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Properties of Dual Language Exposure that Influence Two-Year-Olds' Bilingual Proficiency

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Abstract

The mothers of 29 Spanish-English bilingual 25-month-olds kept diary records of their children's dual language exposure and provided information on their children's English and Spanish language development using the MacArthur-Bates inventories. Relative amount of exposure predicted language outcomes in English and Spanish. In addition, the number of different speakers from whom the children heard English and the percent of their English input that was provided by native speakers were unique sources of variance in children's English skills. These properties of children's dual language exposure and their bilingual proficiency varied as a function of whether the children's mother, father, or both parents were native Spanish speakers. Practical and theoretical implications are discussed.

Keywords

bilingual development; bilingual first language acquisition; dual language exposure; input effects

An estimated half of the world's children grow up exposed to two or more languages, because they live in bilingual homes and/or bilingual communities (Grosjean, 2010). In the U.S., where immigration is the primary source of bilingualism, an estimated one fourth of children come from an immigrant family (Hernandez, Denton, & Macartney, 2008). Despite this prevalence of dual language environments, the course of language development in children exposed to two languages is less studied than the course of language development in monolingual environments, and, as a result, it is not well understood (McCardle & Hoff, 2006).

Bilingual development is difficult to study in part because of the heterogeneity of bilingual populations (Genesee, 2006; Hammer, 2009). Simply characterizing the environments in which bilingual children acquire their languages is a formidable challenge because the parameters on which experience in two languages can vary are more numerous than the parameters of variation in monolingual experience. Researchers in the field often comment that every bilingual child seems to have a unique constellation of language experiences and language abilities. The goal of the research reported here is to begin to tackle this variability,

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identifying patterns of variability in bilingual experience and properties of that variability that are associated with individual differences in bilingual development.

Variability in Bilingual Experience

For some children in dual language environments, the amount of exposure to each language is fairly balanced; other children hear much more of one language than the other (De Houwer, 2009). For some children, the two languages they hear are quite separated in their experience; other children frequently experience both languages within the same conversation (Pearson, 2008). Some, but not all children exposed to two languages may hear one or both of their languages from a restricted number of different people, and children in bilingual environments may hear their languages from both native and nonnative speakers to varying degrees (Fernald, 2006).

Previous research has identified the language background of parents as one factor that creates variance in how much of the heritage language children hear and in the likelihood that the children will acquire that language. When both parents are speakers of the heritage language, it is used more in the home (Alba, Logan, Lutz, & Stults, 2002) and is more likely to be acquired by the children than when only one parent speaks the heritage language (De Houwer, 2007). There are other possible influences of parents' native languages that have not been studied: Parents' native languages might influence (a) how much of the heritage and community language children hear from others outside the home, via their parents' social networks (Lanza & Svendsen, 2007); (b) how much of the community language children hear from nonnative speakers, and (c) how much the heritage and community language co-occur in daily experience. One goal of the present study was to describe differences in the bilingual experiences of children as a function of their parents' native languages.

Properties of Bilingual Experience that May Influence Bilingual Development

A second goal of the present study was to examine the effects of these sources of variability in children's dual language exposure on their bilingual development. Previous research has established that the relative amount of exposure in each language is a strong predictor of children's rates of development in those languages (De Houwer, 2009; Gathercole & Thomas, 2009; Hoff et al., 2010; Oller & Eilers, 2002; Pearson, Fernández, Lewedeg, & Oller, 1997; Scheele, Leseman, & Mayo, 2010). Apart from the finding that the frequency of book reading in English has effects over and above the amount of English exposure (Patterson, 2002), little research has examined the relation of specific properties of children's dual language exposure to their bilingual development.

The literature does suggest hypotheses regarding the influence of some properties of dual language exposure on bilingual development. There are arguments from sociolinguistic theory that bilingual development depends on the functional significance of each language for the child learner and that heritage language maintenance requires the language to have a separate function and its own context of use (Fishman, Cooper, & Ma, 1971). There is

evidence from experimental psychology that hearing a language from multiple speakers benefits both word recognition and word production (Richtsmeier, Gerken, Goffman, & Hogan, 2009; Singh, 2008). This should not be surprising because children need to be able to recognize words despite the variations in articulation that occur from speaker to speaker, and thus children need to have experience on which to base mental representations of words that accommodate this variability (Fisher, Church, & Chambers, 2004; Singh, 2008).

It is entirely unknown whether input from nonnative speakers has an effect on language development. It is possible that the phonological properties of nonnative speech – either alone or in combination with native speech – provide children with a less consistent signal from which to extract language-specific phonological categories and stress patterns, which support further language development (e.g., Liu, Kuhl, & Tso, 2003; Thiessen & Saffran, 2003). It is also possible that when adults talk to children in a language that is not their native language, the lexical, morphosyntactic, and pragmatic properties of child-directed speech that support language acquisition are affected. To our knowledge, no studies have asked the question of whether exposure to nonnative speech is related to language development. Last, intermingling of the two languages to be learned has been suggested to be a potential source of confusion to children, leading some to advocate a one-parent, one-language approach. There is evidence from older children that this approach is neither necessary nor sufficient to ensure bilingual development (De Houwer, 2007), but there is also some evidence that the degree of language mixing in input is negatively related to early vocabulary development (Byers-Heinlein, 2009).

In sum, there is agreement in the field that bilingual environments are enormously heterogeneous and that the consequences of that heterogeneity have not been well explored. One reason previous work has not more fully examined the influence of many properties of bilingual environments is that the method used to measure properties of bilingual environments has been retrospective caregiver report, which limits the level of detail that can be obtained in descriptions of children's dual language experience.

Aims and Method of the Present Study

In this study we make use of the Language Diary method developed by De Houwer and Bornstein (2003), in which caregivers keep a log of the children's language exposure over the course of seven days, providing a more detailed description of children's bilingual experience than can retrospective caregiver report. From these detailed records we calculated measures of the children's bilingual experience that have been suggested as influences on bilingual development. The children's relative exposure to English and Spanish was measured as the percent of 30-minute periods in which the child heard only English or only Spanish. The children's exposure to co-occurring English and Spanish input was measured as the percent of blocks in which both languages were addressed to the child. The degree to which each language served a separate function was measured as the number of contexts (e.g., mealtime, bedtime) that occurred only in that language over the course of 7 days and the number of speakers (e.g., mother, grandmother) who addressed the child in only one language over the course of 7 days. We also counted for each child, the number of different speakers who addressed the child in each language and the percent of input in each

language that was provided by native speakers of that language. Using these measures we describe the nature of the children's dual language exposure, the influence of parents' language backgrounds on those properties of dual language exposure, and the consequences of these differing experiences for children's acquisition of two languages.

Method

Participants

The participants were 29 twenty-five-month-old children (Mean age = 25.66 months, *SD* = . 44, 12 boys and 17 girls) living in South Florida. All children were born in the U.S. and had been exposed to English and Spanish from birth. The sample for the current study was obtained from a larger study of bilingual development. Participants for that study were recruited through advertisements in newspapers and magazines aimed at parents, through preschools, childcare facilities, libraries, and online throughout the university community. The requirement was that the children had been exposed to both English and Spanish since birth and that the less-frequently heard language constituted at least 10% of their language exposure. This exposure criterion is consistent with previous studies (Marchman, Fernald & Hurtado, 2010; Marchman, Martínez-Sussmann & Dale, 2004) and allows capturing the full range of variability in bilingual experience that exists in this population. All the children were producing words in both languages at 22 months.

