child language acquisition, we are examining the characteristics of speech rate in bilingual parents.

Research Questions

1. During child-directed speech, does English speaking rate differ between native English-speaking and native Spanish-speaking parents?
2. Within the group of native Spanish-speaking parents, does speaking rate differ across languages (English and Spanish) during CDS?
3. For both native English-speaking and native Spanish-speaking parents, does speaking rate (in either language) in longer utterances correlate with child language outcomes at 30 months?
4. For both native English-speaking and native Spanish-speaking parents, does parental volubility and lexical diversity in English correlate with child language outcomes at 30 months?
5. For the native Spanish-speaking parents, do self-ratings of oral language proficiency correlate to speaking rate or to child language outcomes at 30 months?

**Chapter 2: Methods**

**Participants**

There were two groups of parents. The first group, the Native Spanish Speaking (NSS) group consisted of 15 parents. The second group, the Native English Speaking (NES) group consisted of 13 parents. Both groups were recorded in conversation with their 30-month-old children. All participants lived in southern Florida and were recruited by Florida Atlantic University (FAU) through a combination of flyers, word of mouth, and newspaper advertisements. For the NSS group, participant families were selected for the study if either one or both parents were immigrants from a Spanish-speaking country. For the NES group, participant families were selected for the study if at least one parent was a native English speaker and the child was exposed to Spanish at least 10 percent of the time at home. Participant families in both groups were selected only if their children
were typically developing at 30 months, had begun producing words in both languages, and were exposed to both Spanish and English at home, with at least 10 percent of input in each language by the age of 24-months. All children were born in the United States at full term with no history of hearing problems. Families received a gift card, a t-shirt, and a children’s toy for their participation. The study was approved by the Human Subjects Committee at FAU and all parents signed letters of informed consent prior to participation.

**Native Spanish-speaking (NSS) group.** This sample included 15 parents (14 mothers and one father). All parents were native speakers of Spanish who acquired English as a second language. All NSS speakers were born in Spanish-speaking countries and were exposed to Spanish from birth. The parents were born in the following locations: eight in Colombia, two in the Dominican Republic, two in Peru, one in Mexico, one in Guatemala and one in Puerto Rico. They arrived in the United States at a mean age of 21.8 years (SD: 10.631). Language proficiency for the parents was determined from self-reports on a scale from 1-3 (1=never uses the language, hears it very little, 2=uses the language a little, hears it sometimes, 3=uses the language most of the time, hears it most of the time.) Proficiency reports were received from 14 of the 15 parents. Self-reported oral English proficiency for the group was 2.79 (SD: .426). The average self-reported oral Spanish proficiency was 2.71 (SD: .469). The parents’ highest level of education was as follows: two held high school degrees, four held two-year degrees, seven held four-year degrees, and two held advanced degrees. On average, these parents spoke Spanish to their child 73 percent of the time (SD: 23.664) and English 27 percent of the time (SD: 23.664).
The children of the NSS parents were born in the US and were 30 months old at the time of the study. Participants included eight female and seven male children. All children were determined to be bilingual (producing words in both Spanish and English by 2 years of age) and were determined to have typically developing speech and language abilities by scores on the Ages & Stages Questionnaire (Squires, Bricker & Mounts, 2009). Using a standardized interview, parents estimated the total amount of input to their children in both Spanish and English. The mean percentage of Spanish input at home was estimated as 65.33 percent (SD: 22.398). The mean percentage of English input at home was estimated as 34.67 percent (SD: 22.398). Other languages in the home accounted for a mean of .20 percent of input (SD: .775). Only one dyad reported another language spoken at home and this language accounted for 3 percent of their home input. For 12 of the children, their other parent (who did not participate in the study) was also a native Spanish-speaker. Two of the children had a native English-speaking parent and one had a parent who was a native speaker of another language.

**Native English-speaking (NES) group.** This sample included 13 parents. All parents in the group were native speakers of English. Twelve parents were born in the United States and one was born in Australia. The group consisted of nine mothers and four fathers. Language proficiency reports were received from 12 of the 13 parents. Self-rated oral English proficiency for the group was 3.0 (SD: 0). Mean oral Spanish proficiency was 1.83 (SD: .389). The parents’ highest level of education was as follows: one held a high school degree, five held two-year degrees, four held four-year degrees, and three held advanced degrees. No other languages were spoken in the home. On average, these NES parents spoke English to their children 85.23% of the time (SD:
24.184, and Spanish 14.77% of the time (SD: 24.184).

The children of the NES parents were 30-months old at the time of the study. Participants included eight female and five male children. All children were bilingual and were determined to have typically developing speech and language abilities as determined by the Ages & Stages Questionnaire (Squires, Bricker & Mounts, 2009). The total amount of input to each child in both Spanish and English was estimated. The mean percentage of English input at home was estimated as 62.31% (SD: 18.21). The mean percentage of Spanish input at home was estimated as 37.69% (SD: 18.213). For 11 of the children, their other parent (who did not participate in the study) was a native Spanish speaker. One of the children had a second native English-speaking parent and one had a parent who was a natively bilingual speaker.

