CHILD DEVELOPMENT

Child Development, xxxx 2020, Volume 00, Number 0, Pages 1–19

Within and Across Language Predictors of Word Learning Processes in Dual Language Learners

Amy Pace
University of Washington

Rufan Luo
Rutgers University-Camden

Dani Levine
Temple University

Aquiles Iglesias
University of Delaware

Jill deVilliers
Smith College

Roberta M. Golinkoff
University of Delaware

Mary S. Wilson
Laureate Learning Systems, Inc

Kathy Hirsh-Pasek
Temple University

This study investigated the relation between Dual Language Learners' (N = 90) vocabulary and grammar comprehension and word learning processes in preschool (aged 3-through-5 years). Of interest was whether: (a) performance in Spanish correlated with performance in English within each domain; and (b) comprehension predicted novel word learning within and across languages. Dual-language experience was evaluated as a potential moderator. Hierarchical linear modeling revealed stronger predictive associations within each language than across languages. Across languages, results varied by experience and domain. Structural sensitivity theory suggests exposure to two languages heightens awareness of parameters along which languages vary and provides a framework for interpreting complex associations within and across languages. Knowledge from one language may influence learning in both.

A central area of theoretical import in bilingual development is the degree to which children's languages are interdependent in acquisition (Zhao & Li, 2010). Dual Language Learners (DLLs) who are exposed to two languages in the first 5 years of life vary widely in their experiences with each language. This diversity of experience leads to linguistic knowledge that may be largely distributed across the two (Bialystok, Luk, Peets, & Yang, 2010; Buac, Gross, & Kaushanskaya, 2014; Oller, Pearson, & Cobo-Lewis, 2007; Rojas & Iglesias, 2013). Nonetheless, languages in an emerging system are far from autonomous. A substantial body of work has addressed questions of cross-linguistic transfer in development, revealing associations across languages in several domains including vocabulary and grammar (Maier, Bohlmann, & Palacios, 2016; Melby-Lervag & Lervag, 2011; Paradis, Rusk, Duncan, & Govindarajan, 2017; Von Holzen & Mani, 2012). Of interest in this research is whether children rely on existing knowledge from one language to support novel word learning processes in both of their languages.

Despite the recent proliferation of evidence for cross-linguistic transfer in early dual language acquisition, relatively little is known about the extent to which children make use of knowledge from one language to support learning within and across languages. A deeper understanding of cross-linguistic effects on children's word learning processes may enrich theoretical approaches that have generated testable hypotheses about the

Amy Pace and Rufan Luo contributed equally to this manuscript.

This research was supported by the Institute of Education Sciences (R305A110284, R324A160241). We are grateful to the children who participated in this research and their parents, as well as the schools that facilitated data collection. We thank Giovana Morini, Natalie Brezack, Kristina Strother-Garcia, Andrea Takahesu Tabori, Paula Yust, and Max Freeman for their contribution to this research.

Correspondence concerning this article should be addressed to Amy Pace, University of Washington, 1417 NE 42nd St, Seattle, WA 98105. Electronic mail may be sent to amypace@uw.edu.

 0009-3920/2020/xxxx-xxxx
DOI: 10.1111/cdev.13418

organization of semantic networks, but make more limited predictions about how DLLs will perform when they encounter a novel lexical item given their relative experience with each language. In practice, studying the relation between the language a child knows and how they learn new words—in combination with input and use across the child's languages—may provide clues for early supports to bolster acquisition and growth in not one language, but two.

Several prominent frameworks explain cross-linguistic transfer in terms of common structural elements (Kroll & Bialystok, 2013; Kuo, Uchikoshi, Kim, & Yang, 2016; Odlin, 1989; Sanoudaki & Thierry, 2015). One language might facilitate learning in the other if both languages share a structural regularity such as plural marking for count but not mass nouns. Structural differences may result in errors because of ambiguities that lead to inaccurate mapping from one language to the other (e.g., adjective position; la manzana roja; the apple red; Nicoladis, 2006). For the purpose of this study, transfer is defined as the overall, enduring influence of one language on the other, which is distinct from investigations into temporary effects of priming where one language influences the other in the moment (Arias-Trejo & Plunkett, 2013; Jardak & Byers-Heinlein, 2019; Singh, 2014; Vasilyeva et al., 2010). According to *structural sensitivity theory* (Kuo & Anderson, 2012; Kuo et al., 2016), as children acquire knowledge and skills in each language, they also abstract language-independent information that can apply across learning contexts. One underexplored area in which both language-specific knowledge and language-independent skills may be important is novel word learning.

In a cross-sectional sample of 3- through 5-year-old children learning both English and Spanish, this study investigated: (a) associations between vocabulary, grammar, and word learning processes *across* languages within each domain; and (b) whether vocabulary and grammar comprehension predicted word learning processes within each language and across languages. Children were directly assessed using the Quick Interactive Language Screener: English–Spanish (QUILS:ES; Iglesias, de Villiers, Golinkoff, Hirsh-Pasek, & Wilson, in press), a computerized instrument designed for use as a language screener with preschool children exposed to both English and Spanish. The tool measured receptive vocabulary, grammar, and word learning processes (including fast mapping, syntactic bootstrapping, and syntactic transformation) using equivalent subtests in both languages. If DLLs extract knowledge about linguistic structure through their joint exposure to both languages as suggested by structural sensitivity theory, cross-linguistic associations might be expected to vary by the degree of overlap in a particular domain (between a given language pair) but also by the relative exposure children receive in each language. Therefore, we predicted different patterns of transfer among vocabulary, grammar, and word learning processes within and across languages and we examined children's dual-language experience (i.e., relative exposure to and use of Spanish and English) as a potential moderator of these associations.

Cross-Language, Within-Domain Associations in Vocabulary, Grammar, and Word Learning Processes

Vocabulary

The domain of vocabulary is considered to be relatively language-specific because word meaning is arbitrarily associated with a unique label in each language (Parra, Hoff, & Core, 2011). To illustrate, a child may be exposed to the word *ciruela* at the grocery store with their Spanish-speaking grandmother, but may not encounter the English translation equivalent, *plum*, until a super-market themed unit at preschool. For this reason, a significant proportion of DLLs' early vocabularies may be comprised of words known in one or the other language, but not both (Peña, Bedore, & Zlatic-Giunta, 2002; Rinker, Budde-Spengler, & Sachse, 2017). Moreover, a large body of work suggests that vocabulary growth in one language may be more strongly linked with properties of input in that language than the other, at least in the early stages of development (Goodrich & Lonigan, 2017; Hoff et al., 2012).

Although many studies find that vocabulary in one language is not related to vocabulary in the second (Bialystok et al., 2010; Oller et al., 2007; Simon-Cereijido & Gutiérrez-Clellen, 2009), other investigations have revealed positive cross-language associations in this linguistic domain (Kohnert, Kan, & Conboy, 2015; Maier et al., 2016; Melby-Lervag & Lervag, 2011). From a structural sensitivity perspective, this variation may reflect methodological differences that capture aspects of vocabulary knowledge which may be specific to each language (e.g., individual words that do not overlap in form or meaning, like *manzana* in Spanish and *chien* in French) or rather, aspects that may apply more generally to lexical skills across languages (e.g., the number of different words produced in a narrative elicitation task; Branum-Martin et al., 2009).

To date, no study has directly tested comprehension of equivalent word classes while accounting for moderating effects of relative experience with each language. This study assessed vocabulary comprehension in Spanish and English across equivalent word classes including nouns, verbs, prepositions, and conjunctions. Children's bilingual experience was quantified via parent report of children's language *use* as well as the reported *exposure* children received in each language at home, to determine whether experience with each language moderated cross-linguistic associations within each domain (Bedore et al., 2012; Ribot, Hoff, & Burridge, 2018). Given the language-specific nature of exposure to individual vocabulary words, we predicted that children's vocabulary comprehension in English would not be associated with comprehension in Spanish, and that this pattern would be consistent for children with different dual-language experiences.

Grammar

Although grammar development is undoubtedly linked with exposure to each language (Marchman, Martínez-Sussmann, & Dale, 2004), children may also generate abstract grammatical representations by detecting distributional regularities in the input across languages (Goodrich & Lonigan, 2017; Messenger & Fisher, 2018). Thus, in comparison with vocabulary, the domain of grammar may be relatively language-independent. For example, regardless of the language of input, children learn that words combine in predictable ways to form sentences and use argument structure to assign thematic roles. Transfer from one language to another may be observed as children rely on emerging knowledge about the unique and overlapping features of each language. In this study, equivalent subtests assessed preschool children's comprehension of the following grammatical structures in English and Spanish: wh-questions, past tense prepositional phrases, and embedded clauses. We predicted positive correlations across languages, reflecting structural commonalities in English and Spanish; however, we hypothesized that associations would not vary significantly by dual-language experience because children should be sensitive to structural commonalities within their two languages even with asymmetrical exposure.

Word Learning Processes

Little is known about whether DLLs apply the same heuristics to learn new words in both of their languages. One well-established approach to word learning focuses on the processes that children use to infer the correct meaning for a novel label. In addition to known vocabulary and grammar, this study evaluated word learning processes including fast-mapping, syntactic bootstrapping, and syntactic transformation. Fast mapping refers to the process by which children make a rapid inference about the likely meaning of a novel word based on the information available at the time of first exposure (Carey & Bartlett, 1978) and extend the novel label to new exemplars. Although word learning encompasses a great deal more than forming an initial referent-label link, fast mapping is widely recognized as a reliable measure of children's early lexical acquisition (Bion, Borovsky, & Fernald, 2013; Schmidt, de Oliveira Franco, Santos Lotério, & Gomes, 2016; Zosh, Brinster, & Halberda, 2013) and has been used frequently with nouns as well as adjectives in monolingual samples (Booth & Waxman, 2009).

