# Lexical–Semantic Organization in Bilingual Children: Evidence From a Repeated Word Association Task

**Li Sheng**
Northwestern University, Evanston, IL

**Karla K. McGregor**
University of Iowa, Iowa City

**Viorica Marian**
Northwestern University

**Purpose:** This study examined lexical–semantic organization of bilingual children in their 2 languages and in relation to monolingual age-mates.
**Method:** Twelve Mandarin–English bilingual and 12 English monolingual children generated 3 associations to each of 36 words. Responses were coded as paradigmatic (*dog–cat*) or syntagmatic (*dog–bark*).
**Results:** Within the bilingual group, word association performance was comparable and correlated between 1st and 2nd languages. Bilingual and monolingual children demonstrated similar patterns of responses, but subtle group differences were also revealed. When between-group comparisons were made on English measures, there was a bilingual advantage in paradigmatic responding during the 1st elicitation and for verbs.
**Conclusion:** Results support previous studies in finding parallel development in bilinguals' 1st- and 2nd-language lexical–semantic skills and provide preliminary evidence that bilingualism may enhance paradigmatic organization of the semantic lexicon.

**KEY WORDS: bilingual, lexical–semantic organization, syntagmatic–paradigmatic shift, word association**

To achieve a fully developed lexicon, a child not only has to add new entries to the extant vocabulary store but also needs to organize this store into an efficient system. An important shift in the organization of the semantic lexicon around middle childhood is well documented in monolingual children (Nelson, 1977). Of interest in this article is the semantic organization of bilingual children aged 5 to 8 years, the age period when this developmental shift occurs.

## Lexical–Semantic Organization in Monolingual Children

*Thematic* relations, which involve co-occurrence in event schemas (e.g., *dog–bone*), and *taxonomic* relations, which involve hierarchical category membership (e.g., *dog–horse, animal*), are basic organizational principles of the semantic lexicon. Although both relations are available at an early age (Waxman & Gelman, 1986), a shift from thematic to taxonomic strategies is evident such that, with age, taxonomic relations become increasingly salient in structuring children's semantic networks and guiding the retrieval of semantic knowledge. The thematic-to-taxonomic shift is thought to result from the fast expansion of vocabulary and world knowledge characteristic of middle childhood. This shift has

been shown in a variety of verbal tasks. For example, in cued and free recall tasks, preschoolers more frequently used event schemas in clustering words to facilitate recall, whereas second-graders more readily discerned the common categorical features of the items to be recalled (Corsale & Ornstein, 1980). In category-generation tasks, kindergarteners generated more items in the contextually constrained slot-filler condition (e.g., name animals found at the zoo) than in the taxonomic condition (e.g., name animals), whereas second-graders generated more items in the taxonomic condition than in the slot-filler condition (Nelson & Nelson, 1990). Furthermore, a similar shift toward taxonomic organization was revealed in automatic semantic processing. In kindergarteners, thematic primes (e.g., *bone*), but not taxonomic primes (e.g., *horse*), facilitated naming times (e.g., *dog*). In second-graders, however, facilitation in naming times was evidenced after either prime (McCauley, Weil, & Sperber, 1976).

Although this shift in salience from thematic to taxonomic organization does not necessarily generalize across all cultures (Cole, 1990; Greenfield, 1997), evidence exists for its transportability across industrialized and schooled societies. For example, Yu and Nelson (1993) administered a category-generation task to monolingual Korean-speaking children and found a similar shift from better responding in the slot-filler condition to better responding in the taxonomic condition as shown in English-speaking children.

A parallel developmental phenomenon, the *syntagmatic–paradigmatic shift,* is observed in children's responses in word association tasks. At age 5, most children respond to a word stimulus with a word that follows in a syntactic sequence (e.g., *cold–outside*). By age 9, most children respond with a word from the same form class or paradigm (e.g., *cold–hot*). Researchers consequently termed responses from different form classes *syntagmatic* and those from the same class *paradigmatic*. A predominance of paradigmatic over syntagmatic responses is indicative of a more developed semantic system, as this pattern is typical of mature language users (Lippman, 1971). A number of factors have been implicated as mechanisms driving this shift in word association responses, such as a shift in conceptual organization (Nelson, 1977), changes in an individual's interpretation of the task as a result of formal schooling (Cole, 1990; Nelson, 1977), and the acquisition of reading (Cronin, 2002).