Materials

This study was part of a larger study of language, phonologic, and fluency development in dual-language learners. Assessments included standardized interviews with the parents, administration of standardized tests, and videotaped interactions between the children and their parents. The following assessments were used in this study:

- Preschool Language Scale, Fourth Edition (PLS-4) English and Spanish Editions (Zimmerman, Steiner & Pond, 2002): These are norm-referenced standardized assessment tools. The auditory comprehension subtests of the assessments were used to evaluate each child’s receptive language abilities.
- Macarthur-Bates Communicative Development Inventories (CDI) and Inventario
del Desarrollo de Habilidades Comunicativas (IDHC) (Fenson, Dale, Reznick, Thal, Bates & Hartung, 1993): These are word and sentence inventories in English (CDI) and Spanish (IDHC) used to measure a child’s vocabulary. They are based on parent report and were used in this study as a measure of each child’s expressive language abilities.

In addition to the assessments, a standard set of toys was used in each play session. These toys were used to facilitate parent-child interact during video taped conversations. The toys used were picnic objects, including toy foods and utensils.

**Procedures**

Each NSS parent received a copy of the IDHC and the CDI prior to one of the 30-month assessment sessions. The NSS parents were asked to have a native speaker of Spanish fill out the IDHC and a native speaker of English fill out the CDI. Spanish and English versions of the PLS-4 were administered following the 20-minute play sessions. The Spanish version was administered following the Spanish play session and the English version was administered following the English play session.

The NES parents completed the CDI, and their children were given the PLS-4 (English version) at the 30-month assessment session. The CDI, IDHC, and both versions of the PLS-4 were scored at FAU and the scores were sent to GWU for comparison to parental speech rate.

Each parent-child dyad was video-recorded using a Sony HD Handycam video camera with a Sony Bluetooth Wireless Microphone System for Video Cameras during a 20-minute play session in their home. The toys used in the play sessions were similar
across all sessions, including one bag of animal toys and one bag of food toys. The NSS parents were recorded twice. They were instructed to speak Spanish during one play session and English during the other. The sessions were recorded within 6 weeks of one another, beginning with the week before the child turned 30 months and including the time up until one week after the child turned 31 months. The NES parents were recorded once, speaking English to their children. This yielded 15 Spanish videos and 15 English videos for the NSS group, and 13 English videos for the NES group.

**Data Entry & Analysis**

Trained transcribers at FAU watched the video-recordings of the play sessions and transcribed them using published transcription and coding procedures (Codes for Human Analysis of Transcripts or CHAT, MacWhinney, 2000) system, which is a transcription tool developed for the Child Language Data Exchange System (CHILDES; MacWhinney, 2000). Spanish play sessions were transcribed by native Spanish speakers, and English play sessions were transcribed by native English speakers. Each transcript was reviewed for accuracy by a second trained transcriber. All disagreements were resolved by consensus.

**Rate Analyses**

Transcripts, linked to the videos via CHAT’s SonicChat feature, were sent to the George Washington University (GWU) where they were analyzed for speaking rate. All utterances of four or more words in length were identified in each transcript. A graduate student listened to the videotaped play sessions while viewing the written CHAT
transcript. After allowing for a 10-minute ‘warm up’ period, when the graduate student heard an utterance containing four or more words, she copied this utterance into an Excel file and noted the line number in the CHAT transcript. This process continued until the entire remaining transcript had been reviewed for each participant and all 4+ word utterances identified. In order to analyze the same number of utterances from each participant, the student identified the first 15 utterances for each parent that were 4 or more words in length for subsequent analyses. Utterances of 3 or fewer words were omitted from rate analyses in order to remove single-word utterances that included directives, labeling, and vocatives. This generated 195 English utterances for the NES group (15 utterances x 13 participants), 225 English utterances from the NSS group (15 utterances x 15 participants) and 225 Spanish utterances from the NSS group (15 utterances x 15 participants) for a total of n = 420 English utterances and n = 224 Spanish utterances for rate analyses.

Video-recordings of the play sessions were converted into audio-files using the MPEG Streamclip software (Cinque, 2011). These audio files were then imported into PRAAT (Boersma & Weenink, 2012). From these larger audio-files, smaller audio-files were made for each of the 15 utterances for each parent. The total utterance time was measured for each utterance by placing one cursor at the beginning of the utterance and one at the end of the utterance, and noting the elapsed time in between. Cursor placement was guided by the following rules (J. Liss, personal communication, March 30, 2012):

1. Voiced onset: first glottal pulse that extends through second formant
2. Voiced offset, last glottal pulse extending through second formant
3. Stop consonant or affricate: onset of burst; offset of noise or noiseburst
4. Fricative onset: onset of noise; offset of noise

The number of words and the number of syllables between the cursors were totaled for each utterance. For each utterance, the total number of words was divided by the total utterance duration to determine each utterance rate in words per minute (WPM). For each utterance, the total number of syllables was divided by the total utterance duration to determine each utterance rate in syllables per minute (SPM). The following data were also calculated: total words, total syllables, and total time for each parent’s 15-utterance samples.

**Linguistic Analyses**

Parent volubility (# of total words in the sample) and lexical diversity (types) were calculated using Computerized Language Analysis or CLAN (MacWhinney, 2000). Each 20-minute play sample was examined by a single coder, who used the CLAN system’s frequency command to calculate tokens and types. Filled pauses, animal noises, singing, and all words spoken in an unassigned language (e.g. Spanish words spoken during an English play sample) were excluded from this analysis.

**Reliability**

Inter-rater reliability of speech rate was conducted by an independent listener who received training in how to use PRAAT. This judge independently measured beginning and ending times for 25 percent of the sample. The listener randomly selected 12 samples (four from the NES group, four Spanish-language samples from the NSS group, and four English-language samples from the NSS group) and independently measured
total utterance time for all 15 utterances of each parent. Utterance lengths within 100 milliseconds were considered adequately precise for reliability. Of the 180 utterances independently re-measured by the second judge, 145 (81%) were within 100ms of the first judge’s ratings.