Syntactic bootstrapping refers to children's ability to use the grammatical structure of a sentence to infer word (typically verb) meaning (Gleitman, 1990). For example, offered a sentence such as "Mary is *pilking* the balloon," children as young as 2 years of age link the novel transitive verb with a visually presented action (e.g., waving) and extend the label to a new situation involving a different object (i.e., *pilking* the rake; Arunachalam & Waxman, 2010). This skill has been interpreted as a meaningful marker of children's grammatical competency (Fisher, Gertner, Scott, & Yuan, 2010). Syntactic transformation is another process by which children generalize syntactic structures to newly learned verbs and is often used to measure children's ability to understand passive constructions. Successful comprehension of passive syntactic constructions requires children to revise role assignments to determine who did what to whom. Children's ability to understand passives emerges throughout the preschool years (Baldie, 1976; de Villiers & de Villiers, 1973; Deen, 2011; Huang, Zheng, Meng, & Snedeker, 2013; Messenger & Fisher, 2018) and may be an important indicator, along with other noncanonical constructions, of overall language development in monolingual children (Leech, Rowe, & Huang, 2016).

Prior research has compared word learning processes such as fast mapping between monolingual and bilingual children (Buac, Gross, & Kaushanskaya, 2016; Byers-Heinlein, Fennell, & Werker, 2013; Kalashnikova, Escudero, & Kidd, 2018; Singh, Fu, Tay, & Golinkoff, 2017) or between monolingual children learning different languages (Arunachalam,

Leddon, Song, Lee, & Waxman, 2013; Chan, Lieven, & Tomasello, 2009; Katerelos, Poulin-Dubois, & Oshima-Takane, 2011), but few studies have examined how DLLs acquire new words in *both* of their languages. Although one study found a positive relation between children's performance on fast-mapping tasks in Hmong and English (Kan & Kohnert, 2008), this work may have limited generalizability due to a small sample and a restricted set of word learning trials that focused on nouns only. To date, the development of word learning processes like syntactic bootstrapping and syntactic transformation have rarely been investigated with bilingual populations. To test for cross-linguistic associations between word learning processes, children's ability to rapidly infer the meaning of a novel label was assessed English and Spanish for nouns, adjectives, and verbs. We expected to find positive associations between word learning processes in Spanish and English based on children's ability to extract structural parallels that apply to word learning in both languages. We also hypothesized that cross-linguistic associations in this domain would not vary by children's dual-language experiences since children should be sensitive to commonalities in word learning processes with even minimal exposure to a second language.

Predictive Associations Between Comprehension (Vocabulary, Grammar) and Word Learning Processes—Within and Across Languages

Another robust finding from research with monolingual children is that fast mapping performance is closely linked with language development. Specifically, children acquiring a single language tend to perform better on fast mapping tasks when they have larger vocabularies or more complex grammars (Bion et al., 2013; Gray, 2004; Jackson, Leitao, Claessen, & Boyes, 2019). Similarly, performance on syntactic bootstrapping tasks is influenced by vocabulary size (Scott & Fisher, 2012). This is likely due to both intrinsic properties of language input (e.g., phonotactic probability, statistical regularities, patterns of stress and prosody) as well as extrinsic factors (e.g., speaker variability, sources of input, context for language learning). Comparable evidence for DLLs is not currently available and findings from the limited body of work that has directly investigated the relation between vocabulary development and word learning processes in DLLs are often inconclusive. Therefore, another aim of this study was to examine whether vocabulary and grammar comprehension in one language predicted word learning processes not only in that language (i.e., English–English; Spanish–Spanish), but also across languages (i.e., English–Spanish; Spanish–English).

One foundational study investigated associations between vocabulary measures and fast mapping performance in preschool children learning Hmong and English (Kan & Kohnert, 2008). In contrast with previous research involving monolingual children, results indicated that children's fast-mapping performance was not related to existing vocabulary in either language. This work also identified a negative cross-linguistic association, where larger vocabulary in one language (Hmong) was linked with lower fast mapping scores in the other (English). Although the authors do not discuss language dominance as an explanation for these findings, they suggest that differences in experience and exposure may have influenced word learning outcomes. Large individual variation in task performance and a limited number of fast mapping trials may limit the generalizability of these results.

Subsequent work by the same authors revealed links between vocabulary and word learning within languages, as well as correlations across languages. In a study that investigated novel word learning in Hmong and English over weekly training sessions (four in each language), positive longitudinal associations were identified between existing vocabulary and fast mapping within both languages (Kan & Kohnert, 2012). Moreover, the strength of these associations differed as a function of language experience with stronger and more consistent correlations in children's nondominant language (English) than in the dominant language (Hmong), highlighting the importance of this link at the initial stages of language development. This work also revealed complex cross-language associations over time: larger vocabularies in Hmong supported children's English word learning, whereas children with larger English vocabularies were slower to learn new Hmong words. Other work has also described attrition (Schmid & Köpke, 2017), but this pattern has not been widely replicated using word learning paradigms in a developmental population. Although these results contribute to the field's understanding of bilingual word learning, the sample was relatively small ($n = 32$) and only included children for whom Hmong was the primary language used at home. Thus, it remains an open question whether word learning skills in one language support word learning in the other, and how dual-language experience might impact children's ability to rely on existing language knowledge to learn new words within and across their languages.

One additional study investigated how vocabulary in older preschool children (5–6 years) learning Russian and Hebrew related to fast mapping skills in Hebrew (though fast mapping in Russian was not measured), with particular attention to effects of language dominance (Altman, Goldstein, & Armon-Lotem, 2018). Children identified as Russian-dominant relied on receptive vocabulary in Russian to support fast mapping in Hebrew (the nondominant language). However, for children in the Hebrew-dominant group, vocabulary (in Hebrew) was not associated with fast mapping (in Hebrew). Together with previous work (Kan & Kohnert, 2012), these findings provide preliminary evidence that word learning processes like fast mapping may show varying patterns of association with existing vocabulary knowledge based on children's dual-language experiences. Notably, this study treated vocabulary as the outcome variable dependent on word learning processes, which raises interesting theoretical questions about the directionality of the relation. Since fast mapping in Russian was not examined, however, a full picture of cross-language effects in word learning did not emerge.

The Current Study

Given the landscape of complex and often contradictory results, this study investigated associations among preschool children's vocabulary, grammar, and word learning processes in English and Spanish and asked how existing vocabulary and grammar comprehension in each language was related to children's ability to learn new words—including nouns, adjectives, and verbs—within and across languages. In addition, this research tested for a moderating role of dual-language experience by asking whether associations varied for children reported to have balanced experience with English and Spanish and for children reported to have more experience with Spanish than English. Our hypotheses were guided by the tenets of structural sensitivity theory, which suggests that DLLs are oriented to the parameters along which their two languages vary. Although previous work has not evaluated this hypothesis in the context of word learning processes, we argue that children may draw from their experience with both languages as they learn new vocabulary words and generalize new grammatical structures to newly learned words in one language or the other. We asked two research questions:

1. Are there associations within the domains of vocabulary, grammar, and word learning processes across languages (English–Spanish), and do these associations vary with dual-language experience? We hypothesized that across-language correlations would vary by domain, based on the level of structural similarities children can potentially detect and abstract from the input, with stronger correlations in grammar and word learning processes than vocabulary. We also hypothesized that cross-language associations would not be significantly moderated by children's dual-language experiences because structural similarities should be available to children at all levels of input and use.
2. Do vocabulary and grammar comprehension predict word learning processes within each language (English to English; Spanish to Spanish) or across languages (English to Spanish; Spanish to English), and are these relations moderated by dual-language experience? Based on evidence with monolingual children, we hypothesized that we would observe strong within-language associations in which children rely on existing knowledge to support word learning processes. We also anticipated that children with predominantly Spanish exposure may show associations of greater magnitude between English comprehension and English word learning than children with more balanced dual-language experience because existing vocabulary may be a key source of information at the initial stages of learning whereas a combination of other factors may guide word learning at more advanced stages of acquisition (Kan & Kohnert, 2012).

Across languages, we also expected predictions to vary by dual-language experience. One possibility was that children with asymmetrical experience would use knowledge in their more established language (i.e., Spanish) to "bootstrap" or support word learning in their less established language (Pham, 2016), but that comprehension in the less established language would be negatively related to word learning in the more established language as a result of distributed input or a process akin to language attrition. Both of these explanations are considered in the discussion. Children who receive more balanced dual-language experience, in contrast, may show consistent patterns of transfer across languages because of the ability to draw upon structural parallels to support word learning processes in both languages.

Method

Participants

Participants were 90 three- through five-year-old children (M = 54.50 months, SD = 8.64, range = 39.52–71.42; 44 females; 25 three-year-olds, 34 four-year-olds), recruited from preschools, daycares, and Head Start centers in Florida, Delaware, Pennsylvania, and Massachusetts. All children were typically developing. To determine eligibility, preschool teachers were consulted prior to recruitment. Children with known diagnoses and children on Individualized Educational Plans were excluded. Teachers had no concerns about language, learning, or development for any study participant. The highest level of education attained by the child's primary caregiver (1-lower than high school, 2-high school, 3-trade school, 4-associated degree, 5-Bachelor's degree; see Table 1 for descriptive statistics) was used as a proxy for socioeconomic status (SES) to align with the substantial literature linking parental education with child language development (Hoff, 2013). Participants were selected from a larger, standardization sample (N = 363) for the QUILS:ES. From this group, we first retained only those children with valid parent-report data on dual-language experiences and parental education (N = 115). We then calculated a language exposure score based on parent-report (see Measurements) and retained only those participants with Spanish exposure that was reported to be greater than or equal to their English exposure (N = 90).