Compared with the thematic–taxonomic distinction, which is used mainly for categorizing object kinds (i.e., nouns), the syntagmatic–paradigmatic distinction pertains to all form classes (e.g., adjectives, nouns, verbs). Frequency of syntagmatic and paradigmatic responses is dependent upon form class, word frequency, and the particular features of the stimulus words (e.g., whether the stimuli are contrastive, such as *big* and *small,* or noncontrastive, such as *yellow*; Entwisle, 1966). The syntagmatic–paradigmatic shift is observed most predominantly in high-frequency adjectives, whereas nouns tend to be paradigmatic even at early stages, and verbs are more strongly syntagmatic (Nelson, 1977). These patterns are in keeping with Miller and Fellbaum's (1991) conclusion that central sense relations differ for different word classes. For example, an understanding of paradigmatic relations (i.e., synonymy, antonymy, gradation) is central in the acquisition of adjectives, which may facilitate an earlier and more complete shift from syntagmatic to paradigmatic responding for adjectives versus other word classes.

## Lexical–Semantic Organization in Bilingual Children

Studies of bilingual children's lexical–semantic knowledge can provide much-needed information about the simultaneous development of two linguistic systems. Furthermore, such studies may shed light on the driving forces of lexical–semantic development, be they general developmental factors (e.g., age/cognitive maturity, schooling, or reading acquisition), or specific linguistic factors (e.g., proficiency or exposure in a certain language). If lexical–semantic organization is shaped by general cognitive factors that transcend the boundaries of language, we may expect to see parallel development in each of a bilingual person's two languages and in individuals learning one or two languages. If, however, linguistic/experiential factors dictate lexical–semantic organization, we may expect differences in rate or pattern of development between monolinguals and bilinguals and between bilinguals' two languages.

Lexical–semantic organization is relatively less studied than other linguistic domains among bilingual children (Lindholm, 1980). An exception is Peña, Bedore, and Zlatic-Giunta (2002), who extended the category-generation paradigm (Nelson & Nelson, 1990) to Spanish–English bilingual 4- to 7-year-olds. Similar to monolingual peers, bilingual children showed a shift in productivity from the script-based (slot-filler) condition to the taxonomic condition. Moreover, bilingual children generated a comparable number of category exemplars in each language (Spanish, English) under each condition (slot filler, taxonomic) and for each category (animal, food, clothing), indicating similarity in rates of semantic development between the children's two languages. In another study, Peña, Bedore, and Rappazzo (2003) administered six semantic tasks to three groups of 4- to 7-year-old Spanish–English bilingual children: (a) predominantly Spanish speaking, (b) predominantly English speaking, and

(c) balanced Spanish–English groups. The balanced bilinguals were tested in both languages, and the other two groups were tested in their dominant language. The experimental tasks tapped an array of semantic knowledge. Although differences were found in the *patterns* of performance of the bilingual children in English and Spanish, the bilingual children's overall level of performance was similar to that of the two predominantly monolingual groups and between their two languages.

The underlying mechanism for this similarity in first- and second-language achievement can be derived from the *linguistic interdependence principle* (Cummins, 1979, 2001). This principle postulates that linguistic proficiency, in particular academically oriented aspects of bilingual proficiency, is common and interdependent across languages. As a result, cross-language transfer of these skills is expected. Among the studies that provided evidence in support of this view, one bore direct relevance to ours (Ordóñez, Carlo, Snow, & McLaughlin, 2002). In Ordóñez et al.'s (2002) study, Spanish–English bilingual fourth- and fifth-graders defined object words in both languages. Responses were coded as paradigmatic (e.g., the superordinate category to which the object belongs) or syntagmatic (e.g., functions, features). Children's ability to produce paradigmatic responses in Spanish was a predictor of such ability in English, suggesting that providing paradigmatic definitions is an academic skill amenable to cross-linguistic transfer.