Forty families were contacted for the present study; one family refused to participate and six agreed to participate but did not return the data. Of the children whose families kept diary records, two were excluded from analysis because their caregivers did not fill out the instrument properly, and two were excluded because the children were receiving speech and language therapy at 30 months of age. All children had been screened for hearing and developmental problems. Caregivers were compensated for their participation in the larger study.

All children in the present sample lived in two-parent households. Eighty-three percent of mothers and 66% of fathers had a college or advanced degree; all parents had the equivalent of at least a high school degree. Of the 34 native Spanish-speaking parents (17 mothers and 17 fathers) 30 were born in South American or Caribbean Spanish-speaking countries; four were born in the U.S. but described themselves as native Spanish speakers and not as native bilinguals. Most of the immigrant parents arrived in the U.S. as adults; four fathers and three mothers emigrated before the age of 14. The mean age of arrival in the U.S. for the immigrant parents was 22.25 years (*SD* = 8.95) for mothers and 20.82 years (*SD* = 8.43) for fathers. Nineteen of the children in the study were first born or only children; 10 had one or more older siblings.

Families were classified into six constellations according to their combination of parental native language. The frequency of each family constellation and the mean years of education for parents in each category are presented in Table 1. There was no difference among the three most frequently-occurring family constellations in parents' mean years of education. In two of the households with a native Spanish-speaking mother and two of the households

with two native Spanish-speaking parents there was also another resident adult who was a native Spanish speaker.

Procedure and Instruments

The data for the present study were collected when the children were 25 months old; all children and families had previously been seen when the children were 22 months old, and they were seen again at 30 months as part of the larger study. At the 25-month visit, the primary caregiver (in all cases here, the mother) provided information about the home language environment in an interview with a fully bilingual researcher. Three instruments were left with the mother to complete and return by mail: A self-report measure of the parents' English and Spanish language proficiency, the MacArthur-Bates inventories to assess the children's English and Spanish language development, and the Language Diary. The language inventories were completed within one week of the 25-month visit. The Language Diaries were completed over the course of seven weeks.

The measure of adult language proficiency was completed by both parents. They indicated their English and Spanish oral language proficiency using a 3-point scale in which 0 indicated that the respondent cannot speak the language, 1 indicated limited proficiency, and 2 indicated good expressive and comprehension abilities (Restrepo, 1998). The parents' responses indicated that the native English-speaking parents were almost all monolingual English speakers, while two-thirds of the native Spanish-speaking parents had good English skills – according to their self report. One native English-speaking mother (out of 7) and 1 native English-speaking father (out of 8) described their Spanish language skills as good; 11 out of 17 native Spanish-speaking mothers and 13 out of 17 native Spanish-speaking fathers described their English skills as good.

The MacArthur-Bates inventories are caregiver-report instruments, with parallel forms for English (the *MacArthur-Bates Communicative Development Inventory* [CDI], Fenson et al., 2003) and Spanish (*Inventario del Desarrollo de Habilidades Comunicativas* [IDHC], Jackson-Maldonado et al., 2003), which have established reliability and validity for monolingual and bilingual populations (Fenson et al., 2003; Jackson-Maldonado et al., 2003, Marchman & Martínez-Sussman, 2002). Two measures from these instruments were employed in the present study: (1) raw vocabulary scores based on words the child was heard to produce, and (2) grammatical complexity scores based on 37 items in which a pair of utterances is presented, one grammatically more advanced than the other, and the caregiver indicates which sounds more like the child's speech. When possible, English and Spanish native speakers completed the English and the Spanish versions, respectively; otherwise, a caregiver who was a proficient Spanish-English bilingual completed both inventories.

The Language Diary was developed by De Houwer and Bornstein (2003) for the study of Dutch-French bilingual children in Belgium. The instructions were translated into English for this project by De Houwer, and the English instructions were translated into Spanish by Spanish-English bilingual researchers who were native speakers of Spanish. All instructions on the diary were printed in English and in Spanish. The Language Diary consisted of seven pages, each with five columns. The first column listed the time of the day in 30-minute

blocks. The next four columns were designed for parents to write the person or persons who interacted with the child, the language used during the time period, the activity, and comments. An example of activity was provided for reference (e.g., breakfast, play). At the top of the page, a space was provided for the date and day of the week. Once diary recording started, it was repeated at 8-day intervals for seven weeks. This procedure was chosen to allow the recording of the child's typical routine across the seven days of the week without overburdening the diary-keeper. On the day before each scheduled date for diary recording, the caregiver received a reminder call, e-mail, or text message. In cases in which the child had a change in his or her typical routine, such as going on a trip or parent being unable to keep diary recording at a certain day of the week, the caregiver was allowed to resume recording in the following week at the corresponding day. On average, caregivers completed the diary in 7.12 weeks (*SD* = .055).

From the language diary records, each 30-minute period was categorized with respect to the language addressed to the child, the person talking to the child, and the context in which talk occurred. Language was classified as English-only for every 30-minute period in which only English was spoken to the child, Spanish-only for every 30-minute period in which only Spanish was spoken to the child, or both English and Spanish for every 30-minute period in which the child was addressed in both languages.

The 12 categories of conversational context and 11 categories of conversational partner are listed in Tables 2 and 3 with mean number of hours per day children spent in each. In case of multiple activities assigned to a single time block, the context was categorized based on the salience of the competing activities. Activities executed in the foreground were considered more important than activities in the background. For example, the activity of a child eating lunch while the TV is on was categorized as “meal,” but a child watching TV while eating a snack was categorized as “media.” When multiple conversational partners were present, information from the activity description (e.g. playing with siblings) was used to assign the block to conversational partner category. In cases of no other information, conversational partners were assigned in the order listed in Table 3. Two coders separately coded 29 of the 31 diaries collected. (Recall, two were excluded from the present analyses because the children were later brought by their parents for speech-language services.) Agreement between coders was high: for conversational partner, Kappa = .96, and for conversational context, Kappa = .91.

Using information on the native languages of household members that had been provided in the Home Language Environment interview, each child's English-only and Spanish-only blocks were categorized in terms of whether the source of input was a native speaker of the language being used, a nonnative speaker, or both – if both native and nonnative speakers were addressing the child in the same time period. Native bilinguals were categorized as native speakers of both languages. On average, 9% (*SD* = 14) percent of English-only blocks and 4% (*SD* = 10) of Spanish-only blocks were categorized as both; 30% (*SD* = 33) of English-only blocks and 5% (*SD* = 9) of Spanish-only blocks were categorized as unknown because information on the native language of the speaker indicated in diary record (e.g., a child care provider) was not available at the time of coding. For two children there were no 30-minute blocks in which the child heard only English, and for three children there were no

30-minute blocks in which the child heard only Spanish. Thus, there were no data for these children on the percent of input from native speakers.

Results

Quantity and Properties of Dual Language Exposure

Table 4 describes the dual language exposure of the full sample, with the results of paired *t*-tests comparing properties of the children's English and Spanish language experience. The percent of language exposure in English-only and Spanish-only blocks did not differ. There was also no difference between English and Spanish in the number of single-language contexts or conversational partners the children experienced. The mean levels of both were low; the majority of the children experienced no contexts in which one language was used exclusively or one conversational partner who spoke exclusively in one language. There was no difference in the number of different speakers from whom the children heard English and Spanish. There was a difference in the proportion of English and Spanish exposure provided by native speakers; significantly more of the children's English input came from nonnative speakers than did their Spanish input.