Of the final sample (N = 90), approximately 20% of primary caregivers had earned Bachelor's degrees, 20% had Associate's degrees, 4.4% completed trade school, 27.8% earned a high school diploma, 27.8% had completed some high school. Combined for analyses, approximately 44% of participants had primary caregivers with higher education experience compared with 56% with high school degree or lower. The majority of participants (88.5%) were reported to have one or more sibling in the home (M = 1.89; SD = 1.05; range = 1–4). Number of adults in the home ranged from 1 to 5 (M = 2.18; SD = 0.76). Eighty-one percent of the sample reported dialects spoken at home. Of this subset, over nine variants were reported: Mexican (28.8%); Puerto Rican (15.1%); Venezuelan (9.6%); Dominican (6.8%); Columbian (2.7%); Chilean (2.7%); Argentinian (1.1%); Cuban (1.4%); Other (1.4%); and 28.8% reported speaking multiple dialects at home. A majority of participants were reported to be Hispanic (71%), 2% were non-Hispanic, and 27% did not respond to this item on the questionnaire. In terms of racial/ethnic identity, 38% of participants were White; 3% selected "Other" indicating that they did not identify as White/Caucasian, Black/African American, American Indian/Alaska Native, Asian, or Hawaiian native/Pacific Islander; and 58% of participants did not respond to this item.

Table 1
Descriptive Statistics

	M/%	(*SD*)	Min	Max
English[a]				
Vocabulary	0.41	(0.18)	0.06	0.94
Grammar	0.44	(0.25)	0.00	0.93
Learning process	0.46	(0.28)	0.00	1.00
Overall	0.44	(0.21)	0.11	0.96
Spanish[a]				
Vocabulary	0.54	(0.21)	0.06	1.00
Grammar	0.40	(0.22)	0.00	0.93
Learning process	0.43	(0.22)	0.07	1.00
Overall	0.46	(0.19)	0.13	0.91
Child age (mon)	54.86	(8.42)	39.52	71.42
Language dominance[b]	3.82	(0.74)	2.67	5.00
Primary caregivers' education				
Lower than high school	27.8			
High school	27.8			
Trade school	4.4			
Associate degree	20.0			
Bachelor's degree	20.0			

[a]Proportion correct. [b]The scale of language dominance ranged between 1 (*only English*) and 5 (*only Spanish*).

Measures

Children's Dual-Language Exposure and Production

Parents, primarily mothers (89%), completed a questionnaire designed by the researchers with items about children's dual-language *use* with their primary caregivers, secondary caregivers, siblings, and friends outside the home, and their received dual-language *input* from primary caregivers, secondary caregivers, and siblings (i.e., 1-only English, 2-mostly English, 3-English and Spanish equally, 4-mostly Spanish, 5-only Spanish). Responders chose whether to complete the questionnaire in English or Spanish. Factor analysis suggested that all items loaded onto a single factor, which explained over 65% of the variance (Eigenvalue = 4.52). Therefore, average scores were calculated to indicate children's dual-language experiences. Children who had dual-language experience scores lower than 2.5 were excluded from the analysis due to the low

frequency and limited exposure to Spanish, yielding a final sample of 90 children. On average, children produced and received slightly more Spanish than English (M = 3.81, SD = 0.74, range = 2.67–5.00).

Note that although some children predominantly produced and received language in Spanish at home, all participants were all in some stage of English language acquisition from their time in preschool, and many were using both Spanish and English in the school environment. Instruction was primarily in English in all preschool classrooms; however, Spanish-speaking teaching assistants or instructional aides frequently worked in the classroom as well. Children who had relatively more Spanish experience had primary caregivers with higher educational level (r = .26, p = .012). To account for this variability, we controlled for SES (i.e., primary caregivers' education) in all analyses.

The English–Spanish Screener

The QUILS:ES is a computerized, interactive tool, designed to assess DLL children's English and Spanish comprehension from ages 3 through 5. Since the tool was designed to measure children's English and Spanish skills separately, the English and Spanish versions include parallel subtests but no overlapping items. The instrument also avoided cognates (e.g., "fruit" in English and "fruta" in Spanish) to ensure that children's performance on Spanish and English items reflected knowledge specifically in that language. All test items were evaluated by native Spanish-speaking and native English-speaking researchers to ensure that they were appropriate for Spanish–English DLLs and variation across Spanish and English dialects was controlled. For instance, the Spanish word for "yellow" rather than "brown" was selected because brown has many dialectal variants. Voiceovers for the English test were recorded by a native male speaker of Standard American English from the Northeastern United States; voiceovers for the Spanish test were recorded by a native male speaker of Spanish who is of Cuban-American descent with advanced bilingual proficiency.

The QUILS:ES contains 12 subtests with a total of 90 items (45 in English; 45 in Spanish) measuring specific language constructs across three language components: Vocabulary, Grammar, and Word Learning Processes (see Supporting Information for additional detail). The QUILS:ES has high internal consistency reliability (English: Cronbach's α = .877, n = 90; Spanish: Cronbach's α = .822, n = 90) and adequate test–retest reliability (English: $r(19)$ = .877, p < .001; Spanish: $r(21)$ = .863, p < .001) across a period of 4 to 6 weeks in the current sample. Convergent validity was evaluated with the Auditory Comprehension portion of the Preschool Language Scales, 5th ed. (PLS–5) in a nonoverlapping subset of participants within 4 weeks of testing and scored using bilingual norms that capture the child's Spanish and English skills in a single standard score (Zimmerman, Steiner, & Pond, 2012). The QUILS:ES showed moderate convergent validity with the PLS–5:AC (English: $r(61)$ = .618, p < .001; Spanish: $r(63)$ = .474, p < .001).

The *Vocabulary* component measured children's knowledge of Nouns, Verbs, Conjunctions, and Prepositions in English and Spanish. For example, an item from the English Noun subtest asked children, "Find the fireworks," whereas the Spanish Noun subtest asked children to, "Encuentra el recojedor" (English translation: "Find the dustpan") while presenting four pictures: a dustpan (target), a trashcan (foil), soap (foil), and a clock (foil). Spanish and English targets on the Vocabulary component were balanced for equivalent difficulty according to word frequency and age of acquisition norms from lexical databases and other published resources (Davies, 2012; Masterson, Druks, & Gallienne, 2008).

The *Grammar* component assessed children's knowledge of equivalent syntactic structures in English and Spanish including sentences referring to past actions and locations, sentences with multiple modifiers including prepositional phrases and adjectives, sentences with embedded clauses, and *wh*-questions. These subtests were selected because they can be measured in both English and Spanish, they represent skills known to improve over the preschool years (Rispoli, Hadley, & Holt, 2012; Rowland, Pine, Lieven, & Theakston, 2003); and are thought to be informative markers for language delay (de Villiers & Roeper, 1996). The Past Tense subtest, for instance, measured past auxiliary and copula of *be (estar), was (estaba)*, which is neutral across dialects (Seymour, Roeper, De Villiers, & de Villiers, 2003) and has a clear Spanish equivalent. To illustrate, children viewed an object presented in a particular location (e.g., hat on a boy), followed by a scene in which the object has moved to a new location (e.g., the hat is located above the boy's head, blown by a gust of wind). Children were then prompted to indicate where the object was previously located (English: Where *was* . . .? Spanish ¿Dónde *estaba* . . .?) from three options: the new location of the object (i.e., hat in the sky); the target location (i.e., on the boy's head); or an entirely different location (i.e., on the girl's head; Figure S1).

The *Word Learning Process* component measured children's ability to learn and generalize new words, including nouns, verbs, and adjectives. Across all Process subtests, novel words were selected if they: (a) conformed to the phonotactics of English or Spanish; (b) had been used in prior research on word learning (Janse & Newman, 2013); (c) did not rhyme with any of the other words within or across trials; and (d) did not share initial phonemes with any of the foils included in the item. Familiar objects and known words included on the Process subtests were based on words understood by most typically developing children by 30 months of age based on the CDI CLEX (Cross-Linguistic Lexical Norm, Dale & Fenson, 1996) and were produced by most children by age 3 (Stadthagen-Gonzalez & Davis, 2006).

Subtests were derived from the developmental literature (Arunachalam & Waxman, 2010; Carey & Bartlett, 1978; Fisher et al., 2010; Johnson & de Villiers, 2009). The *Noun Learning* subtest evaluated children's skill at fast mapping and extending novel nouns to novel whole objects; the *Adjective Learning* subtest (Gelman & Markman, 1985; Waxman & Klibanoff, 2000) assessed children's skill at fast mapping and extending novel adjectives to novel properties of familiar objects; the *Verb Learning* subtest examined children's ability to infer the meaning of a novel verb from the syntax of a sentence and extend the verb to a novel exemplar of the action (i.e., syntactic bootstrapping); and the *Converting Active to Passive* subtest measured children's skill at recognizing that novel verbs can be converted from one grammatical structure (i.e., active voice) to another (i.e., passive voice).

In an item from the *Noun Learning* subtest in Spanish, for example, children viewed an array of four objects and heard the novel word *mepe* embedded in a sentence: "El *mepe* tiene un sombrero (translation: The *mepe* has a hat). Enseñame el *mepe* con el sombrero (translation: Show me the *mepe* with the hat)." Children were required to make their selection from the following options on the screen: two known nouns that met the description (e.g., a *dog* and a *cat* wearing a hat), a novel object that did not meet the description (i.e., a novel object with no hat), and one that was novel and met the description (i.e., a novel creature wearing a hat). Children were then prompted, "¿Me puedes enseñar otro *mepe*? (translation: Can you show me another mepe?)." A new array of four objects appeared on the screen: two known nouns (i.e., a pig wearing a hat; a horse without a hat), one novel object (i.e., a novel creature), and a novel exemplar of the object labeled in the first trial (i.e., a mepe creature of a different color without a hat). Thus, children needed to demonstrate that they mapped the novel label (i.e., *mepe*) to the target creature and understood that the descriptor (i.e., wearing a hat) was not relevant to the word meaning (Figure S2).