Inter-rater reliability for number of words and number of syllables in each utterance was conducted by an independent listener. This listener listened to the applicable utterances in the CHAT transcript and counted the number of words and syllables in each utterance. Of the 180 utterances, judges were in agreement for 170 (94%) when counting total words and 169 (94%) when counting total syllables.

Chapter 3: Results

The aim of this study was to measure speaking rate in NES and NSS parents when speaking to their children and to assess what influences, if any, parent speaking rate had on child language outcomes at 30 months. Speaking rate was calculated in WPM and SPM for a set of 15, 4+ word utterances per subject. We compared English speaking rate between the groups of NES and NSS parents. Within the NSS group, we compared speaking rates across Spanish and English. For both groups of parents we correlated various speaking rate measures with child language outcomes at 30 months.

Table 1 contains means and standard deviations for words per minute (WPM) in the 4+ word utterances for each group, as well as the average number of words per utterance and total number of words in the subset of longer utterances containing 4 or more words (hereafter referred to as ‘longer utterances subset’). Table 2 contains means
and standard deviations for syllables per minute (SPM) in the longer utterances subset for each group, as well as the average number of syllables per utterance and total number of syllables in the longer utterances subset. Table 3 contains information about the entire 20-minute play sample. It shows the means and standard deviations for the parents’ total words across the whole play session, and diversity of word types used in the 20-minute play session. These measures are for the English-language samples only. Table 4 contains the means and standard deviations for the child language outcomes on the PLS-4 (raw scores and standard scores), the CDI and the IDHC (raw scores and percentiles).

Table 1
Mean and Standard Deviations for Words per Minute, Words per Utterance, and Total Words for n=15 Subset of Longer Utterances

<table>
<thead>
<tr>
<th>Group</th>
<th>WPM</th>
<th>Words Per Utterance</th>
<th>Total Words</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>NES(^a)</td>
<td>304.97</td>
<td>40.90</td>
<td>5.54</td>
</tr>
<tr>
<td>NSS(^b); English-language Sample</td>
<td>287.23</td>
<td>45.52</td>
<td>5.47</td>
</tr>
<tr>
<td>NSS(^b); Spanish-language Sample</td>
<td>266.62</td>
<td>39.89</td>
<td>5.16</td>
</tr>
</tbody>
</table>

\(^a\)NES = Native English-speaking, n=13

\(^b\)NSS = Native Spanish-speaking, n=15

Table 2
Mean and Standard Deviations for Syllables per Minute, Syllables per Utterance, and Total Syllables for n=15 Subset of Longer Utterances

<table>
<thead>
<tr>
<th>Group</th>
<th>SPM</th>
<th>Syllables Per Utterance</th>
<th>Total Syllables</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>NES(^a)</td>
<td>366.40</td>
<td>53.87</td>
<td>6.53</td>
</tr>
<tr>
<td>NSS(^b); English-language Sample</td>
<td>325.97</td>
<td>46.40</td>
<td>6.27</td>
</tr>
<tr>
<td>NSS(^b);</td>
<td>442.17</td>
<td>74.29</td>
<td>8.63</td>
</tr>
</tbody>
</table>
Table 3
Mean and Standard Deviations for Parents’ Total Words (Tokens) and Number of Different Types of Words Used in the English-language 20-minute Play Session

<table>
<thead>
<tr>
<th>Group</th>
<th>Total Tokens</th>
<th>Types of Words</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>NES(^a)</td>
<td>2286.92</td>
<td>538.62</td>
</tr>
<tr>
<td>NSS(^b)</td>
<td>1495.47</td>
<td>467.95</td>
</tr>
</tbody>
</table>

\(^a\)NES = Native English-speaking, n=13

\(^b\)NSS = Native Spanish-speaking, n=15

Table 4
Mean and Standard Deviations for Raw and Standard Scores for Child Language Outcomes at 30 Months

<table>
<thead>
<tr>
<th>Group</th>
<th>Children of NES Parents(^a)</th>
<th>Children of NSS Parents(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLS-4(^c) Raw Score</td>
<td>Mean</td>
<td>38.09</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>4.16</td>
</tr>
<tr>
<td></td>
<td>Standard Score Mean</td>
<td>105.36</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>10.67</td>
</tr>
<tr>
<td>CDI(^d) Raw Score</td>
<td>Mean</td>
<td>363.31</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>135.05</td>
</tr>
<tr>
<td></td>
<td>Percentile Score Mean</td>
<td>20.00</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>16.33</td>
</tr>
<tr>
<td>IDHC(^e) Raw Score</td>
<td>Mean</td>
<td>151.23</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>106.85</td>
</tr>
<tr>
<td></td>
<td>Percentile Score Mean</td>
<td>7.69</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>6.84</td>
</tr>
</tbody>
</table>

\(^a\)NES = Native English-speaking: For the 13 children of NES parents, there are data available for 11 on the PLS-4, and 13 for the CDI and IDHC.
Research Question 1

During child-directed speech, does the English speaking rate of NES and NSS parents differ? (Between groups)

An independent samples t-test revealed no significant differences between English rate of speech in the NES and the NSS groups when measured in WPM ($t = 1.078$, $p = .29$).

An independent samples t-test revealed significant differences in the rate of speech of the NES and the NSS when measured in SPM. The native English speakers spoke significantly faster, when measured in SPM, than native Spanish speakers did ($t = 2.135$, $p = .04$).