Effects of Family Constellation on the Quantity and Properties of Dual Language Exposure

We next compared these properties of the children's dual language exposure in families with different constellations of parental native languages. We compared the three most frequent family constellations only: a native English-speaking mother and Spanish-speaking father, a native Spanish-speaking mother and English-speaking father, and two native Spanish-speaking parents. The mean percent of waking hours accounted for by English-only, Spanish-only, and both English and Spanish 30-minute blocks for each family constellation are presented in Figure 1. For each analysis of variance (ANOVA), we calculated and reported eta squared rather than the partial eta squared generated by SPSS, following Levine & Hullet's (2002) recommendations. Three separate one-way ANOVAs with the percent of language exposure that was English-only, Spanish-only, and both English and Spanish as outcome variables revealed a marginally significant effect of family constellation on the percent of language exposure that was English-only ($F(2,21) = 3.26$, $p = .058$, $\eta^2 = .24$), a significant effect of family constellation on the percent of language exposure that was Spanish-only ($F(2,21) = 6.34$, $p = .007$, $\eta^2 = .38$), and no effect of family constellation on the percent of language exposure in which both Spanish and English were addressed to the child within the same 30-minute period. Bonferroni corrected post hoc tests revealed that children with a native English-speaking mother heard more English-only input than children with two native Spanish-speaking parents ($t(14) = 2.84$, $p = .013$, two-tailed), and the children with two native Spanish-speaking parents heard more Spanish-only input than the children with a native English-speaking mother ($t(14) = 3.53$, $p = .003$, two-tailed).

The mean number of exclusively English or Spanish conversational contexts for children in each of these family constellations is presented in Figure 2. A two-way 2 (Language, exclusively English or exclusively Spanish) x 3 (Family Constellation) ANOVA revealed no main effects on the experience of single-language conversational contexts, but there was a significant Family Constellation x Language interaction ($F(2,21) = 7.67$, $p = .003$, $\eta^2 = .42$).

Bonferroni corrected post hoc tests showed that only the children with two native Spanish-speaking parents experienced more exclusively Spanish contexts than exclusively English contexts ($t(8) = -4.00$, $p = .004$, two-tailed). There were no significant effects in the analysis of children's experience of exclusively English or exclusively Spanish conversational partners or the number of different sources of English and Spanish.

The mean percent of the children's English and Spanish exposure provided by native speakers is presented for each family constellation in Figure 3. A two-way ANOVA revealed a significant effect of Language ($F(1,18) = 31.46$, $p < .001$, $\eta^2 = .43$), repeating the finding from the full sample that, on average, more of the children's English input came from nonnative speakers than did their Spanish input. There was also a Family Constellation x Language interaction ($F(2,18) = 11.52$, $p = .001$, $\eta^2 = .32$). Bonferroni corrected analyses revealed that the difference between English and Spanish in the percent of exposure provided by native speakers was significant only for those families with a native Spanish-speaking mothers and English-speaking fathers ($t(6) = -4.67$, $p = .003$, two-tailed) or with two Spanish-speaking parents ($t(6) = -10.61$, $p < .001$, two-tailed).

Consequences of the Quantity and Properties of Children's Dual Language Exposure for their Bilingual Development

Having described properties of children's dual language exposure and their relation to the native languages of the children's parents, we next investigated the relation of these properties of dual language exposure to the children's bilingual development. The intercorrelations among the hypothesized predictors are presented in Table 5. The children who heard more English also experienced more English-only contexts and partners, and heard English from a greater number of speakers. The percent of English exposure from native speakers was unrelated to any other measure of English exposure. The pattern of interrelations among measures of Spanish exposure was similar, although the correlation between number of Spanish-only conversational partners and amount of Spanish exposure did not reach significance, nor did the correlation between the number of Spanish-only conversational contexts experienced and the number of different sources of Spanish. There was, in addition, a significant negative correlation indicating that children who heard Spanish from more different sources also heard more nonnative Spanish.

Descriptive data on the children's English and Spanish development indicated that there was variance to explain, although there was also the suggestion of floor effects in the measures of grammatical complexity. English raw vocabulary scores ranged from 23 to 658 ($M = 226.48$, $SD = 166.14$); English grammatical complexity scores ranged from 0 to 34 (out of a possible 37) ($M = 7.55$, $SD = 10.11$). Spanish raw vocabulary scores ranged from 17 to 365 ($M = 125.86$, $SD = 98.40$); Spanish grammatical complexity scores ranged from 0 to 24 ($M = 3.72$, $SD = 7.34$). These instruments were designed for use with 16 to 30 month olds, but they were developed and normed on monolingual populations. These bilingually-developing children at 25 months were frequently not producing the grammatical constructions tapped by these instruments, and this problem was particularly acute in Spanish. Thirty-eight percent of the present sample scored zero on the English grammatical complexity scale, and 59% scored zero on the Spanish grammatical complexity scale.

Correlations between the measures of the children's exposure to English and Spanish and the measures of their English and Spanish development are presented in Tables 6 and 7. Table 6 presents the correlations between the amount of exposure to English-only, Spanish-only, and mixed 30-minute blocks and measures of the children's vocabulary and grammar in English and Spanish. Exposure to English was positively related to English vocabulary and grammar and negatively related to Spanish vocabulary and grammar. Exposure to Spanish was positively related to Spanish vocabulary, but not to Spanish grammar, and was negatively related to English vocabulary and grammar. Exposure to mixed-language blocks was unrelated to any measure of language development.

Table 7 presents the zero-order correlations between measures of the properties of the children's language exposure and the measures of their vocabulary and grammatical development in English and Spanish. Children's English vocabulary scores were positively related to the number of English-only contexts they experienced, the number of English-only conversational partners they experienced, the number of different speakers who were their sources of English exposure, and the percent of their English exposure that was provided by native speakers. All these measures except the percent of English exposure from native speakers were also significantly related to English grammatical complexity scores. In the parallel analyses for Spanish, the only significant correlation was between the number of different speakers who were sources of Spanish and children's Spanish vocabulary size.

To ask whether the predictive properties of language exposure accounted for variance in language level over and above effects of amount of language exposure, partial correlations were calculated between measures of the properties of children's exposure to English and Spanish and their English and Spanish development holding constant the amount of their exposure in each language. Those partial correlations are presented in Table 8. The number of exclusively English-speaking conversational partners the children experienced, the number of different sources of English input the children experienced, and the percent of their English input that came from native speakers were all significant correlates of English vocabulary over and above the effects of the percent of their language exposure that was in English. The number of exclusively English-speaking partners and the number of different English speakers to address the child were also significant correlates of English grammatical complexity, over and above amount of English exposure. For Spanish, the only significant partial correlation was a negative relation between the number of Spanish-only contexts experienced and Spanish vocabulary score.