To learn new adjectives, children must recognize that a novel descriptor is being used to highlight a feature of one item amongst other items (e.g., Waxman & Klibanoff, 2000). Children learn how to extend novel adjectives to features of objects from diverse basic-level categories, such as extending a novel label for a feature of a basket to the same feature of a spoon (Waxman & Klibanoff, 2000). The *Adjective Learning* subtest was adapted from the literature (Gelman & Markman, 1985) and utilized novel, visually salient patterns applied to familiar objects for which young children typically have labels by age 3 (Dale & Fenson, 1996), so that children would not simply map the novel adjective onto the novel object. For English, we used novel adjectives from prior research ending in -ish (Waxman & Klibanoff, 2000). For Spanish, novel nonsense words were selected from words in phonologically dense neighborhoods and the suffix -oso or -osa was attached, depending on the noun's gender (e.g., ¡Mira, el buho es *quefoso*!). This allowed us to develop structurally equivalent prompts to assess adjective learning in English (e.g., Look at this bird! This bird is *mezzish*. What else is *mezzish*? Show me what else is *mezzish*) and Spanish (e.g., ¡Mira esta mesa! Esta es una mesa *petosa*. ¿Qué otra cosa es *petosa*? Enséñame otra cosa que es *petosa*.).

Children begin to utilize syntactic cues for *Verb Learning* by age two (Gertner, Fisher, & Eisengart, 2006; Naigles, 1990), and increasingly rely on this information as they build their vocabularies (Hollich, Hirsh-Pasek, & Golinkoff, 2000). Novel verbs for English items were adopted from prior research and presented in the present progressive form using the morphological marker *-ing*. For Spanish items, novel verbs were created using a list of nonsense words with phonologically dense neighborhoods, were conjugated using "-ar," "-er," or "-ir" endings, and presented in the present progressive form using the morphological markers *-iendo* (e.g., comer/comiendo) or *-ando* (e.g., bailar/bailando). In this subtest, children observed a dynamic scene involving an actor, a patient, and an object. Children were required to rely on the syntactic structure of the verbal description to infer the meaning of a novel verb ("Mira, alguien está *braliando* a alguien. Oye, alguien está *braliando* a alguien.

¿Puedes encontrar otro igual? Encuentra, 'alguien está *braliando* a alguien'").

On the *Converting Active to Passive* subtest, children viewed a dynamic scene involving three actors: one performing a transitive action on a second actor (or with an object), while the third remained stationary (Figure S3). On the English version, children heard, "The girl is *praving* the basket! See? The girl is *praving* the basket?" (or in Spanish: Oye, el hombre está *letando* la pelota. Mira, el hombre está *letando* la pelota). Children were then prompted, "Which one got *praved*?" (or in the Spanish equivalent: ¿Qué fue *letado*?) as they viewed a smaller image of the original event, presented with three options underneath it: the girl (agent foil), the boy (unrelated foil), or the basket (target). To answer this item, children were required to convert the active form of the verb *praving* to the passive *got praved* in order to identify which constituent was being *praved*.

Procedure

English and Spanish tests each took approximately 15 min to administer and were given on two different days within 2 weeks. Order of administration for English and Spanish versions was counterbalanced. Each child was tested individually by an administrator in a quiet area at school. The QUILS:ES is presented on a touch screen computer and includes three training items to familiarize children with the format of the assessment. Children then view test items one by one and respond to the auditory prompts by touching one of the options on the screen. Each option is surrounded by a yellow border, which turns red after it has been selected. Children can only respond after the auditory prompt of an item is finished. If a child does not respond in 20 s, the prompt is repeated. If a child does not respond in 15 s after the repeated prompt, the test moves on to the next item. Intermittently, children view a short, animated video as a transition between subtests.

Scoring

For the fast mapping nouns and fast mapping adjectives subtests, each test item contained two trials (i.e., fast mapping and extension), and children were required to answer both trials correctly to receive credit for the item. For all other subtests, items contained a single trial and were scored as correct or incorrect based on the child's response. Subtest scores were computed automatically by the instrument, and the percent of items answered correctly in English and Spanish was calculated for Vocabulary, Grammar, and Word Learning Process components.

Analysis Plan

We first ran descriptive statistics for vocabulary, grammar, and word learning processes in English and Spanish, respectively, followed by a preliminary analysis on whether children's performance varied by language type and language domain. We ran a 2 (language: English and Spanish) × 3 (domain: vocabulary, grammar, and word learning) repeated measures analysis of covariance (ANCOVA), controlling for SES, child age, and dual-language experience.

To examine the cross-language associations in vocabulary, grammar, and word learning processes, we conducted three hierarchical regression models, using vocabulary, grammar, and word learning processes in English as dependent variables, respectively. Step 1 included child age, SES, and dual-language experience as control variables, and vocabulary, grammar, or word learning processes in Spanish as the key predictor; Step 2 included an interaction term between dual-language experience and Spanish skills to test whether the associations varied by dual-language experience.

Finally, we conducted hierarchical regression models to examine the prediction from existing lexical and grammatical knowledge to word learning processes within and across languages, and how the predictive patterns were moderated by dual-language experience. Children's English and Spanish word learning processes were used as dependent variables, respectively. Step 1included child age, SES, and dual-language experience as control variables; Step 2 included vocabulary and grammar in the same language; Step 3 included vocabulary and grammar in the other language; and the last step included dual-language experience interaction terms. We removed nonsignificant interaction terms from the regression models to increase power. To interpret significant interaction terms, we examined the predictive effects of vocabulary and grammar for children who had more balanced bilingual and predominantly Spanish experiences, respectively, by centering dual-language experience at two values: 3 = English and Spanish equally and 5 = Spanish only.

Results

Table 1 presents descriptive statistics for vocabulary, grammar, and word learning processes in

English and Spanish. All variables (i.e., English vocabulary, English grammar, English word learning processes, Spanish vocabulary, Spanish grammar, Spanish word learning processes) were normally distributed, with Skewness ranging from −0.082 to 0.759, and Kurtosis ranging from −1.435 to 0.138. Thus, all variables were treated as continuous variables in the following analyses. A 2 (language: English and Spanish) × 3 (domain: vocabulary, grammar, and word learning process) repeated measures ANCOVA suggested that children's performance did not vary by language ($F(1, 86) = 0.201$, $p = .655$) or domain ($F(2, 172) = 1.903$, $p = .152$), after controlling for SES, child age, and dual-language experience. The interaction term was also nonsignificant ($F(2, 172) = 0.793$, $p = .454$).

Cross-Language, Within-Domain Associations in Vocabulary, Grammar, and Word Learning Processes

We examined cross-language associations in vocabulary, grammar, and word learning processes. Children who had better grammar and better word learning processes in English also scored higher in those domains in Spanish (grammar: $B = .55$, $SE = .09$, $\beta = 0.50$, $p < .001$; word learning process: $B = .61$, $SE = .11$, $\beta = 0.48$, $p < .001$; Models 2 and 3, Table 2). In contrast, children's English vocabulary did not relate to their Spanish vocabulary ($B = .08$, $SE = .08$, $\beta = 0.09$, $p = .326$; Model 1, Table 2). The moderating effect of dual-language experience was not significant for vocabulary, grammar, or word learning processes.

Existing Knowledge Predicting Word Learning Processes

We used hierarchical regression models to examine whether existing knowledge in both languages uniquely contributed to children's ability to learn new words in English and Spanish.

Predicting English Word Learning Processes

We focus on the prediction of English word learning processes first (see Table 3). As expected, English vocabulary ($B = .74$, $SE = .16$, $\beta = 0.48$, $p < .001$) and grammar ($B = .34$, $SE = .11$, $\beta = 0.30$, $p = .002$) uniquely predicted English word learning processes and together explained 30% of the variance over and above age, SES, and dual-language experience (Table 3, Model 1 Step 2). Thus, existing knowledge in both English vocabulary and grammar related to children's ability to learn English words using the processes we tested. However, Spanish vocabulary and grammar did not uniquely contribute to English word learning processes, over and above existing English knowledge (ps > .05, Table 3, Model 1 Step 3).

More importantly, the above predictive patterns varied by children's dual-language experience, as indicated by significant interactions between English grammar and dual-language experience ($B = -.38$, $SE = .13$, $\beta = -1.34$, $p = .006$) and between Spanish grammar and dual-language experience ($B = .32$, $SE = .15$, $\beta = 1.05$, $p = .040$; see Table 3, Model 1 Step 4). To further examine the simple effects, we centered dual-language experience at 5 (i.e., Spanish only) and 3 (i.e., Spanish and English equally), respectively. For children with predominantly Spanish experience, Spanish grammar ($B = .44$, $SE = .22$, $\beta = 0.35$, $p = .053$), rather than English grammar ($B = -.12$, $SE = .20$, $\beta = -0.11$, $p = .531$), positively related to their ability to learn English words. For children with balanced bilingual experience, however, English grammar ($B = .63$, $SE = .16$, $\beta = 0.56$, $p < .001$) but not Spanish grammar ($B = -.20$, $SE = .16$, $\beta = -0.16$, $p = .218$), made a significant contribution. The interaction between dual-language experience and English or Spanish vocabulary was not significant. English vocabulary predicted English word learning processes, regardless of children's dual-language experience.

Predicting Spanish Word Learning Processes

We next look at the prediction of Spanish word learning processes (see Table 3). Again, Spanish vocabulary ($B = .44$, $SE = .09$, $\beta = 0.42$, $p < .001$) and grammar ($B = .36$, $SE = .08$, $\beta = 0.37$, $p < .001$; see Table 3, Model 2 Step 2) predicted Spanish word learning processes, explaining 34% of the variance in addition to age, SES, and dual-language experience. English vocabulary and grammar did not have a unique contribution, after controlling for Spanish knowledge (see Table 3, Model 2 Step 3).