Further questions. Upon finding that rate of speech differed significantly between groups when measured in SPM but not WPM, we suspected that the NES group might have used either more multisyllabic words or longer multisyllabic words than the non-native speakers. In order to evaluate this possibility, we generated a ratio of syllables to words for each utterance in every sample. Table 5 provides the mean ratio of syllables to words in each utterance for both the NES and the NSS groups in the English-language longer utterances subset.
Table 5
Mean and Standard Deviations for Parents’ Syllable to Word Ratios in the Subset of Longer Utterances

<table>
<thead>
<tr>
<th>Group</th>
<th>Syllables:Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>NES(^a)</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>1.185</td>
</tr>
<tr>
<td>NSS(^b); English-language Sample</td>
<td>1.157</td>
</tr>
</tbody>
</table>

\(^a\)NES = Native English-speaking, n=13
\(^b\)NSS = Native Spanish-speaking, n=15

A paired samples t-test revealed no significant differences between the NES group and the NSS in their ratios of syllables to words during the English-language sample (\(t = 1.309, p = .20\)). Thus, we cannot assume that the NES group used more or longer multisyllabic words in their subset of longer utterances.

**Research Question 2**

Within the NSS group during CDS, does speaking rate differ across languages?

A paired samples t-test revealed significant differences in rate of speech between English and Spanish CDS when measured in WPM (\(t = 2.216, p = .04\)). English was significantly faster than Spanish for this group of NSS when measured in WPM.

A paired samples t-test revealed significant differences in rate of speech between English and Spanish CDS when measured in SPM (\(t = -9.890, p = .000\)). Spanish was significantly faster than English for this group of NSS when measured in SPM.

**Research Question 3**

For both NES and NSS speakers, does parental speaking rate in the longer utterances subset in English (for the NES group) and English or Spanish (for the NSS group) correlate with child language outcomes at 30 months?
**Word per minute correlations.** Pearson product-moment correlations were used to examine the relationship between parent rate in WPM and child language outcomes. For the NES parents, WPM in English was not significantly correlated with children’s CDI raw score (r = .052), CDI percentile score (r = -.201), English PLS-4 raw score (r = .170), or English PLS-4 standard score (r = .187). For the NSS parents, English WPM did not correlate with children’s CDI raw score (r = .496), CDI percentile score (r = .508), English PLS-4 raw score (r = .126), or English PLS-4 standard score (r = .123). For the NSS parents, Spanish WPM did not correlate with the IDHC raw score (r = -.404), IDHC percentile score (r = .123), Spanish PLS-4 raw score (r = -.137), or Spanish PLS-4 standard score (r = -.156). For the WPM measure, there were no significant correlations between parent rate of speech in English and child outcomes on English measures for either group. Nor were there any significant correlations between Spanish rate of speech and outcomes on Spanish measures for the NSS group.

**Syllable per minute correlations.** Pearson product-moment correlations were used to examine the relationship between parental rate in SPM and child language outcomes at 30 months. As with WPM in English, English SPM in the NES group was not significantly correlated with children’s CDI raw score (r = -.318), CDI percentile score (r = -.331), English PLS-4 raw score (r = .053), or English PLS-4 standard score (r = .089).

English SPM rate in the NSS group was not significantly correlated with children’s CDI raw score (r = .405), CDI percentile score (r = .459), English PLS-4 raw score (r = -.060), or English PLS-4 standard score (r = -.049).
Spanish SPM rate in the NSS group did not correlate with the IDHC raw score (r = -.076), the IDHC percentile score (r = .222), the Spanish PLS-4 raw score (r = .028) or the Spanish PLS-4 standard score (r = .004). As with the WPM measure, for the SPM measure, there were no significant correlations between parent speech rate in English and child language outcomes in English for either group. Nor were there any significant correlations between Spanish rate of speech and outcomes on Spanish measures for the NSS group. In summary, we did not find any relationship between parent speaking rate and child language outcomes for either the NES group or the NSS group.

Figure 1 illustrates the non-significant relationship between parental speaking rate in SPM during an English-language sample and children’s raw scores on the CDI for the NES group. Figure 2 shows the relationship between parental speaking rate in SPM during the English-language sample and child outcomes on the CDI for the NSS group in the English-language sample. Although there is not a strong relationship between parental speaking rate and child language outcomes for either group, the two scatterplots, when shown together, depict the significant difference in speaking rate in SPM between the NES group (figure 1) and the NSS group (figure 2).

Figure 1

*Scatterplot of parent English speech rate (SPM) in longer utterances and child CDI scores for the NES group*
Figure 2

Scatterplot of parent English speech rate (SPM) in longer utterances and child CDI scores for the NSS group
Research Question 4

For both NES and NSS speakers, does parental volubility and lexical diversity in English correlate with child language outcomes at 30 months?

Table 6 provides the correlations between the type and token counts and children’s language outcomes on the English PLS-4 for the NES group. Table 7 provides the correlations between the type and token counts and children’s language outcomes on the English PLS-4 for the NSS group.