To ask how much of the total variance in the children's vocabulary and grammar could be accounted for by the relative amount of language exposure and the specific properties of that exposure combined, separate hierarchical regressions were conducted with vocabulary and grammar in English and in Spanish as outcomes. The results of the analyses for English are presented in Tables 9 and 10. In both, the amount of exposure was entered first, and the specific properties were entered together in a second step. For vocabulary, the percent of children's waking hours that were in English-only 30-minute blocks accounted for 39% of the variance in children's English vocabulary scores; the three properties of that English exposure – number of English-only conversational partners, number of different sources of English, and percent of English from native speakers – accounted for an additional 29% of

the variance, which was a significant increase in variance accounted for. For grammar, the percent of language exposure in English-only blocks accounted for 34% of the variance and the properties of that exposure accounted for an additional, significant 21% of the variance. The parallel analyses of Spanish revealed no significant effects other than an effect of the quantity of Spanish exposure on Spanish vocabulary score.

Effects of Family Constellation on Children's Bilingual Development

Given the foregoing findings of differences among family constellations in children's language exposure and of effects of language exposure on bilingual development, the next analyses asked whether children from different family constellations displayed different patterns of bilingual development. Vocabulary scores for the children from the three most frequent family constellations are presented in Figure 4. A two-way 2 (Language) x 3 (Family Constellation) ANOVA with vocabulary score as the outcome measure revealed a significant main effect of Language ($F(1,21) = 6.13$, $p = .022$, $\eta^2 = .15$); on average the children had larger English vocabularies than Spanish vocabularies. There was a marginal main effect of Family Constellation ($F(2,21) = 3.46$, $p = .050$, $\eta^2 = .25$) in the direction of children with two native Spanish-speaking parents having smaller vocabularies ($M = 252.00$, $SD = 140.80$), averaged across English and Spanish, than children with a native English-speaking mother ($M = 434.43$, $SD = 124.89$) ($t(14) = 2.70$, $p = .017$, two-tailed). There was a significant Language x Family Constellation interaction ($F(2,21) = 6.99$, $p = .005$, $\eta^2 = .34$); the difference between the size of the children's English and Spanish vocabularies differed depending on Family Constellation. Bonferroni corrected post hoc tests showed that only the children with a native English-speaking mother had significantly larger English than Spanish vocabularies ($t(6) = 5.01$, $p = .002$, two-tailed). In a parallel analysis with grammatical complexity scores as the outcome variable, the only significant effect was a Language x Family Constellation interaction ($F(2,21) = 4.49$, $p = .024$, $\eta^2 = .28$). Although the grammatical complexity scores are not directly comparable across languages (and thus not displayed in a figure), the pattern among family constellations was the same as was the case for vocabulary. Bonferroni corrected post hoc tests showed that only the children with native English-speaking mothers were more advanced in English ($M = 11.71$, $SD = 9.03$) than in Spanish ($M = 1.86$, $SD = 2.73$) ($t(6) = 3.36$, $p = .015$, two-tailed).

Language Exposure as a Mediator of Family Constellation Effects

The last set of analyses asked whether the amount and/or properties of children's language exposure mediated associations between family constellation and children's language skills. Because the significant interactions in the previous Family Constellation by Language ANOVAs indicated that the effects of family constellation were different for English and Spanish, the first step was to identify the outcome measures that differed as a function of family constellation. The results of separate one-way ANOVAs for the four outcomes, English vocabulary, English grammatical complexity, Spanish vocabulary, and Spanish grammatical complexity, revealed a significant effect of Family Constellation only on English vocabulary ($F(2,21) = 9.28$, $p = .001$, $\eta^2 = .47$). Bonferroni corrected post hoc tests indicated that children with a native English-speaking mother had higher English vocabulary scores than children with two native Spanish-speaking parents ($t(14) = 6.39$, $p < .001$, two-tailed). The direction of the differences in English grammatical complexity were parallel,

but the effect was only marginally significant ($F(2,21) = 2.80$, $p = .084$, $\eta^2 = .21$). There were no significant effects on Spanish vocabulary or grammar.

Two analyses of covariance were conducted to identify mediators of that effect of family constellation on English vocabulary size. The first ANCOVA showed that removing the effect of the amount of English exposure reduced the variance accounted for by family constellation from $\eta^2 = .47$ to $\eta^2 = .27$, but that the effect of family constellation remained statistically significant ($F(2,20) = 4.71$, $p = .021$, $\eta^2 = .27$) after those significant quantity effects were removed ($F(1,20) = 5.99$, $p = .024$, $\eta^2 = .17$). When the properties of English exposure were also added as covariates, the effect of family constellation was no longer significant. These results suggest that the difference in English vocabulary observed among children of the three family constellations was accounted by a combination of the amount and properties of the children's exposure to English (see Table 11).

Discussion

For the present study, 29 mothers of 2-year-old bilingual Spanish-English first language learners kept detailed diaries of their children's dual language experience, recording the language the children were exposed to, the contexts of the interaction, and the speakers addressing the children for every half-hour time period the children were awake over the course of 7 different days. These records were used to describe previously unexplored properties of the dual language experience of children in bilingual environments, the relation of those properties to the constellation of their parents' native languages, and the influence of those properties of dual language exposure on bilingual development.

For these children, who were living in bilingual homes in the larger bilingual environment of South Florida in the U.S., the relative amount of their exposure to English and Spanish was, on average, approximately equal but was distributed across the full range allowed by the selection criterion – from 10% English and 90% Spanish to 10% Spanish and 90% English. The nature of the children's exposure to English and Spanish differed on only one measure: Children heard more of their Spanish from native speakers than their English. The measures on which Spanish and English did not differ included the relative amount of exposure, the number of contexts in which the children heard only one language, the number of individuals with whom the children interacted in only one language, and the number of different speakers who were sources of input in each language.

One other feature of these children's dual language exposure that was revealed in the diary records was the high degree to which the two languages co-occurred in the children's experience: Over one-third of the 30-minute blocks in the diary records included use of both languages in speech addressed to the child, and for the majority of children there was no context (e.g., mealtime, bedtime) in which only one language was always used nor one person with whom they interacted in only one language. These findings are consistent with other descriptions of the Spanish-English bilingual community in South Florida as one in which both languages are freely used within the same conversation (Pearson, 2007; Eilers, Pearson, & Cobo-Lewis, 2006).

As previous studies have found, differences among children in their relative amount of exposure to English and Spanish were related to their levels of development in English and Spanish. For English, relative amount of exposure was a significant predictor of both vocabulary and grammar; for Spanish, relative amount of exposure was a significant predictor only of vocabulary, but the measure of grammar suffered from floor effects, with many children scoring zero. The proportion of variance accounted for in these significant zero-order correlations between the relative amount of language input and language level ranged from 20% to 41%.

The present study found new evidence that not only the amount but also specific properties of language exposure influenced language development in bilingual children. In these data, three properties of the English children heard were positive predictors of their English skills: the number of conversational partners with whom the child spoke only English, the number of different speakers from whom the child heard English, and percent of the child's English exposure that was provided by native speakers. All three measures were significant correlates of English vocabulary, holding the relative amount of English exposure constant. The number of exclusively English conversational partners and the number of different sources of English were also significant correlates of the grammatical complexity of the children's English. Together the amount and properties of these bilingual children's exposure to English accounted for 68% of the variance in vocabulary and 55% of the variance in grammar.