Children's dual-language experience again played a moderating role. The Spanish Grammar × Dual-Language Experience ($B = .25$, $SE = .13$, $\beta = 1.05$, $p = .055$) and English Grammar × Dual-Language Experience ($B = -.32$, $SE = .11$, $\beta = -1.44$, $p = .006$) interactions were marginally significant (see Table 3, Model 2 Step 4). For children with predominantly Spanish experience (i.e., dual-language experience centered at 5), Spanish grammar ($B = .69$, $SE = .19$, $\beta = 0.69$,

Table 2
Cross-Language, Within-Domain Associations in Vocabulary, Grammar, and Word Learning Process

Dependent variables	Models	Steps	Predictors	*B*	*SE*	β	*t*	*p*	95% CI for *B*		*F* change	R^2 change
English vocabulary	1	1	Age	.01	.00	0.58	6.33	.00	0.01	0.02	14.74	.41
			SES	.02	.01	0.14	1.54	.13	−0.01	0.04		
			Dual-language experiences	−.04	.02	−0.17	−1.95	.06	−0.08	0.00		
			SpaVoc	.08	.08	0.09	0.99	.33	−0.08	0.24		
		2	SpaVoc × Exp	.08	.10	0.42	0.82	.42	−0.11	0.27	0.67	.01
English grammar	2	1	Age	.01	.00	0.34	4.06	.00	0.01	0.01	22.70	.52
			SES	.01	.01	0.05	0.62	.54	−0.02	0.03		
			Dual-language experiences	−.04	.03	−0.11	−1.34	.18	−0.09	0.02		
			SpaGram	.55	.09	0.50	5.84	.00	0.36	0.74		
		2	SpaGram × Exp	.18	.12	0.67	1.51	.14	−0.06	0.42	2.27	.01
English process	3	1	Age	.01	.00	0.36	4.17	.00	0.01	0.02	23.63	.53
			SES	.02	.02	0.12	1.42	.16	−0.01	0.05		
			Dual-language experiences	−.03	.03	−0.09	−1.13	.26	−0.09	0.03		
			SpaProc	.61	.11	0.48	5.58	.00	0.39	0.83		
		2	SpaProc × Exp	−.14	.14	−0.47	−1.01	.31	−0.40	0.13	1.03	.01

Note. SES = socioeconomic status.

Table 3
Hierarchical Regression Analyses Predicting English and Spanish Word Learning Processes from Age, English Vocabulary and Grammar, and Spanish Vocabulary and Grammar

Models	Steps	Predictors	*B*	*SE*	β	*t*	*p*	95% CI for *B*		*F* change	R^2 change
1. English process	1	Age	.02	.00	0.57	6.51	.00	0.01	0.02	15.64	.35
		SES	.05	.02	0.25	2.76	.01	0.01	0.08		
		Dual-lang exp	−.02	.03	−0.05	−0.56	.58	−0.09	0.05		
	2	EngVoc	.74	.16	0.48	4.69	.00	0.43	1.05	35.98	.30
		EngGram	.34	.11	0.30	3.15	.00	0.13	0.55		
	3	SpaVoc	.01	.10	0.01	0.08	.93	−0.20	0.22	0.04	.00
		SpaGram	.03	.12	0.02	0.23	.82	−0.21	0.26		
	4	EngGram × Dual-Lang Exp	−.38	.13	−1.34	−2.85	.01	−0.64	−0.11	4.10	.03
		SpaGram × Dual-Lang Exp	.32	.15	1.05	2.09	.04	0.02	0.63		
2. Spanish process	1	Age	.01	.00	0.45	4.78	.00	0.01	0.02	9.82	.26
		SES	.04	.01	0.28	2.87	.01	0.01	0.07		
		Dual-lang exp	.02	.03	0.08	0.80	.43	−0.03	0.08		
	2	SpaVoc	.44	.09	0.42	5.10	.00	0.27	0.61	35.42	.34
		SpaGram	.36	.08	0.37	4.39	.00	0.20	0.53		
	3	EngVoc	.11	.14	0.09	0.77	.45	−0.17	0.38	0.31	.00
		EngGram	−.05	.10	−0.05	−0.48	.63	−0.25	0.15		
	4	SpaGram × Dual-Lang Exp	.25	.13	1.05	1.95	.06	−0.01	0.51	4.03	.04
		EngGram × Dual-Lang Exp	−.32	.11	−1.44	−2.84	.01	−0.54	−0.10		

Note. SES = socioeconomic status.

p = .001) predicted Spanish word learning processes, whereas English grammar *negatively* contributed to children's ability to learn Spanish words (B = −.43, SE = .17, β = −0.48, p = .012). For children with balanced bilingual experience (i.e., dual-language experience centered at 3), however, neither Spanish grammar (p = .191) nor English grammar (p = .122) predicted Spanish word learning processes. For both groups, Spanish vocabulary predicted Spanish word learning processes.

Summary

To summarize, we identified cross-language associations in the domains of grammar and word learning processes, but not in vocabulary. The magnitude of the associations did not vary by children's dual-language experience. Vocabulary uniquely contributed to children's word learning processes in the same language, regardless of dual-language experience. However, the predictive role of grammar varied by dual-language experience. For children with balanced bilingual experience, English grammar uniquely predicted children's ability to learn words in English. For children with predominantly Spanish experience, Spanish grammar contributed to children's ability to learn words in both languages, whereas English grammar played a negative role in Spanish word learning processes.

Discussion

Children learning two languages represent an important test case for examining how relative exposure promotes language-specific development, but also how learning mechanisms operate over stored input to support the acquisition of novel words in both languages. This research is among the first to directly investigate how vocabulary and grammar comprehension within each language may be related to children's ability to acquire new vocabulary words—including nouns, adjectives, and verbs—within and across languages. Three key findings emerged. First, we found evidence for association across languages in the domains of grammar and word learning processes, but not in vocabulary—and this pattern did not vary by dual-language experience. Second, vocabulary and grammar predicted word learning *within* each language, with dual-language experience playing a moderating role in the case of grammar but not vocabulary. Third, and perhaps most importantly, grammar revealed a complex pattern of predictions for word learning processes *across* English and Spanish that varied by dual-language experience and domain. Together, this research extends the field's understanding of language development in DLLs and helps to clarify the interplay between language experience, language development, and language learning in the preschool years. We draw from structural sensitivity theory to interpret associations across languages within linguistic domains and to evaluate effects on word learning within and across languages.

Cross-Language, Within Domain Associations (Vocabulary, Grammar, Word Learning Processes)

Spanish vocabulary was not associated with English vocabulary in this sample of preschool children. A similar lack of cross-linguistic associations within the lexical domain has been previously documented (Simon-Cereijido & Gutiérrez-Clellen, 2009) and is often attributed to variability in the parameters of input, context, and use surrounding children's exposure to each language (Bialystok et al., 2010; Buac et al., 2014; Place & Hoff, 2011). We consider this finding to be consistent with structural sensitivity theory, which may also explain positive associations from prior work (Kohnert et al., 2015; Melby-Lervag & Lervag, 2011). That is, studies that have identified cross-linguistic associations in the lexical domain may be tapping into overlap in meaning as in the case of translation equivalents (Bilson, Yoshida, Tran, Woods, & Hills, 2015; Poulin-Dubois, Kuzyk, Legacy, Zesiger, & Friend, 2018), overlap in form and meaning as in the case of cognates (Simpson Baird, Palacios, & Kibler, 2016), or a general language ability that is shared across languages and emerges from experience with the two (Branum-Martin et al., 2009; Cummins, 1991). In comparison, vocabulary was assessed in this study using a subset of words that belonged to equivalent classes (e.g., prepositions), but were not intended to capture the full range of lexical transfer across languages.

In contrast with vocabulary, the domains of grammar and word learning processes showed positive associations between English and Spanish and provided evidence for cross-linguistic influence. Specifically, children with greater grammar comprehension in English also had greater grammar comprehension in Spanish and the direction and magnitude of the association was identical for children with balanced and asymmetrical dual-language experience. At first glance, this finding may appear to conflict with prior evidence documenting language-specific patterns of grammatical development with limited transfer (Pham, 2016; Thordardottir, 2015). From a structural sensitivity perspective, however, results indicate that children can and do take advantage of overlapping grammatical structures and this process may complement language-specific skills.

Children who were better at word learning in English were also likely to be better at word learning in Spanish, a pattern that did not vary by dual-language experience. Such an association between word learning processes in two languages has not

been reliably demonstrated before. Thus, this research is among the first to show that word learning processes may be associated across both languages and is the first to have explored this question in a heterogeneous group of DLLs while accounting for the role of prior language experience. It is likely that children's performance on fast mapping, syntactic bootstrapping, and syntactic transformation trials relied upon an associative mechanism that is fundamental to early lexical acquisition and might be applied across both languages because English and Spanish share structural features that may be mutually informative for word learning (e.g., SVO syntax). In a language with a distinct word order (e.g., Japanese) or a language that relies upon agglutinative morphology over syntax (e.g., Hungarian), we might expect less of a relation. Furthermore, language typology may account for some of the variation found in previous research (Kan & Kohnert, 2012; Odlin, 1989) and has been highlighted as critical for understanding patterns of early bilingual development (Floccia et al., 2018). There is ongoing debate as to whether typology matters at different stages of dual language acquisition, and whether it may in fact be the learner's processing capacity that results in different degrees of transfer at a given developmental stage (Manfred Pienemann & Kawaguchi, 2005). Nonetheless, this explanation aligns with recent evidence that cross-linguistic effects on language development may vary by the amount of overlap (lexical, phonological, or morphological) between language pairs—a construct known as linguistic distance (Floccia et al., 2018; Persici, Vihman, Burro, & Majorano, 2019).

Existing Knowledge Predicting Word Learning Processes—Within and Across Languages

Another aim of this research was to determine if children's vocabulary and grammar comprehension would predict the ability to acquire new words, in one or both languages. First, children's language-specific vocabulary comprehension predicted word learning within each language respectively, over and above age, SES, and dual-language experience. This pattern aligns with prior evidence in monolinguals (Bion et al., 2013) and suggests that word learning processes may be inextricably linked with vocabulary comprehension in each language for DLLs as well. Although one prior study found similar evidence in a longitudinal sample (Kan & Kohnert, 2012), the current work is the first to document this predictive association concurrently. Contrary to our original hypothesis, this pattern did not vary significantly with children's dual-language experiences. This finding suggests that children rely on semantic and lexical knowledge in each language to acquire new words within that language and that this skill may be applicable for children who receive balanced input as well as those with more asymmetrical language experiences.