Table 6
Correlations Between Parents’ Total Words in the Longer Utterances Subset, Total Words (tokens) and Number of Different Types of Words Used in the English-language 20-minute Play Session and Children’s Outcomes on the PLS-4 English edition for the NES Group

<table>
<thead>
<tr>
<th>Child Outcome Measure</th>
<th>NES* Parents</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tokens in Subset</td>
<td>Tokens in Total Play</td>
</tr>
<tr>
<td>PLS-4 Raw Score</td>
<td>.340</td>
<td>-.157</td>
</tr>
<tr>
<td>PLS-4 Standard Score</td>
<td>.382</td>
<td>-.098</td>
</tr>
<tr>
<td>CDI Raw Score</td>
<td>.332</td>
<td>.026</td>
</tr>
<tr>
<td>CDI Percentile Score</td>
<td>.181</td>
<td>.093</td>
</tr>
</tbody>
</table>

aNES = Native English-speaking, n=13

Table 7
Correlations Between Parents’ Total Words in the English Longer Utterances Subset, Total Words (tokens) and Number of Different Types of Words Used in the English-language 20-minute Play Session and Children’s Outcomes on the PLS-4 English edition for the NSS Group

<table>
<thead>
<tr>
<th>Child Outcome Measure</th>
<th>NSS* Parents</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tokens in Subset</td>
<td>Tokens in Total Play</td>
</tr>
<tr>
<td>PLS-4 Raw Score</td>
<td>.596*</td>
<td>.551</td>
</tr>
<tr>
<td>PLS-4 Standard Score</td>
<td>.605*</td>
<td>.579*</td>
</tr>
<tr>
<td>CDI Raw Score</td>
<td>.643</td>
<td>.144</td>
</tr>
<tr>
<td>CDI Percentile Score</td>
<td>.663*</td>
<td>-.062</td>
</tr>
</tbody>
</table>

aNSS = Native Spanish-speaking, n=15

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)

**Volubility.** Pearson product-moment correlations were used to examine the relationship between parent volubility (total tokens in the 20-minute play session) and child language outcomes. As with SPM and WPM rate measures, overall parent volubility in the NES group did not correlate with children’s CDI raw scores \((r = .026)\), CDI percentile score \((r = .093)\), English PLS-4 raw score \((r = -.157)\) or English PLS-4 standard score \((r = .098)\). For the NSS group the pattern was slightly different. Parent volubility in the NSS group did not correlate with children’s CDI raw score \((r = .144)\), CDI percentile score \((r = -.062)\) or English PLS-4 raw score \((r = .551)\), but was significantly correlated with standard scores on the PLS-4 \((r = .579*)\). Figure 3 shows the relationship between parent volubility in the 20-minute English-language sample and child PLS-4 standard scores (English version) in the NSS group.

Figure 3

*Parents’ volubility in a 20-minute English-language sample and children’s PLS-4 standard scores in the NSS group*
Pearson product-moment correlations were used to examine the relationship between volubility within the longer utterances subset (rather than the entire play session) and child language outcomes. In the NES group, total words spoken in these longer utterances did not correlate with the children’s CDI raw score \( (r = .332) \), percentile score \( (r = .181) \), English PLS-4 raw score \( (r = .340) \), or English PLS-4 standard score \( (r = .327) \). In the NSS group, the number of total words spoken in these longer utterances was moderately correlated with the children’s CDI raw score \( (r = .643^*) \), CDI percentile score \( (r = .663^*) \), English PLS-4 raw score \( (r = .596^*) \), and English PLS-4 standard score \( (r = .605^*) \).

After examining the correlations within each group, we decided to look at any differences in volubility between the two groups. A paired samples t-test revealed significant differences between the NES group and the NSS group in their volubility \( (t = 4.162, p = .00) \). The NES group used more total words than the NSS group.
**Lexical Diversity.** Pearson product-moment correlations were used to examine the relationship between diversity of parent word types across the 20-minute sample and child language outcomes. Lexical diversity was calculated by counting the number of different words each parent used. Lexical diversity in the NES group did not correlate with children’s CDI raw score (r = .308), CDI percentile score (r = .308), English PLS-4 raw score (r = .427), or English PLS-4 standard score (r = .386). Lexical diversity in the NSS group did not correlate with children’s CDI raw score (r = .480) or CDI percentile score (r = .233), but did correlate with both the English PLS-4 raw score (r = .800**) and the English PLS-4 standard score (r = .827**).

Figure 4 shows the non-significant relationship between parent lexical diversity in the 20-minute English-language sample and child PLS-4 (English version) scores in the NES group. Figure 5 depicts the moderate correlation between lexical diversity in the 20-minute English-language sample and child PLS-4 (English version) scores in the NSS group.

Figure 4

*Parents’ lexical diversity in a 20-minute English-language sample and children’s raw scores on the PLS-4, English version in the NES group*
Figure 5

Parents’ lexical diversity in a 20-minute English-language sample and children’s raw scores on the PLS-4, English version in the NSS group
After examining the correlations within each group, we looked at any differences in lexical diversity between the two groups. A paired samples t-test revealed significant differences between the NES group and the NSS group in their lexical diversity ($t = 4.588, p = .00$). The NES group used more different types of words than the NSS group.

**Research Question 5**

For the NSS speakers, do self-ratings of oral language proficiency correlate to speaking rate or child language outcomes at 30 months in English?

**Speaking rate.** Pearson product-moment correlations were used to examine the relationship between parent English oral language proficiency and speaking rate for the NSS group. English oral language proficiency did not correlate with parent speaking rate in WPM ($r = .478$) or SPM ($r = .431$). In this sample of NSS parents, self-ratings of English oral language proficiency did not correlate significantly with the parents’ speaking rate.

**Child outcomes.** Pearson product-moment correlations were used to examine the relationship between parental English oral language proficiency and child language outcomes at 30 months in English for the NSS group. Parental English oral language proficiency did not correlate with children’s CDI raw score ($r = .333$), CDI percentile score ($r = -.198$), English PLS-4 raw score ($r = .213$), or English on the PLS-4 standard score ($r = .225$). In this sample of NSS parents, self-ratings of English oral language proficiency did not correlate with the English language outcomes of their children.