## The Bilingual Advantage Hypothesis

With regard to the effect of bilingual language exposure on organization of lexical–semantic knowledge, we tested the *bilingual advantage hypothesis,* a working theory (Bialystok, 2001; Oller, Eilers, Urbano, & Cobo-Lewis, 1997) about the relationship between bilingualism and aspects of cognitive development. According to this hypothesis, early awareness that different words can label the same concept may drive early development of semantic relations in the lexicon of the bilingual child (Cummins, 2001; Vygotsky, 1962). Hence, bilingual children may have a more developed semantic network than monolingual age-mates.

This hypothesis receives strong empirical support from research showing that bilingual children are precocious in *metalinguistic awareness,* that is, the ability to attend to and reflect upon the structural properties of language (see Bialystok, 2001, for a review). Take, for example, performance in variations of the classic Piagetian nominal realism task. In such tasks, the child is asked whether two objects could exchange names (e.g., "Can you call the *moon* the *sun*?") and, if so, what would the consequences be after the name changes (e.g., "What would be up in the sky at night?" "What would the sky look like?"). On these tasks, bilingual children demonstrated performance superior to monolinguals (Bialystok, 1988; Cummins, 1978; Ianco-Worrall, 1972; Ricciardelli, 1992), suggesting a greater linguistic flexibility and an earlier separation of words and their meanings in the bilingual children. This flexibility is attributed to bilingual children's early insight that an object can have two names in two different languages.

In the present study, we hypothesized that bilingual children's earlier appreciation of the arbitrariness of the linguistic system may exert an indirect effect on semantic development. This advanced metalinguistic awareness may kindle interests in relationships between linguistic terms and enable the learners to become more actively involved in the learning process. Because bilingual children constantly have to register two labels for the same concept, they may be likely to seek information about how words relate to each other. They may also be likely to engage themselves in deeper linguistic analyses, which would lead to the refinement of their linguistic knowledge (Cummins, 2001; Vygotsky, 1962). Thus, metalinguistic skills may facilitate language development at a global level and may enhance semantic development.

On the other hand, the shift toward paradigmatic organization of the semantic lexicon may be a universal aspect of cognitive development, and more pervasive forces, such as age, schooling, and reading acquisition, may overshadow variations in linguistic input and play dominant roles. This alternative position predicts comparable levels of lexical–semantic development in age-matched monolingual and bilingual children.

To date, studies comparing bilingual and monolingual children's semantic organization have yielded mixed results. In a 3-year longitudinal investigation, Lambert and Tucker (1972) compared percentages and speed of generating paradigmatic word associations (the more mature type of association responses) between English–French bilingual children and monolingual control groups (English-speaking, French-speaking) at the end of each year of French immersion. The bilingual children produced generally comparable or, in some cases, higher percentages of paradigmatic responses than the control children. Depending on the year and the group of comparison, the bilingual children demonstrated faster, comparable, or slower response times than the monolingual children. Additionally, Ben-Zeev (1977) found that although Hebrew–English bilingual children generated a similar number of paradigmatic responses as monolingual controls, they responded more slowly. Taken together, results from these studies did not yield a clear-cut bilingual advantage on lexical–semantic organization and rendered necessary further investigations on this topic.