Second, grammar's role in predicting word learning processes *within* each language was more complex. English grammar comprehension predicted English word learning processes for children with balanced dual-language experience, but not for children with predominantly Spanish experience. Spanish grammar comprehension predicted Spanish word learning processes for children with predominantly Spanish experience, but not for children with balanced bilingual experience. Thus, it appears that children's dual-language experience moderates the association between grammar comprehension within one of their languages and their ability to acquire new words within that same language. This finding is distinct from our original hypothesis in which we expected English grammar to predict English word learning for children with predominantly Spanish experience who were at the initial stages of English acquisition. Rather, the current findings emphasize the role of language-specific experiences in acquisition within that language. Given prior work on the importance of both lexical and grammatical growth for bilingual development (Hoff, Quinn, & Giguere, 2018), future research should evaluate whether predictive associations across linguistic domains hold into kindergarten and beyond using longitudinal samples.

Across languages, this study identified a complex pattern of predictive associations where the presence and direction were moderated by children's dual-language experience. For children with balanced experience in English and Spanish, there were no cross-language predictions for English word learning processes or for Spanish word learning processes. For children with predominantly Spanish experience, however, Spanish grammar comprehension positively predicted word learning in English. Along with evidence from our study, the finding of a unidirectional positive cross-linguistic prediction from the language with more experience (i.e., stronger) to the language with less experience (i.e., weaker) is of critical importance and can be interpreted in the context of literature showing that children's proficiency in their primary language provides a critical springboard for

acquisition of their second, or nondominant language (Altman et al., 2018; Kan & Kohnert, 2012; Pham, 2016). Evidence for cross-linguistic support in English and Spanish word learning for children with predominantly Spanish experience also suggests that there may be a benefit to building a solid linguistic foundation in one language (in this case, Spanish) while receiving sufficient exposure to a second language (here, English) to leverage language-dependent knowledge about structures across the two.

Another key result was that English grammar *negatively* predicted children's Spanish word learning processes for children with predominantly Spanish experience. One prior study identified a similar negative association between vocabulary in English and fast mapping in Hmong in a sample of preschool children for whom Hmong was the primary language (Kan & Kohnert, 2012). It is possible to interpret this finding in relation to the process of *attrition* or *takeover* identified in previous literature, where children's acquisition of a second (typically majority) language interferes with or negatively impacts learning in their other (typically minority or heritage) language under some circumstances (Gathercole & Thomas, 2009; Hoff et al., 2018; Kan & Kohnert, 2012). Although little is known about the factors that contribute to interference in developmental contexts, this finding may have significant educational and policy implications for the growing population of children acquiring more than one language. Whereas there may be multiple pathways to support children's acquisition of the majority language (in this case, English), continued development of the home language (in this case, Spanish) may be more challenging due to more limited contexts for Spanish exposure and use outside of the home environment. Together with the evidence for a conditional relationship in which growth in Spanish may contribute to growth in English but not vice versa, findings reflect a potential imbalance between a child's two languages and underscore the need for educational programming that supports the child's first language in combination with English especially if the goal is to promote bilingual development (Mallikarjun, Newman, & Novick, 2017).

In sum, this study extends the literature on dual language acquisition by clarifying how children's established linguistic knowledge in either language may interface with mechanisms that drive word learning in both languages (Antovich & Graf Estes, 2018). Results are consistent with a dynamic view of bilingualism as a product of the child's individual experiences and internal cognitive learning mechanisms. Structural overlap provides a viable mechanism for guiding transfer, but our findings indicate that associations within and across languages cannot be evaluated without attention to children's dual-language experiences. Although prior work has evaluated structural sensitivity theory in the context of a bilingual advantage compared with children learning one language (Kuo & Anderson, 2012), the current work broadens its theoretical reach by considering implications for cross-language transfer. Our findings are also compatible with a constructivist framework offered by computational models of bilingual language acquisition that have emerged over the last decade (Curtin, Byers-Heinlein, & Werker, 2011; Fang, Zinszer, Malt, & Li, 2016; Zhao & Li, 2010), although much remains to be learned about the parameters and constraints that lead to optimal learning across languages—both in the moment and over time (Braginsky, Yurovsky, Marchman, & Frank, 2019).

Limitations

There are several limitations with the present investigation of within and across-language associations in the developing language system of preschoolers with exposure to both Spanish and English. First, this research utilized cross-sectional, correlational data collected at a single point in development. Results should be interpreted with caution as they are unable to provide information about dual language trajectories or whether vocabulary, grammar, and word learning processes are causally related to one another. It remains an open question whether lexical or grammatical knowledge in a particular language continue to predict acquisition and growth at later stages of development, or whether the association between word knowledge and language learning is more variable at advanced stages as has been identified in monolingual children. Future research might test whether word learning processes in preschool goes on to predict later language outcomes at school entry and explore clinically relevant questions such as whether interventions that target areas of potential transfer (e.g., metalinguistic awareness of specific features with varying degrees of structural overlap) might be more effective at supporting growth in two languages than approaches designed to teach content (e.g., vocabulary words) in a single language. Furthermore, it is impossible to determine from the present results whether word learning processes are better conceptualized as an explanatory or an

outcome variable. Results provide evidence that vocabulary and grammar predict word learning processes, but it is highly likely that word learning processes also contribute to vocabulary and grammar development. Future research based on data collected at multiple time points is needed to test these alternatives in predictive models.

Second, this study relied upon parent report to characterize the nature of children's language input and use. Although this approach is widely accepted, a direct measure of children's language input and use based on naturalistic audio recordings of the home environment may provide a more accurate metric. Children's daily experiences within specific environments and within the broader sociolinguistic context play an integral role in the nature and course of language development (MacLeod, Castellanos-Ryan, Parent, Jacques, & Séguin, 2019). Future research must pay close to attention to the ways in which interactions and interlocutors (e.g., peers, siblings) influence language outcomes (Rojas et al., 2016) and the ways in which language exposure patterns may change over time as children enter formal schooling.

A third set of limitations relates to instrumentation. As the QUILS:ES is a new tool, data on its reliability and validity are limited. The QUILS:ES shows strong test-retest reliability and correlates with the English and Spanish PLS–5, a standardized measure of bilingual language development, but additional research is needed to corroborate the tool's psychometric soundness. Measures of expressive language may reveal other important information about children's language use that cannot be captured with a receptive tool. These limitations speak to a clear need for more instruments that are designed to evaluate language development in DLLs.

Conclusion

The growing population of DLLs in American classrooms increases the need for a better understanding of bilingual development. Findings from this study argue for research that not only investigates existing knowledge in linguistic domains such as grammar and vocabulary, but also considers the role of the child's word learning processes in combination with prior language experience. This evidence and the interpretations we offer also add to the developmental and language literatures that seek to describe complex acquisition patterns observed in bilingualism by confirming that dual-language experience is undoubtedly a critical source of variation and more importantly, that word learning processes should not be ignored. Moving forward, curricula designed to target both of a child's languages in a way that carefully considers relative exposure and use as well as dynamic links between vocabulary, grammar, and word learning processes may be more likely to promote successful acquisition of dual language skills and enhance academic outcomes during the preschool years.

References

Altman, C., Goldstein, T., & Armon-Lotem, S. (2018). Vocabulary, metalinguistic awareness and language dominance among bilingual preschool children. *Frontiers in Psychology*, *9*, 1953. https://doi.org/10.3389/fpsyg.2018.01953

Antovich, D. M., & Graf Estes, K. (2018). Learning across languages: Bilingual experience supports dual language statistical word segmentation. *Developmental Science*, *21*, e12548. https://doi.org/10.1111/desc.12548

Arias-Trejo, N., & Plunkett, K. (2013). What's in a link: Associative and taxonomic priming effects in the infant lexicon. *Cognition*, *128*, 214–227. https://doi.org/10.1016/j.cognition.2013.03.008

Arunachalam, S., Leddon, E. M., Song, H., Lee, Y., & Waxman, S. R. (2013). Doing more with less: Verb learning in Korean-acquiring 24-month-olds. *Language Acquisition*, *20*, 292–304. https://doi.org/10.1080/10489223.2013.828059

Arunachalam, S., & Waxman, S. R. (2010). Meaning from syntax: Evidence from 2-year-olds. *Cognition*, *114*, 442–446. https://doi.org/10.1016/j.cognition.2009.10.015

Baldie, B. J. (1976). The acquisition of the passive voice. *Journal of Child Language*, *3*, 331–348. https://doi.org/10.1017/S0305000900007224

Bedore, L. M., Peña, E. D., Summers, C. L., Boerger, K. M., Resendiz, M. D., Greene, K., . . . Gillam, R. B. (2012). The measure matters: Language dominance profiles across measures in Spanish-English bilingual children. *Bilingualism: Language and Cognition*, *15*, 616–629. https://doi.org/10.1017/S1366728912000090

Bialystok, E., Luk, G., Peets, K. F., & Yang, S. (2010). Receptive vocabulary differences in monolingual and bilingual children. *Bilingualism: Language and Cognition*, *13*, 525–531. https://doi.org/10.1017/S136672890999042

Bilson, S., Yoshida, H., Tran, C. D., Woods, E. A., & Hills, T. T. (2015). Semantic facilitation in bilingual first language acquisition. *Cognition*, *140*, 122–134. https://doi.org/10.1017/S136672890999042

Bion, R. A. H., Borovsky, A., & Fernald, A. (2013). Fast mapping, slow learning: Disambiguation of novel word-object mappings in relation to vocabulary learning at 18, 24, and 30 months. *Cognition*, *126*(1), 39–53. https://doi.org/10.1016/j.cognition.2012.08.008

Booth, A. E., & Waxman, S. R. (2009). A horse of a different color:Specifying with precision infants' mappings of

novel nouns and adjectives. *Child Development*, *80*(1), 15–22. https://doi.org/10.1111/j.1467-8624.2008.01242.x

Braginsky, M., Yurovsky, D., Marchman, V., & Frank, M. (2019). Consistency and variability in children's word learning across languages. *Open Mind*, *3*, 52–67. https://doi.org/10.1162/opmi_a_00026

Branum-Martin, L., Mehta, P. D., Francis, D. J., Foorman, B. R., Cirino, P. T., Miller, J. F., & Iglesias, A. (2009). Pictures and words: Spanish and English vocabulary in classrooms. *Journal of Educational Psychology*, *101*, 897. https://doi.org/10.1037/a0015817

Buac, M., Gross, M., & Kaushanskaya, M. (2014). The role of primary caregiver vocabulary knowledge in the development of bilingual children's vocabulary skills. *Journal of Speech, Language, and Hearing Research*, *57*, 1804–1816. https://doi.org/10.1044/2014_JSLHR-L-13-0055

Buac, M., Gross, M., & Kaushanskaya, M. (2016). Predictors of processing-based task performance in bilingual and monolingual children. *Journal of Communication Disorders*, *62*, 12–29. https://doi.org/10.1016/j.jcomdis.2016.04.001

Byers-Heinlein, K., Fennell, C. T., & Werker, J. F. (2013). The development of associative word learning in monolingual and bilingual infants. *Bilingualism: Language and Cognition*, *16*, 198–205. https://doi.org/10.1017/S1366728912000417.