**Chapter 4: Discussion**

**Between Group Comparisons & Correlations**
**CDS speech rate in English for NES and NSS.** The rate of speech in English of native English speakers and native Spanish speakers was not significantly different when measured in WPM. When measured in SPM, however, a different picture emerged; the NES group spoke English at a significantly faster rate than the NSS group did. In trying to decipher this discrepancy, we considered a possible explanation for these results. We thought, perhaps, that the NES group used either more multisyllabic words or longer multisyllabic words than the non-native speakers. In order to evaluate this possibility, we generated a ratio of syllables to words for each utterance in every sample. We found no significant difference between the two groups in their ratios of syllables to words, suggesting that this was not the cause of the discrepancy. It is unclear why we have this finding; it is possible this difference is related to the statistical power of our sample and that we may not have had enough power to see small differences between groups in WPM, even though a difference may have existed. This can be explored further in future studies by adding additional participants.

The difference between the findings in WPM and SPM emphasizes the importance of carefully selecting an appropriate measure for examining rate of speech. Each measure produces different results, so depending on the goal of a study, it may be critical to examine rate using multiple tools of measurement. The finding that rate does not differ when measured in WPM supports Hilton’s 2008 study in which a group of fluent English, French, and Italian L2 speakers produced speech with temporal characteristics highly similar to native speakers when measured in WPM. Since, however, there does appear to be a difference in our study when measuring rate in
syllables, we suggest that SPM is a more sensitive measure of rate and that it is worth considering using this measure in future studies of speaking rate.

Another noteworthy finding is that the speaking rate of the parents from both groups was, on average, faster than the published norms for monolingual English adult-directed speech of 115-165 WPM (Andrews & Ingham, 1971). This finding is surprising in light of previous reports of monolingual English CDS, which suggests that CDS is slower than ADS (Green et al., 2010). It was also unexpected given a study of monolingual families by Hoff-Ginsberg (1991) indicating that the rate of speech in CDS during toy play is slower than in other settings, such as book reading or dressing. The Hoff-Ginsberg study did not use either WPM or SPM; Hoff-Ginsberg divided the total number of utterances by the total time during the mother-child interaction in order to calculate rate.

Other studies have also found slower rates of speech than we did, both in research on L2 speakers and in research on CDS. Munro & Derwing (2001) examined native and non-native speech and found mean speaking rates of 273 SPM and 211.2 SPM, respectively during a reading task. Green et al. (2010) compared ADS and IDS and found mean speech rates of 122.52 WPM and 107.11 WPM during book-reading. Meyers and Freeman (1985) looked at maternal speech during a play-activity in relation to childhood stuttering and found mean speech rates of 328.8 SPM for mothers with children who stutter and 297.6 SPM for mothers of children who do not stutter.

It is possible that the rate of speech seen in this study is faster than the norms because of the average length of utterance used for analysis. The speech rate norms for ADS are based on a study by Johnson (1961), in which the participants spoke in
monologues for 3-minutes at a time. The utterances that were used for analysis in our study were far shorter, ranging from 4 words to 15 and lasting up to a few seconds each.

Another explanation for our findings might be due to the nature of the task that the parents and children were engaged in, and that toy play did not require much new, novel information to be communicated between participants. For example, several of the utterances used in analysis were repetitions of previous utterances, such as, “Where is the spoon?” followed by another question, “Where is the spoon?” It may be the case that parents produced these repetitive statements and questions faster than they would have if each utterance were unique. Additionally, the nature of the toys used may have led to labeling behaviors in the parents’ speech (e.g., “What is this here? This is a fork.”).

There are several characteristics of our study that may have contributed to the fast rate of speech we found in these parents, including the type of communication setting, the nature of the toys used, and the utterances selected for analysis. It is important, however, to note that we found a rate of speech that was faster than indicated in the majority of available literature regardless of the type of communication setting.

**Rate and language outcomes.** Based on studies suggesting that infants attend more to words spoken at a slower rate of speech (Cooper, 2001; Cooper et al., 1998), we predicted that there would be an inverse relationship between parent rate of speech and child vocabulary and language outcomes for both groups. This does not appear to be the case in our study, as the children’s outcomes on the CDI and PLS-4 were not correlated to the parents’ rate of speech in English in either group at 30 months.

An interesting point to consider pertaining to the NSS parents is that Hilton’s 2008 study found that L2 speakers who have higher levels of fluency and larger
vocabularies, speak at a faster rate than less proficient L2 speakers. Since the native Spanish speakers in this study were highly proficient in English (based on self-reports), one might actually predict the opposite outcome of our hypothesis, namely that parent rate of speech would be positively correlated to vocabulary and language outcomes. If parents who speak fast are parents with higher English proficiencies, then perhaps they will expose their children to a larger English vocabulary. We did not find evidence of this in our current study since there was no correlation in either direction between rate of speech and vocabulary outcomes. More research is needed that includes parents with a broad range of L2 proficiencies.