The children's Spanish skills were related only to how much of their language exposure was in Spanish. There was only one significant correlation with properties of Spanish exposure, and it was admittedly uninterpretable negative correlation between the number of contexts in which Spanish was used exclusively and Spanish vocabulary size. The null finding with respect to effects of properties of Spanish exposure on Spanish development and the relative smaller size of the effect of amount of exposure to Spanish may reflect limited variance in both predictor and outcome variables. Compression of the range in the predictor variable likely arose from the fact that most native English-speaking parents were not fluent in Spanish, but most native Spanish-speaking parents were fluent in English. Thus, these children had fewer sources of nonnative Spanish and fewer different sources of Spanish. As already discussed, the measure of Spanish grammatical complexity suffered from floor effects.

Differences among children in the degree to which Spanish and English use co-occurred in their experience – measured by their use in the same 30-minute time block, in the same interactive context, or from the same person – were unrelated to any measure of language development. This could be because this sort of language mixing creates no difficultly for children exposed to two languages, or it could be because such mixing was very frequent in all these children's experience.

Twenty-five of the 29 families who volunteered for the study had at least one parent who was a native Spanish speaker. Three family constellations accounted for 24 of the 29 families participating: a native Spanish-speaking mother and native English-speaking father, a native Spanish-speaking father and native English-speaking mother, and two native

Spanish-speaking parents. (All the children were living in two-parent households.) Put another way, this sample of children who were bilingual first language learners were not themselves children of bilingual first language learners but children of at least one native Spanish speaker. Thirty of these 34 native Spanish speakers were immigrants; 4 were born in the U.S. This is consistent with what has been described elsewhere as the three-generation rule – bilingualism is largely found in the second generation following immigration; the third generation is monolingual in the community language (Oller & Eilers, 2002). Where community bilingualism persists within a monolingual country, it is because of continued immigration.

There were differences among these three family constellations in both the amount and the properties of the children's exposure to English and Spanish. English was the more-frequently heard language for the children with one native English-speaking parent, and Spanish was the more-frequently heard language for the children with two native Spanish-speaking parents. Another difference among these different types of families is in where and from whom the children received their exposure to English. Children with a native English-speaking mother heard 66% of their English from native speakers. Children with a native Spanish-speaking mother and native English-speaking father heard only 28% of their English from native speakers. For children with two native Spanish-speaking parents, only 12% of the speech addressed to them in English that could be coded for native speaker status came from native English speakers. (Much of these children's English exposure occurred outside of the home, and we did not have information about the native speaker status of these outside sources of English. Given the nature of the bilingual community in South Florida, no assumptions could be made.)

There were also differences among these three family constellations in the children's bilingual competencies. With respect to the balance of the children's skill in two languages, the children with a native English-speaking mother were more advanced in English than Spanish on both vocabulary and grammar measures. Neither group of children with native Spanish-speaking mothers showed a significant difference between their levels of English and Spanish skill. With respect to skills in each language examined separately, the children did not differ significantly in their Spanish skills as a function of family constellation. They did differ in their English vocabulary, and there was a marginal effect on English grammatical complexity ($p = .08$, two-tailed). Children with two native Spanish-speaking parents had smaller English vocabularies than children with a native English-speaking mother. This effect of family constellation on English vocabulary was partially mediated by the amount of English the children heard and was also due to differences in properties of the English the children heard, particularly the number of different sources of their English exposure.

Theoretical Implications

The finding that children's skill levels in each language were related to how much of their language exposure was in those languages is consistent with theories that describe language acquisition as a process of abstracting information from experience—more language experience results in more rapid language development. It is notable that vocabulary

development in both languages and grammatical development in English showed these effects of the amount of input. (The measure of Spanish grammatical complexity suffered from floor effects in these children.) This finding replicates previous findings in the literature on bilingual development (Gathercole & Thomas, 2009; Pearson et al., 1997; Oller & Eilers, 2002) and is consistent with the by-now large literature on monolingual development which finds that variability among children in their rates of language development is predicted by the amount of input they receive (Hoff, 2006).

The finding that the number of conversational partners from whom the child heard only English, the number of different speakers who were sources of the child's English, and the percent of English heard from native speakers suggests, first, that it is not just the amount but also specific properties of input that affect language development. The results of the hierarchical regression suggested that the number of different sources of English was positively related to both vocabulary and grammar; the proportion of input from native speakers was positively related to vocabulary. The finding of an effect of number of sources is consistent with the argument, which has been made for phonological and lexical learning, that learners need exposure to variability in the signal in order to extract the categories that will support later recognition and production (Fisher et al., 2004; Richtsmeier et al., 2009; Singh, 2008). Interpreting the effect of native input will require future work examining how the child-directed speech produced by native and nonnative speakers differ. The implication in the present finding is that nonnative speech is less supportive of language acquisition than native speech, but this finding does not identify why.

Practical Implications

Parents who are trying to raise bilingual children and parents who are speakers of minority languages are frequently given advice that has little empirical basis. One suggestion to parents who are choosing to try to raise their children to be bilingual is to separate the two languages in the children's experience. Consistent with findings from De Houwer (2007), there was no support for this advice in the present data – although the present data are not ideal for bringing data to bear on that suggestion because all the children in this sample experienced frequent intermingling of the two languages.

There is an important implication in the present finding with respect to advice frequently given to native Spanish-speaking parents of children in the U.S. Well-intentioned teachers and other authority figures, who are rightfully cognizant of the importance of English skills to school success, admonish parents to speak English to their children. The results of this study point to one reason that advice may not be good advice: Contrary to some intuitions that it does not take a high level of language proficiency to talk to young children, the findings of the present study suggest that nonnative input is less useful to language acquisition than native input. That, in combination with other drawbacks to interfering with the natural communication between parent and child and impeding the child's access to the family's heritage language suggests this may be bad advice. A similar argument against advising mothers who are native Spanish speakers to use English with their young children has been made by Hammer, Davison, Lawrence & Miccio (2009), based on their finding that maternal use of English did not help young Spanish-English dual language learners increase

their children English vocabulary but did slow the children's growth of Spanish vocabulary. This is not to deny to importance of English language skills to children or the importance of English input to the development of those skills. It is to suggest that the search for ways to improve the English language skills of children of immigrant parents should look elsewhere, for example by providing exposure to multiple sources who are native English speakers, rather than by asking parents not to speak the language they know and instead to speak a language they do not know well.

Limitations of the Present Study

Several limitations of this study should be noted. The measures of language experience and language development were collected concurrently. The direction of causation is not only from adults to children. Children's language skills may well influence the language choice of their parents and others in talking to the children. In fact, the influences are likely spiraling such that as children's skills in one language (typically English) become better than their skills in the other language, the parents interact with them more in that language (Pearson, 2007). However, this limitation does not mitigate the finding that children from different family constellations have different dual language experience and different levels of language skill. This limitation also does not obviate the findings that nonnative input is a negative predictor of language skill. One could argue that the direction of the relation should be the opposite of that observed: If it were children's English language skills that elicited English from adults, then children with better English should more frequently elicit English and thus be more likely to hear English even from native speakers of Spanish.

The present measure of the amount of English, Spanish, and co-occurring dual language input were measures of the amount of time exposed to each language, not the number of utterances. It will be important for future research to measure how much speech children exposed to two languages hear in each language Also, the measure of co-occurring or mixed language input was not a measure of intrasentential mixing, which is the sort of mixing most frequently thought to pose difficulties for children simultaneously learning two languages (Byers-Heinlein, 2009). The present findings do suggest that the separation by function that some have advocated may be less important than has been argued. Future research should explicitly measure intrasentential mixing and attempt to disentangle its frequency and its effects from those of co-occurring dual language input.