Carey, S., & Bartlett, E. (1978). Acquiring a single new word. *Papers and Reports on Child Language Development*, *15*, 17–29.

Chan, A., Lieven, E., & Tomasello, M. (2009). Children's understanding of the agent–patient relations in the transitive construction: Cross-linguistic comparisons between Cantonese, German, and English. *Cognitive Linguistics*, *20*, 267–300. https://doi.org/10.1515/COGL.2009.015

Cummins, J. (1991). Interdependence of first-and second-language proficiency in bilingual children. In B. Education (Ed.), *Language processing in bilingual children* (pp. 70–89). Cambridge, UK: Cambridge University Press.

Curtin S., Byers-Heinlein K., Werker J. F. (2011). Bilingual beginnings as a lens for theory development: PRIMIR in focus. *Journal of Phonetics*, *39*, (4), 492–504. https://doi.org/10.1016/j.wocn.2010.12.002.

Dale, P. S., & Fenson, L. (1996). Lexical development norms for young children. *Behavior Research Methods, Instruments, & Computers*, *28*, 125–127. https://doi.org/10.3758/BF03203646

Davies, M. (2012). *Corpus del Español (100 million words, 1200s–1900s)*. 2002. Retrieved from http://www.corpusdelespanol.org

de Villiers, J. G., & de Villiers, P. A. (1973). Development of the use of word order in comprehension. *Journal of Psycholinguistic Research*, *2*, 331–341. https://doi.org/10.1007/BF01067055

De Villiers, J. G., & Roeper, T. (1996). Questions after stories: Supplying context and removing it as a variable. In D. McDaniel, H. Cairns, & C. McKee (Eds.), *Methods for assessing children's syntax* (pp. 163–188). Cambridge MA: MIT Press.

Deen, K. U. (2011). The acquisition of the passive. In: J. de Villiers & T. Roeper (Eds.), *Handbook of generative approaches to language acquisition. Studies in theoretical psycholinguistics* (Vol. *41*, pp. 155–188). Dordrecht, The Netherlands: Springer.

Fang, S. Y., Zinszer, B. D., Malt, B. C., & Li, P. (2016). Bilingual object naming: A connectionist model. *Frontiers in Psychology*, *7*, 644. https://doi.org/10.3389/fpsyg.2016.00644

Fisher, C., Gertner, Y., Scott, R. M., & Yuan, S. (2010). Syntactic bootstrapping. *Wiley Interdisciplinary Reviews: Cognitive Science*, *1*, 143–149. https://doi.org/10.1002/wcs.17

Floccia, C., Sambrook, T. D., Delle Luche, C., Kwok, R., Goslin, J., White, L., . . . Plunkett, K. (2018). Vocabulary of 2-year-olds learning English and an additional language: Norms and effects of linguistic distance, Introduction. *Monographs of the Society for Research in Child Development*, *83*(1), 7–29. https://doi.org/10.1111/mono.12348.

Gathercole, V. C. M., & Thomas, E. M. (2009). Bilingual first-language development: Dominant language take-over, threatened minority language take-up. *Bilingualism: Language and Cognition*, *12*, 213–237. https://doi.org/10.1017/S1366728909004015

Gelman, S. A., & Markman, E. M. (1985). Implicit contrast in adjectives vs. nouns: Implications for word-learning in preschoolers. *Journal of Child Language*, *12*, 125–143.

Gertner, Y., Fisher, C., & Eisengart, J. (2006). Learning words and rules: Abstract knowledge of word order in early sentence comprehension. *Psychological Science*, *17*, 684–691.

Gleitman, L. (1990). The structural sources of verb meanings. *Language Acquisition*, *1*(1), 3–55.

Goodrich, J. M., & Lonigan, C. J. (2017). Language-independent and language-specific aspects of early literacy: An evaluation of the common underlying proficiency model. *Journal of Educational Psychology*, *109*, 782–793. https://doi.org/10.1037/edu0000179

Gray, S. (2004). Word learning by preschoolers with specific language impairment: Predictors and poor learners. *Journal of Speech, Language, and Hearing Research*, *47*, 1117–1132.

Hoff, E. (2013). Interpreting early language trajectories of children from low-SES and language minority homes: Implications for closing achievement gaps. *Developmental Psychology*, *49*(1), 4–14.

Hoff, E., Core, C., Place, S., Rumiche, R., Señor, M., & Parra, M. (2012). Dual language exposure and early bilingual development. *Journal of Child Language*, *39*(1), 1–27.

Hoff, E., Quinn, J. M., & Giguere, D. (2018). What explains the correlation between growth in vocabulary and grammar? New evidence from latent change score analyses of simultaneous bilingual development. *Developmental Science*, *21*, e12536.

Hollich, G., Hirsh-Pasek, K., & Golinkoff, R. M. (2000). I. What Does it Take to Learn a Word? *Monographs of the Society for Research in. Child Development*, *65*(3), 1–16. https://doi.org/10.1111/1540-5834.00091.

Huang, Y. T., Zheng, X., Meng, X., & Snedeker, J. (2013). Children's assignment of grammatical roles in the online processing of Mandarin passive sentences. *Journal of Memory and Language*, *69*, 589–606.

Iglesias, A., de Villiers, J. G., Golinkoff, R., Hirsh-Pasek, K., & Wilson, M. S. (in press). *The QUILS-ES: A measure of vocabulary, syntax, and language acquisition skills in young bilingual children*. Baltimore, MD: Paul H. Brookes.

Jackson, E., Leitao, S., Claessen, M., & Boyes, M. (2019). Fast mapping short and long words: Examining the influence of phonological short-term memory and receptive vocabulary in children with developmental language disorder. *Journal of Communication Disorders*, *79*, 11–23. https://doi.org/10.1016/j.jcomdis.2019.02.001

Janse, E., & Newman, R. S. (2013). Identifying nonwords: Effects of lexical neighborhoods, phonotactic probability, and listener characteristics. *Language and Speech*, *56*, 421–441. https://doi.org/10.1177/0023830912447914

Jardak, A., & Byers-Heinlein, K. (2019). Labels or concepts? The development of semantic networks in bilingual two-year-olds. *Child Development*, *90*, e212–e229. https://doi.org/10.1111/cdev.13050

Johnson V. E., de Villiers J. G. (2009). Syntactic frames in fast mapping verbs: Effect of age, dialect, and clinical status. *Journal of Speech, Language, and Hearing Research*, *52*, (3), 610–622.

Kalashnikova, M., Escudero, P., & Kidd, E. (2018). The development of fast-mapping and novel word retention strategies in monolingual and bilingual infants. *Developmental Science*, *21*, e12674. https://doi.org/10.1111/desc.12674

Kan, P. F., & Kohnert, K. (2008). Fast mapping by bilingual preschool children. *Journal of Child Language*, *35*, 495–514. https://doi.org/10.1017/S0305000907008604

Kan, P. F., & Kohnert, K. (2012). A growth curve analysis of novel word learning by sequential bilingual preschool children. *Bilingualism: Language and Cognition*, *15*, 452–469. https://doi.org/10.1017/S1366728911000356

Katerelos, M., Poulin-Dubois, D., & Oshima-Takane, Y. (2011). A cross-linguistic study of word-mapping in 18- to 20-month-old infants. *Infancy*, *16*, 508–534. https://doi.org/10.1111/j.1532-7078.2010.00064.x

Kohnert, K., Kan, P. F., & Conboy, B. T. (2015). Lexical and grammatical associations in sequential bilingual preschoolers. *Journal of Speech Language and Hearing Research*, *53*, 684–698. https://doi.org/10.1044/1092-4388(2009/08-0126)

Kroll, J. F., & Bialystok, E. (2013). Understanding the consequences of bilingualism for language processing and cognition. *Journal of Cognitive Psychology*, *25*, 497–514. https://doi.org/10.1080/20445911.2013.799170

Kuo, L. J., & Anderson, R. C. (2012). Effects of early bilingualism on learning phonological regularities in a new language. *Journal of Experimental Child Psychology*, *111*, 455–467. https://doi.org/10.1016/j.jecp.2011.08.013

Kuo, L. J., Uchikoshi, Y., Kim, T. J., & Yang, X. (2016). Bilingualism and phonological awareness: Re-examining theories of cross-language transfer and structural sensitivity. *Contemporary Educational Psychology*, *46*, 1–9. https://doi.org/10.1016/j.cedpsych.2016.03.002

Leech, K. A., Rowe, M. L., & Huang, Y. (2016). Variations in the recruitment of syntactic knowledge contribute to SES differences in syntactic development. *Journal of Child Language*, *44*, 995–1009.