Self-rated oral English proficiency levels in the NSS group were not found to correlate with any of the speaking rate measures (or with any of the child language outcomes). The parents in this study, however, were from a similar proficiency level based on the given scale. This scale may have been problematic in that there were only 3 levels, and therefore not sensitive enough to detect small but potentially important differences in proficiency. A scale with a larger range might help to combat this problem, as well as a proficiency rating from an independent examiner. In addition, future studies might examine speech rate in the context of proficiency and examine child outcomes from a group with a range of L2 proficiencies. Additionally, future studies could examine rates of disfluency, as related to proficiency and speech rate, and their relationship with child outcomes, since Hilton’s 2008 study also found higher rates of disfluency in less proficient L2 speakers. For the time being, it is not evident what, if any, impact there is of parental speech rate on child vocabulary outcomes, but it does
appear that a fast speaking rate in L2 is not detrimental to child language outcomes at 30 months.

Although we don’t know the precise reasons why we did not find a relationship between parent rate of speech and child language outcomes, our findings can be used as evidence to suggest that parents need not modify their rate of speech when speaking to their children. Because intentional modifications of speech rate can result in consequences in other linguistic domains, such as decreased syntactic complexity (Bernstein Ratner, 1992), without clear evidence to suggest that fast rate is detrimental to child language learning, we suggest that clinicians refrain from suggesting that dual-language parents slow their speaking rate when speaking to their children.

**Vocabulary input and language outcomes.** In addition to rate, we examined the amount and diversity of parent speech and correlated it to children’s language outcomes. A study by Huttenlocher et al. (1991) demonstrated a positive link between the amount caregivers speak to children and children’s acquisition of vocabulary. Several other studies, however, note that diversity and sophistication of caregiver input is more closely related to child outcomes than quantity (Hoff, 2003; Rowe, 2012; Weizman & Snow, 2001). We predicted that our data would follow these trends and that tokens and types would correlate to vocabulary and language outcomes in both groups.

We found that in the children of the NES group, neither English word types nor tokens correlated to children’s language outcomes. This was unexpected given the research mentioned above. For the children of the NSS group, English tokens from both the longer utterances subset and the total play session correlated moderately with scores on the PLS-4, English version. In addition, there was a strong correlation between total
word types used and language outcomes on the PLS-4. The correlations with the PLS-4 are what we expected given research on the links between quantity and diversity of input and child language outcomes (Hoff, 2003; Huttenlocher et al., 1991; Rowe, 2012; Weizman & Snow, 2001). It is unclear why the link for these variables was more prominent for the NSS group. It is possible however that the nature of the play task elicited highly repetitive input and so our sample showed less diversity than is typically present for the NES parents. Future studies might consider other types of communication settings.

**Between group conclusions.** From our initial t-test, we know that there is a difference in English between the NES and the NSS groups in their rate of speech and that the native-Spanish speakers speak more slowly when measured in SPM. When we look at the outcomes for children in the two groups, however, the differences in rate do not appear to be correlated with any measures of language or vocabulary. For the native-Spanish group, it is the amount the parents speak, but more importantly the diversity of words types they use in English that is connected to the children’s language abilities. As for the NES group, in this study, there were no clear links between any of the input measures and the child outcomes. Past studies, however, have highlighted the relationship between lexical diversity in parent input and children’s vocabulary growth (Hoff, 2003; Rowe, 2012; Weizman & Snow, 2001).

**Within Group Comparisons & Correlations**

**Rate of speech across languages.** The rate of speech of the NSS group in English and Spanish CDS was significantly different when measured both in WPM and in SPM.
The rate of speech was faster in English when measured in WPM. It was faster in Spanish when measured in SPM.

This difference in findings based on measurement type reinforces the notion that cross-linguistic studies must account for differences in language structures. The parents used more multisyllabic words in Spanish than in English. This may have to do with language proficiency, but more likely it is a result of the fact that Spanish speakers may affix morphemes more readily than in English. For instance, a Spanish speaker may say “Traemela” thus designating the subject, object, and verb using only one word (but multiple syllables). In English, this same sentiment would be expressed using the four words “Bring it to me,” but each word would contain one syllable. Additionally, the Spanish language contains more multisyllabic words than English (Vitevitch & Rodriguez, 2005). So, when parents used multisyllabic words such as “plato,” “frutas,” and “mira” in Spanish, they only used monosyllabic equivalents in English (“plate,” “fruit,” and “look”).

Additionally, the rhythm of the two languages differs. Spanish is a syllable-timed language, meaning that each syllable is given equal emphasis (Major, 2001). This is unlike English, which is considered a stress-timed language. In English, there are stressed and unstressed syllables and speakers allot equal intervals of time between each major stressed group whether each group contains one syllable or many (Major, 2001). In the case of the parents in this study, they used mostly monosyllabic words in English but many multisyllabic words in Spanish. Because of differences in rhythm across languages, parents may produce monosyllabic English words at the same speed as multi-
syllabic Spanish words, thus creating a disparity in their rate of speech when measured in syllables versus words per minute.

**Rate and language outcomes.** No correlations were found between parent rate of speech in English and language outcomes for the children on the CDI or the English version of the PLS-4. Likewise, no correlations were found between parent rate of speech in Spanish and language outcomes on the IDHC or the Spanish version of the PLS-4. As mentioned previously, these results are not what we had expected given a study indicating that young children attend more to utterances spoken at a slower rate (Cooper, 2001; Cooper et al., 1998). This prior study, however, was conducted with very young infants. It is possible that the distinction between slow and fast rates of speech is more salient to younger infants than to 30-month olds, as was found in the study of Panneton et al. (2006) who compared 18 and 32-week old infants. Future studies should examine the impact of parental rate of speech longitudinally across child development.