The present measures of language skill were measure of production only. It is often noted that children from bilingual environments develop the ability to understand, although not produce, one of the languages they hear. In order to more fully understand the process of bilingual development it will be important for future research to assess both comprehension and production and to investigate the factors that influence their development. However, productive competence in English is necessary to function in school and productive competence in Spanish is necessary for children to be able to interact with members of their family who are not proficient in English. Thus as a practical matter, productive language skills are an important outcome, even if they do not provide a full picture of the children's language knowledge.

Last, the present study provided only a snapshot of children's dual language exposure and bilingual development at the age of 25 months. It will be important for future research to describe how the language experience of children from bilingual homes and communities changes as they get older and how these changes affect their language trajectories.

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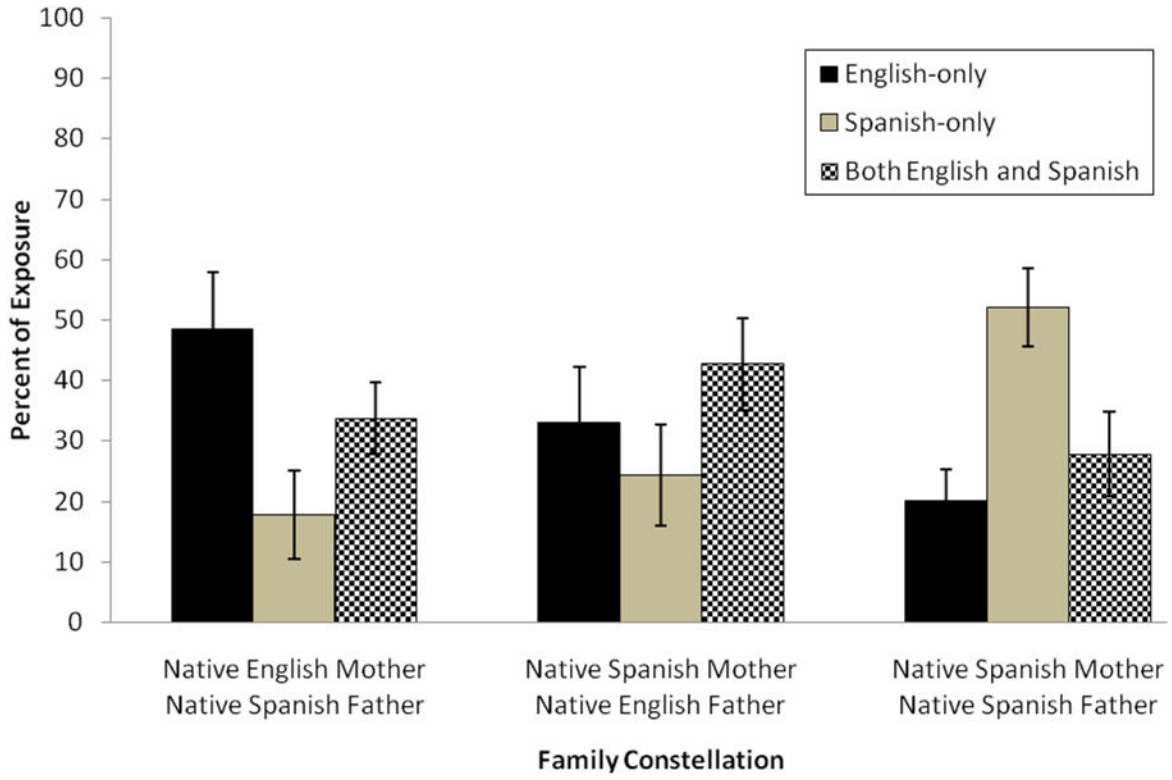

Figure 1.

Mean percent of children's waking hours in English-only, Spanish-only, and both English and Spanish 30-minute blocks, by family constellation.

Note. Error bars represent standard errors.

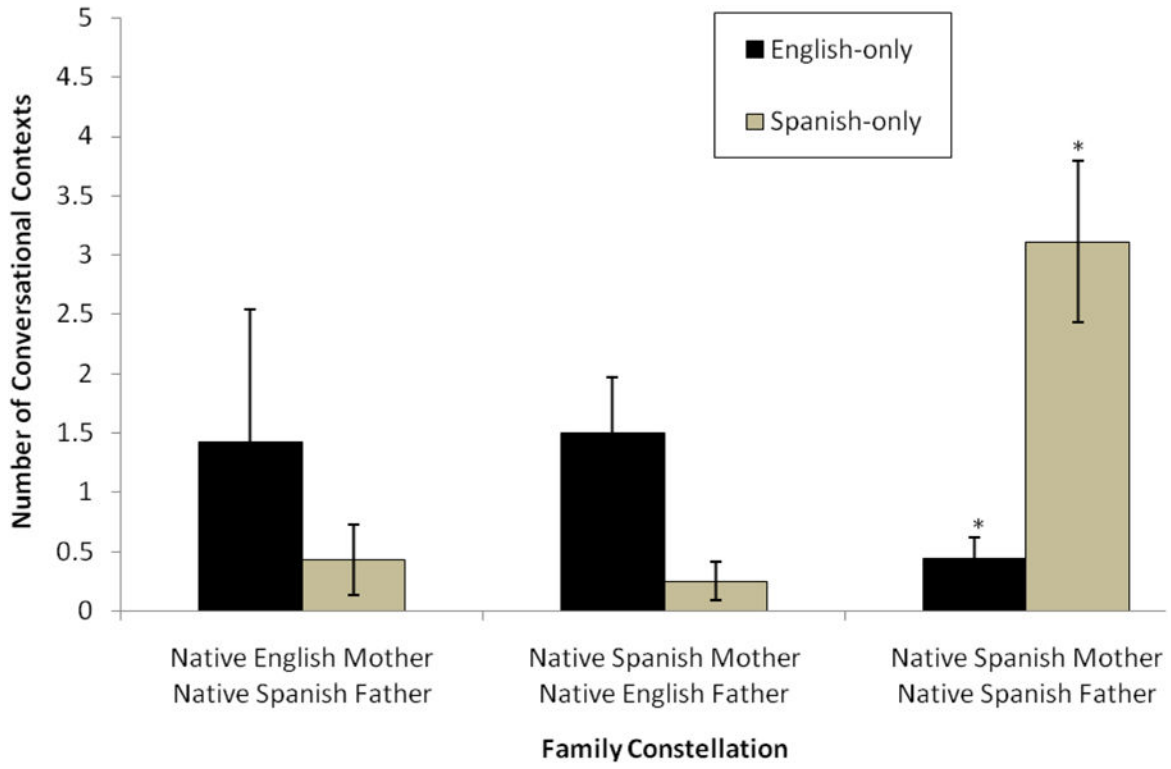

Figure 2.

Mean number of exclusively English and exclusively Spanish conversational contexts children experience in 7 days, by family constellation.

Note. Error bars represent standard errors. Asterisks indicate bars that are significantly different. *p < .05.