MacLeod, A. A., Castellanos-Ryan, N., Parent, S., Jacques, S., & Séguin, J. R. (2019). Modelling vocabulary development among multilingual children prior to and following the transition to school entry. *International Journal of Bilingual Education and Bilingualism*, *22*, 473–492. https://doi.org/10.1080/13670050.2016.1269718

Maier, M. F., Bohlmann, N. L., & Palacios, N. A. (2016). Cross-language associations in the development of preschoolers' receptive and expressive vocabulary. *Early Childhood Research Quarterly*, *36*, 49–63. https://doi.org/10.1016/j.ecresq.2015.11.006

Mallikarjun, A., Newman, R. S., & Novick, J. M. (2017). Exploiting the interconnected lexicon: Bootstrapping English language learning in young Spanish speakers. *Translational Issues in Psychological Science*, *3*(1), 34–47. https://doi.org/10.1037/tps0000105

Manfred Pienemann, B. D., & Kawaguchi, S. (2005). Processability, typological distance. *Cross-linguistic Aspects of Processability Theory*, *30*, 85.

Marchman, V. A., Martínez-Sussmann, C., & Dale, P. S. (2004). The language-specific nature of grammatical development: Evidence from bilingual language learners. *Developmental Science*, *7*, 212–224. https://doi.org/10.1111/j.1467-7687.2004.00340.x

Masterson, J., Druks, J., & Gallienne, D. (2008). Object and action picture naming in three-and five-year-old children. *Journal of Child Language*, *35*, 373–402. https://doi.org/10.1017/S0305000907008549

Melby-Lervag, M., & Lervag, A. (2011). Cross-linguistic transfer of oral language, decoding, phonological awareness and reading comprehension: A meta-analysis of the correlational evidence. *Journal of Research in Reading*, *34*, 114–135. https://doi.org/10.1111/j.1467-9817.2010.01477.x

Messenger, K., & Fisher, C. (2018). Mistakes weren't made: Three-year-olds' comprehension of novel-verb passives provides evidence for early abstract syntax. *Cognition*, *178*, 118–132. https://doi.org/10.1016/j.cognition.2018.05.002

Naigles, L. (1990). Children use syntax to learn verb meanings. *Journal of Child Language*, *17*(2), 357–374. https://doi.org/10.1017/S0305000900013817

Nicoladis, E. (2006). Cross-linguistic transfer in adjective–noun strings by preschool bilingual children. *Bilingualism: Language and Cognition*, *9*(1), 15–32. https://doi.org/10.1017/S136672890500235X

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

Oller, D. K., Pearson, B. Z., & Cobo-Lewis, A. B. (2007). Profile effects in early bilingual language and literacy. *Applied Psycholinguistics*, *28*, 191–230. https://doi.org/10.1017/S0142716407070117

Paradis, J., Rusk, B., Duncan, T. S., & Govindarajan, K. (2017). Children's second language acquisition of English complex syntax: The role of age, input, and cognitive factors. *Annual Review of Applied Linguistics*, *37*, 148–167. https://doi.org/10.1017/S0267190517000022

Parra, M., Hoff, E., & Core, C. (2011). Relations among language exposure, phonological memory, and language development in Spanish-English bilingually developing 2-year-olds. *Journal of Experimental Child Psychology*, *108*, 113–125. https://doi.org/10.1016/j.jecp.2010.07.011

Peña, E. D., Bedore, L. M., & Zlatic-Giunta, R. (2002). Category-generation performance of bilingual children. *Journal of Speech, Language, and Hearing Research*, *45*, 938–947. https://doi.org/10.1044/1092-4388(2002/076)

Persici, V., Vihman, M., Burro, R., & Majorano, M. (2019). Lexical access and competition in bilingual children: The role of proficiency and the lexical similarity of the two languages. *Journal of Experimental Child Psychology*, *179*, 103–125. https://doi.org/10.1016/j.jecp.2018.10.002

Pham, G. (2016). Pathways for learning two languages: Lexical and grammatical associations within and across languages in sequential bilingual children. *Bilingualism*, *19*, 928–938. https://doi.org/10.1017/S1366728915000899

Place S., Hoff E. (2011). Properties of dual language exposure that influence 2-year-olds' bilingual proficiency. *Child Development*, *82*, (6), 1834–1849. https://doi.org/10.1111/j.1467-8624.2011.01660.x

Poulin-Dubois, D., Kuzyk, O., Legacy, J., Zesiger, P., & Friend, M. (2018). Translation equivalents facilitate lexical access in very young bilinguals. *Bilingualism: Language and Cognition*, *21*, 856–866. https://doi.org/10.1017/S1366728917000657

Ribot, K. M., Hoff, E., & Burridge, A. (2018). Language use contributes to expressive language growth: Evidence from bilingual children. *Child Development*, *89*, 929–940. https://doi.org/10.1111/cdev.12770

Rinker, T., Budde-Spengler, N., & Sachse, S. (2017). The relationship between first language (L1) and second language (L2) lexical development in young Turkish-German children. *International Journal of Bilingual Education and Bilingualism*, *20*, 218–233. https://doi.org/10.1080/13670050.2016.1179260

Rispoli, M., Hadley, P. A., & Holt, J. K. (2012). Sequence and system in the acquisition of tense and agreement. *Journal of Speech, Language, and Hearing Research*, *55*, 1007–1021. https://doi.org/10.1044/1092-4388(2011/10-0272)

Rojas, R., & Iglesias, A. (2013). The language growth of Spanish-speaking English language learners. *Child Development*, *84*, 630–646. https://doi.org/10.1111/j.1467-8624.2012.01871.x

Rojas, R., Iglesias, A., Bunta, F., Goldstein, B., Goldenberg, C., & Reese, L. (2016). Interlocutor differential effects on the expressive language skills of Spanish-speaking English learners. *International Journal of Speech-Language Pathology*, *18*, 166–177. https://doi.org/10.3109/17549507.2015.1081290

Rowland, C. F., Pine, J. M., Lieven, E. V., & Theakston, A. L. (2003). Determinants of acquisition order in wh-questions: Re-evaluating the role of caregiver speech. *Journal of Child Language*, *30*, 609–635. https://doi.org/10.1017/S0305000903005695

Sanoudaki, E., & Thierry, G. (2015). Language non-selective syntactic activation in early bilinguals: the role of verbal fluency. *International Journal of Bilingual Education and Bilingualism*, *18*, 548–560. https://doi.org/10.1080/13670050.2015.1027143

Schmid, M. S., & Köpke, B. (2017). The relevance of first language attrition to theories of bilingual development. *Linguistic Approaches to Bilingualism*, *7*, 637–667. https://doi.org/10.1075/lab.17058.sch

Schmidt, A., de Oliveira Franco, M. G., dos Santos Lotério, L., & Gomes, G. F. (2016). Learning name–object relations after a single exclusion trial in 18- to 48-month-old children. *The Psychological Record*, *66*(1), 53–63. https://doi.org/10.1007/s40732-015-0151-2

Scott R. M., Fisher C. (2012). 2.5-Year-olds use cross-situational consistency to learn verbs under referential uncertainty. *Cognition*, *122*, (2), 163–180.

Seymour, H. N., Roeper, T., De Villiers, J., & de Villiers, P. A. (2003). *Diagnostic evaluation of language variation—Screening test*. San Antonio, TX: The Psychological Corporation.

Simon-Cereijido, G., & Gutiérrez-Clellen, V. F. (2009). A cross-linguistic and bilingual evaluation of the interdependence between lexical and grammatical domains. *Applied Psycholinguistics*, *30*, 315–337. https://doi.org/10.1017/S0142716409090134

Simpson Baird A., Palacios N., Kibler A. (2016). he cognate and false cognate knowledge of young emergent bilinguals. *Language Learning*, *66*, (2), 448–470. https://doi.org/10.1111/lang.12160.

Singh, L. (2014). One world, two languages: Cross-language semantic priming in bilingual toddlers. *Child Development*, *85*, 755–766. https://doi.org/10.1111/cdev.12133

Singh L., Fu C., Tay W. Z., Golinkoff R. M. (2017). Novel word learning in monolingual and bilingual infants: Evidence of a bilingual advantage. *Child Development*, *89*, (3), 183–198.

Stadthagen-Gonzalez, H., & Davis, C. J. (2006). The Bristol norms for age of acquisition, imeageability, and familiarity. *Behavior Research Methods*, *38*, 598–605.

Thordardottir, E. (2015). The relationship between bilingual exposure and morphosyntactic development. *International Journal of Speech-Language Pathology*, *17*, 97–114. https://doi.org/10.3109/17549507.2014.923509

Vasilyeva, M., Waterfall, H., Gámez, P. B., Gómez, L. E., Bowers, E., & Shimpi, P. (2010). Cross-linguistic syntactic priming in bilingual children. *Journal of Child Language*, *37*, 1047–1064. https://doi.org/10.1017/S0305000909990213

Von Holzen K., Mani N. (2012). Language nonselective lexical access in bilingual toddlers. *Journal of Experimental Child Psychology*, *113*, (4), 569–586.

Waxman S. R., & Klibanoff R. S. (2000). The role of comparison in the extension of novel adjectives. *Developmental Psychology*, *36*, (5), 571. https://doi.org/10.1037/0012-1649.36.5.571

Zhao, X., & Li, P. (2010). Bilingual lexical interactions in an unsupervised neural network model. *International Journal of Bilingual Education and Bilingualism*, *13*, 505–524. https://doi.org/10.1080/13670050.2010.488284

Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (2012). *Preschool Language Scale-5th edition Spanish (PLS–5 Spanish)*. San Antonio, TX: Psychological Corporation.

Zosh, J. M., Brinster, M., & Halberda, J. (2013). Optimal contrast: Competition between two referents improves word learning. *Applied Developmental Science*, *17*(1), 20–28. https://doi.org/10.1080/10888691.2013.748420

Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Appendix S1. QUILS:ES supplementary materials and language questionnaire.