**Within group conclusions.** Differing language structures make it complicated to compare rate of speech across languages. Although the parents spoke faster in English when measured in WPM, they spoke faster in Spanish when measured in SPM. Despite the difficulties of rate comparison across two languages, we found that parent speech rate is not highly correlated with child language outcomes. Likely, other characteristics of CDS, such as lexical diversity, are more important in child outcomes. Additionally, there may be other CDS characteristics, specifically related to L2 speech that influence outcomes, such as vowel and consonant accuracy. This is the topic of a current project, which is using the same participants and language samples as this thesis.
Limitations of the Current Study

There are a few factors that act as potential threats to the internal validity of this study. The first concerns the language mode of the bilingual parents during the play activities. In his writing about bilingual methodology, Grosjean (2008) discusses the idea of language mode. He notes that, when speaking, a bilingual person establishes a base language for the conversation and will then activate the second language to varying degrees based on factors such as the language of the conversation partner, the formality of the situation, and so on. Grosjean emphasizes the importance of monitoring both the base language and the level of activation of the other language during any studies of bilingual speakers. He notes that one of the few ways to ensure decreased activation of the second language is to use a monolingual conversation partner. Our current study specified a base language for each play session when parents were instructed to speak either entirely in Spanish or entirely in English. We were unable, however, to control the level of activation of the “unused” language as the conversation partners (the children) were all bilingual. It is evident in transcripts of the play sessions that activation is not entirely controlled for, as the parents can be heard responding to children’s utterances and using words in the unassigned language. Despite the difficulty in controlling language activation, it is possible that our findings on rate were not significantly impacted by this variable. We attempted to control for this difficulty by excluding from analysis any utterances that contained words from the non-target language. Additionally, to the extent that our findings may have been impacted, perhaps it provides us a more ecologically valid reflection of the input that the children are exposed to, representative of any code-switching that occurs during daily parent-child interactions. So, although, we could not
monitor language mode in the manner that has been recommended in bilingual literature by Grosjean (2008), we suspect this did not interfere greatly with our findings.

In addition to language mode, there are conceivable problems with our selection of utterances for analysis. Our analysis included utterances of four or more words. We eliminated shorter utterances in order to reduce the number of directive statements included in analysis. Children, however, may be impacted by everything they hear, including shorter utterances. For this reason, it is important to account for all the input they hear during a given activity, and our choice of utterances to analyze for rate may have artificially truncated the input to these children. We included the whole 20-minute sample when looking at types and tokens in order to address this issue. It was not possible, however, due to time limitations for us to include all utterances in our rate analysis. Other studies may consider using entire samples or sampling shorter utterances only, as a way to provide a more complete picture of parent speaking rate.

Other factors impact the external validity of the study, preventing us from applying our findings to larger populations of bilingual parents. First, the group of bilingual native-Spanish speaking parents used in this study was relatively homogenous in that very few of them arrived in the United States during early childhood. As well, they all had similar levels of self-rated English proficiency (although the proficiency scale contained a small range of options). In order to generalize our findings to a larger group, we would need to include in our sample speakers from different backgrounds, monolingual Spanish speakers, speakers of more varied L2 proficiencies, and even speakers of different languages. Secondly, the children in this sample were all 30-months of age. Several studies have demonstrated that parent input changes as children age.
(Huttenlocher et al., 2007; Phillips, 1973; Snow, 1972). In order to see the effects of varied input to child vocabulary outcomes, we would need to examine child outcomes longitudinally.

**Larger Implications & Future Research**

Our current study represents an early stage in the process of learning about the characteristics of L2 CDS. We examined CDS in L2 English-speakers as compared to L1 English-speakers and found that speech rate looks somewhat similar when measured at the word-level. Rate differences exist when rate is measured at the syllable level, indicating that L2 speakers use a slower rate of speech. We believe this indicates that syllable-level measurements of rate are more sensitive than word-level measurements and should be used when possible. We also looked at relationships between parent rate of speech and child language outcomes and did not find correlations in either direction for either language. We did, however, find relationships between amount of parent input, lexical diversity, and child language outcomes in the native Spanish-speakers. This relationship was not apparent for the native English-speakers.

Additionally, we examined the rate of speech across languages in the same group of L2-English speakers. We found conflicting results (Spanish was faster in SPM and English was faster in WPM) due to structural differences in the languages. No correlations existed between the rate of speech and child language outcomes in either language.

While speaking rate was not significantly correlated to outcomes for children in this study, it is important to keep in mind that certain characteristics of CDS may carry
more importance at either earlier or later stages in development. The data used for this thesis constitute one part of a larger longitudinal study. Transcripts of play activities will continue to be collected at 6-month intervals for the next few years. Upcoming projects will expand upon our current study, continuing to quantify rate in different ways, including other measures of volubility and articulation rate. Additionally, the next set of projects may look at CDS speech rate in other settings, such as book reading. Lastly, the longitudinal data will allow for a more complete look at the relationship between speaking rate and child vocabulary outcomes, as we can examine changes over time.

Future studies of children at different ages may or may not find a link between parent speaking rate and child language outcomes. Regardless, we know that speaking rate is only one small piece of a much larger framework that relates to child language learning.
References


Cooper, J. (2001). *Infant attention to rate of infant-directed speech in the context of*
varying levels of visual stimulation. (Doctoral dissertation). Retrieved from ProQuest. (3203693).


Magloire, J., & Green, K.P. (1999). A cross-language comparison of speaking rate effects


Ferguson (Eds.), *Talking to children: Language input and acquisition* (pp. 109-149). Cambridge: Cambridge UP.