## The Repeated Word Association Test

The word association test has been frequently used to examine lexical–semantic organization (De Groot, 1992; Entwisle, 1966; Henriksen, 1999). In the present study, we examined paradigmatic semantic organization using the repeated word association paradigm (Elbers & van Loon-Vervoorn, 1998), a technique not yet applied to the investigation of bilingual language development. In Elbers and van Loon-Vervoorn's (1998) study, Dutch speakers generated associations to nouns four times. A decrease of coordinate responses (e.g., *cat–lion*) across repeated trials was seen in adults, suggesting that coordinate relation, a subtype of paradigmatic relations, was initially more accessible in the mature system. The repeated nature of this task allows measurement of both storage and accessibility of paradigmatic semantic relations. Although the number of paradigmatic responses may be equivalent between two groups of children, suggesting comparable storage of paradigmatic relationships, the pattern of retrieval may differ across repeated elicitations, suggesting differences in accessibility (Elbers & van Loon-Vervoorn, 1998). For example, in one group of children, paradigmatic responses may be at their peak during the initial elicitation and gradually decrease, whereas in another group, such responses may be initially rare but steadily increase across trials.

During three trials, we elicited bilingual and monolingual children's associations to a set of adjectives, nouns, and verbs. These form classes were chosen because of their differential sensitivity to the syntagmatic–paradigmatic shift (Nelson, 1977). We were particularly interested in paradigmatic responses because they are associated with more mature semantic organization. We explored the order of occurrence of paradigmatic responses across trials to examine the saliency of this type of semantic relation.

## The Present Study

Using a repeated word association task, we examined the number and the accessibility of paradigmatic relations in bilingual and monolingual children. Our goal was twofold: (a) to investigate the status of lexical–semantic organization in one language of the bilingual children in relation to the other language and (b) to examine the status of bilingual lexical–semantic development relative to monolingual performance. With regard to the first goal, we predicted that, similar to the Spanish–English bilinguals in Peña et al.'s (2003; Peña et al., 2002) studies, Mandarin–English bilingual children would show similarity in overall performance in their two languages. With regard to the second goal, we predicted a bilingual advantage manifested by a larger proportion of paradigmatic responses and/or earlier occurrence of paradigmatic responses in the bilingual compared with the monolingual children. The comparison between bilingual and monolingual children was conducted in two ways. First, we compared bilingual children's performance in English to the performance of their monolingual peers; second, we compared bilingual children's *best performance* to the performance of the monolingual children. For this latter analysis, we compared bilingual children's word association performance in their first and second languages for each experimental condition and took performance from the higher scored language (with *higher score* defined as a higher proportion of paradigmatic associations) to represent the child's best performance for that condition. This best-performance score awards the bilingual children maximal credit for their current level of semantic development.

Following previous studies, we predicted that adjectives would elicit the most paradigmatic responses and verbs the least. With regard to the effect of repeated trials on paradigmatic responding, we did not have a firm a priori prediction, because this paradigm has not been applied to young school-age children.

## Method

### *Participants*

Twelve Mandarin–English bilingual children and 12 monolingual English-speaking children participated in this study. For both groups, inclusionary criteria were age (5–8 years) and proficiency in the target language(s). Exclusionary criteria were speech, language, hearing, social, or emotional disorders and proficiency in a language other than the one(s) under study.

Information about the bilingual children's language use and proficiency level was collected through rating forms and structured parent interviews (adapted from Gutiérrez-Clellen & Kreiter, 2003). Slight modifications were made to these materials by simplifying the sections on family history of speech and language problems and on writing and other literacy activities. The child's parent filled out the questionnaire. Afterward, a bilingual examiner conducted a face-to-face interview with the parent. Specific questions were asked about the people with whom the child interacted in different settings (school vs. home), on different days of the week (weekdays vs. weekend), and the language of communication (Mandarin, English, or both) between the child and each person. In cases where the interactant was a bilingual, the parent estimated the percentage of time each language was used. On the basis of these reports, average usage times for Mandarin and English were calculated. The calculation closely followed the steps stipulated by Gutiérrez-Clellen and Kreiter (2003) and

counted the number of hours the child spent using each language out of a total of 94 waking hours per week. Estimated use of English, encompassing both the input a child received and the output the child produced in English, averaged 59% of total amount of language use and varied from 30% to 84%. According to parent reports, these bilingual children listened to and spoke Mandarin at home and/or when communicating with adult family members and were exposed to and used English outside the home environment and/or when communicating with peers, siblings, and non–Mandarin-speaking adults.