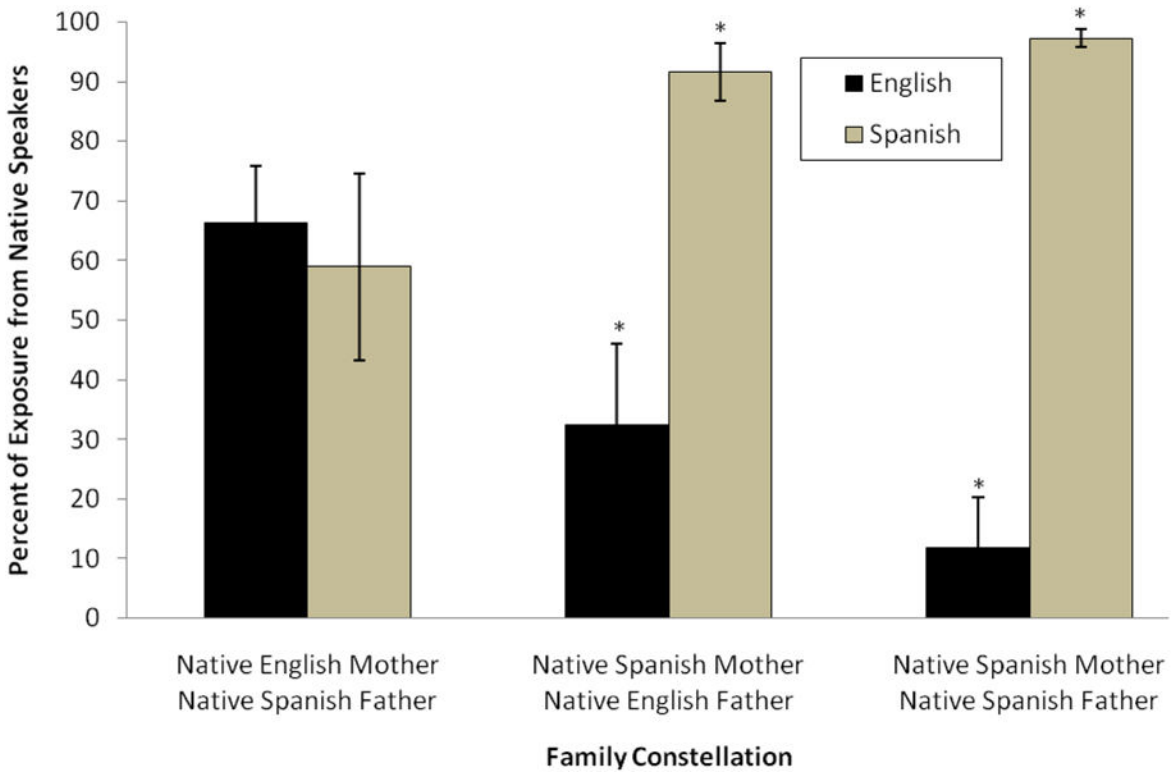

Figure 3.

Mean percent of children's English and Spanish input heard from native speakers, by family constellation.

Note. The percentages were calculated based on 21 of the 24 children in these three family constellations. Data from 3 children who experienced no English-only and/or Spanish-only blocks were excluded. Error bars represent standard errors. Asterisks indicate bars that are significantly different. *p < .05.

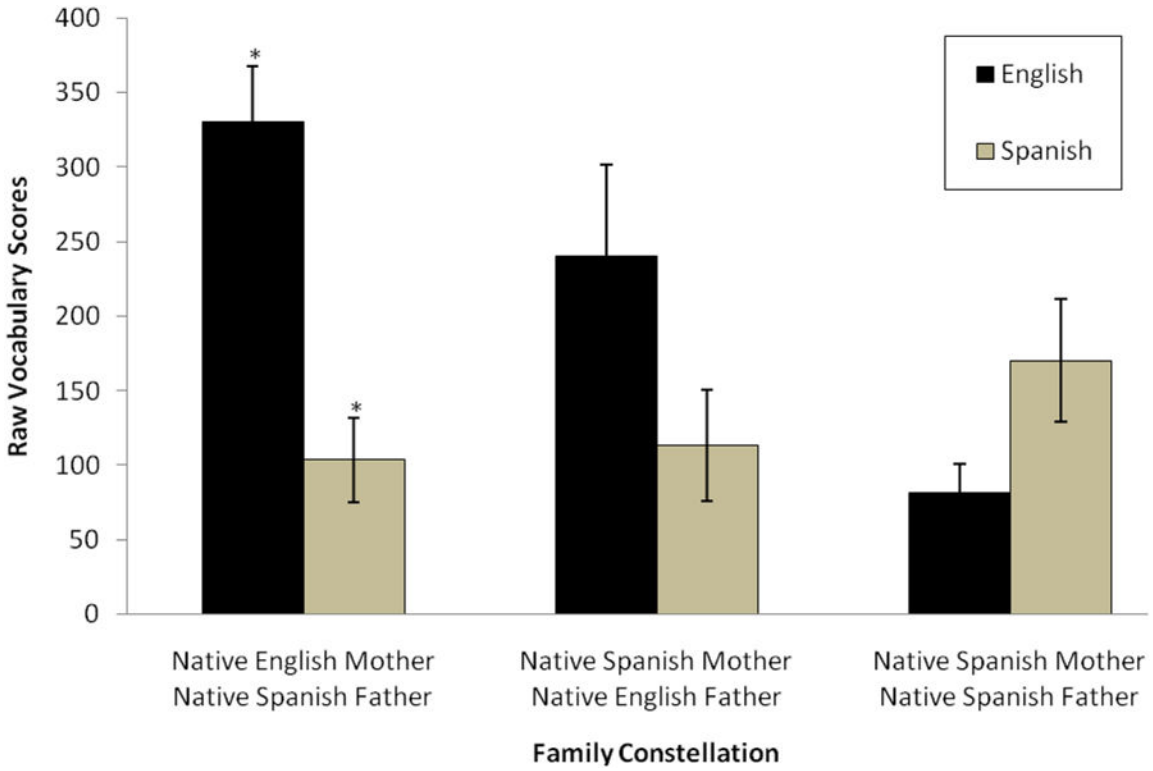

Figure 4.

Children's mean English and Spanish vocabulary scores, by family constellation.

Note. Error bars represent standard errors. Asterisks indicate bars that are significantly different. *p < .05.

Table 1

Family Constellations by Parents' Native Languages, with Parents' Mean Years of Education (N=29)

Family constellation	Frequency	Percent of sample	Mean years of education
Native English mother, native Spanish father	7	24.1	15.50
Native Spanish mother, native English father	8	27.6	16.56
Native Spanish mother, native Spanish father	9	31.0	16.89
Native Spanish-English bilingual mother, native English father	3	10.3	16.17
Native Spanish-English bilingual mother, native Spanish father	1	3.4	12.00
Native English mother, native English father	1	3.4	15.50

Table 2

Conversational Context Categories

Context	Mean hours per day	Definition
Bedtime	0.43	All activities related to the preparation for napping or sleeping, including dressing, reading, praying, storytelling
Book reading	0.25	Reading or looking at books
Car time	0.89	Any activity occurring during car travel
Childcare	1.11	Childcare and summer camp related activities
Dressing/bathing	0.82	Morning dressing, changing clothes, bathing, brushing teeth, cleaning up
Meal	1.91	Lunch, dinner, breakfast, and snacks
Media	0.91	Watching TV and videos or playing on the computer
Inside play	2.28	Playing with toys inside the house, coloring, dancing
Outside play	1.28	Playing in the backyard, swimming at a pool, playing at the beach, walking in a park
Shopping	0.48	Accompanying adults shopping
Solitary rest	0.09	Child lying in bed or resting
Other	0.74	Low frequency activities such as potty training, church, helping mother to clean the house, accompanying mother running errands

Table 3

Conversational Partner Categories

Person	Mean hours per day	Definition
Both parents	3.27	Both parents present, regardless of the presence of other individuals
Mother only	4.41	Mother present and father absent, regardless of the presence of other individuals
Father only	0.88	Father present and mother absent, regardless of the presence of other individuals
Grandparents	0.10	Grandparents present and parents absent, regardless of the presence of other individuals
Grandmother	0.40	Grandmother only present and parents absent, regardless of the presence of other individuals
Siblings	0.18	Playing with siblings, regardless of the presence of friends and cousins
Teacher	1.10	Interacting with teacher or teachers at childcare
Babysitter	0.35	At babysitter care
Friends	0.26	Playing with friends
Alone	0.07	Child alone (e.g., watching TV, resting)
Other relative	0.16	Uncles, aunts, or cousins and absence of the previously mentioned people

Table 4

Descriptive Statistics for Properties of Children's Exposure to English and Spanish (*N*=29)

Measures	Language exposure						
	English			Spanish			*t*
	M (*SD*)	Range	Mode	*M* (*SD*)	Range	Mode	
Percent of time[a]	34.06% (23.25)	0 – 82		29.06% (24.77)	0 – 77		.62
Number of single language conversational contexts[b]	1.21 (1.86)	0 – 8	0	1.17 (1.77)	0 – 6	0	.06
Number of single language conversational partners[b]	.90 (1.45)	0 – 6	0	.45 (.83)	0 – 3	0	1.45
Number of different speakers as sources of exposure[b]	4.38 (2.37)	0 – 10	4	3.38 (2.19)	0 – 10	3	1.61
Percent of language exposure from native speakers[c]	44.03% (38.40)	0 – 100		83.16% (27.28)	0 – 100		-3.59**[d]

[a] Counted in 30-minute blocks in which only one language was addressed to the child. In 37% of blocks, English and Spanish were both used.

[b] Across the seven days of diary recording.

[c] The percentages were calculated based on data from the 24 children who had both English-only and Spanish-only exposure.

[d] $^{**}p = .002$ (two-tailed), $d = .73$.

Table 5

Correlations between Relative Amount of Exposure and Properties of Language Exposure, Calculated for English and Spanish (*N*=29)

Measures	1	2	3	4	5
English					
1. Percent time in English-only blocks	1	.589**	.500**	.517**	.015
2. Number of English-only conversational contexts		1	.552**	.404*	.009
3. Number of English-only conversational partners			1	.564**	-.013
4. Number of different sources of English				1	-.081
5. Percent of English-only blocks with from native speakers[a]					1
Spanish					
1. Percent time in Spanish-only blocks	1	.774*	.233	.494**	.104
2. Number of Spanish-only conversational contexts		1	.408*	.294	.163
3. Number of Spanish-only conversational partners			1	.355*	-.173
4. Number of different sources of Spanish				1	-.581**
5. Percent of Spanish-only blocks with native speakers[b]					1

[a] *N*=27.

[b] *N*=26.

* $p < .05$, one-tailed.

** $p < .01$, one-tailed.

Table 6

Correlations between Relative Amount of Exposure to English, Spanish, and Co-Occurred Language Blocks and Measures of Language Development for English and Spanish (*N*=29)

Percent of language exposure	English		Spanish	
	Vocabulary Score	Grammar Score	Vocabulary Score	Grammar Score
English-only blocks	.644**	.581**	-.547**	-.439**
Spanish-only blocks	-.661**	-.568**	.442**	.249
English and Spanish blocks	.067	.027	.085	.195

** $p < .01$, one-tailed.

Table 7

Correlations between Properties of Language Exposure and Measures of Language Development for English and Spanish (*N*=29)

Measures	Vocabulary Score	Grammar Score
English		
Number of English-only conversational contexts	.405*	.490**
Number of English-only conversational partners	.576**	.546**
Number of different sources of English	.600**	.566**
Percent of English-only blocks with native speakers[a]	.334*	.176
Spanish		
Number of Spanish-only conversational contexts	.160	.100
Number of Spanish-only conversational partners	-.036	-.020
Number of different sources of Spanish	.365*	.157
Percent of Spanish-only blocks with native speakers[b]	-.088	.163

[a] N=27

[b] N=26.

* $p < .05$, one-tailed.

** $p < .01$, one-tailed.

Table 8

Partial Correlations between Properties of Language Exposure and Measures of Language Development Holding Relative Amount of Single-Language Exposure Constant, for English and Spanish (*N*=29)

Measures	Vocabulary Score	Grammar Score
English		
Percent time in English-only blocks held constant		
Number of English-only conversational contexts	.043	.225
Number of English-only conversational partners	.384*	.363*
Number of different sources of English	.408*	.381*
Percent of English-only blocks with native speakers[a]	.424*	.206
Spanish		
Percent time in Spanish-only blocks held constant		
Number of Spanish-only conversational contexts	-.321*	-.151
Number of Spanish-only conversational partners	-.160	-.083
Number of different sources of Spanish	.188	.041
Percent of Spanish-only blocks with native speakers[b]	-.150	.142

[a] *N*=27.

[b] *N*=26.

* $p < .05$, one-tailed.

Table 9

Hierarchical Multiple Regression Analyses Predicting English Vocabulary Scores (CDI) From Measures of the Amount and Properties of English Language Exposure

Predictor	ΔR^2	β
Step 1	.39***	
Percent time in English-only blocks		.63***
Step 2	.29**	
Percent time in English-only blocks		.39*
Number of English-only conversational partners		.18
Number of different sources of English		.36*
Percent of English-only blocks with native speakers		.36**
Total R^2	.68***	
N	27	

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 10

Hierarchical Multiple Regression Analyses Predicting English Grammatical Complexity Scores (CDI) From Measures of the Amount and Properties of English Language Exposure

Predictor	ΔR^2	β
Step 1	.34**	
Percent time in English-only blocks		.59**
Step 2	.21*	
Percent time in English-only blocks		.36*
Number of English-only conversational partners		.16
Number of different sources of English		.38*
Percent of English-only blocks with native speakers		.20
Total R^2	.55**	
N	27	

* $p < .05$.

** $p < .01$.

Table 11

The Relation of Family Constellation to Children's English Vocabulary with and without Measures of English Exposure as Covariates

Source of variation	*df*	*F*	*p*	η^2
ANOVA				
Family constellation	2,21	9.28	.001	.47
ANCOVA				
Covariate				
Percent time in English-only blocks	1,20	5.99	.024	.17
Family constellation	2,20	4.71	.021	.27
ANCOVA				
Covariates				
Percent time in English-only blocks	1,15	5.88	.028	.19
Number of English-only conversational partners	1,15	.28	.602	.01
Number of different sources of English	1,15	5.32	.036	.18
Percent of English-only blocks with native speakers	1,15	1.37	.260	.05
Family constellation	2,15	1.15	.343	.08