Six of the bilingual children were born in the United States and were exposed to both Mandarin and English from birth. These American-born children learned their first words in Mandarin, and systematic English learning did not start until age 3, when preschool began. The other 6 children were born in China and moved to an English-speaking country at various ages. By the time they were tested, all children had been immersed in an English-speaking environment for at least 13 months. Therefore, all children fell into the category of sequential bilinguals with Mandarin as their first language (L1) and English as their second language (L2).

Parents of the bilingual children rated their children's proficiency along a 5-point scale from 0 to 4 (0 = *no proficiency,* 4 = *native-like proficiency*). Parents read descriptions accompanying the anchor points and chose the one that most accurately depicted their children. As a group, the bilingual children were rated as having good L1 proficiency ($M$ = 3.17, $SD$ = 0.83), indicating that they had some social and academic vocabulary, understood most of what was said to them, and sometimes made grammatical errors. A range of language proficiency was observed so that some children had limited proficiency (a rating of 2) in Mandarin, and others had native-like proficiency. As a group, the children's L2 proficiency ($M$ = 3.67, $SD$ = 0.49) was comparable to their L1 proficiency ($p$ = .17) and varied from good (a rating of 3) to native-like.

In summary, the bilingual group was homogeneous in that all children were sequential Mandarin–English bilinguals whose first language was Mandarin and who used Mandarin in the home environment and English in the school environment. However, they were heterogeneous as regards levels of proficiency in their two languages and the amount of time spent using each language.

The monolingual children served as controls for the bilingual children. Age was balanced between groups by matching each monolingual child to a bilingual child by ±3 months, $t(22) = 0.06$, $p = .95$. Gender was balanced both within and between groups. Years of maternal education, an index of socioeconomic status, were comparable between groups, $t(22) = 1.28$, $p = .21$. The two groups were also matched on nonverbal intelligence as measured by the matrices subtest of the Kaufman Brief Intelligence Test (K-BIT, Kaufman & Kaufman, 1990), $t(22) = 1.17$, $p = .25$. Parents of the monolingual children also filled out a general background questionnaire. Characteristics of the participants are summarized in Table 1.

## Test Materials

*Repeated word association test*. One hundred forty potential stimulus words were selected from Battig and Montague (1969), Entwisle (1966), and Fenson et al. (1993). The English words were translated into Mandarin by two native speakers with an agreement level of 92%. A third native Mandarin speaker back-translated the Mandarin words into English, and the agreement level was 86%. All disagreements were resolved by consensus.

The stimulus words were of high frequency and acquired early by both English and Mandarin speakers. We collected age-of-acquisition information from adult raters following the procedures developed by Carroll and White (1973). Raters were 15 adult native speakers of Mandarin and 15 adult native speakers of American English. In both cases, there were 7 men and 8 women. Raters estimated the age at which they had acquired each word in either spoken or written form, from age 1 to 13+. In addition to the 140 candidate words, 60 filler words were selected from Snodgrass and Vanderwart (1980) and Dunn and Dunn (1997), so that raters could make use of the full rating scale. With three exceptions, only words that met the following two criteria were included in the final stimulus list: (a) acquired before age 6 according to both Mandarin and English adult estimates and (b) equivalent age of acquisition (±1 year) in English and Mandarin. The exception words were *milk, juice, and fork,* which were rated as acquired more than a year earlier by the English speakers than by the Mandarin speakers.

Frequencies of occurrence of the English words were obtained from a children's literature database (Zeno, Ivens, Millard, & Duvvuri, 1995). The only existing Chinese word frequency dictionary (Beijing Language Institute, 1986) is based on printed materials intended for adults published from the 1940s until the 1970s in China. Because early word acquisition is contingent upon the ambient environment, we considered this source inappropriate for bilingual children raised in the United States. Findings of significant correlations between Mandarin and English age-of-acquisition estimates ($r$ = .87, $p < .0001$), and between English age-of-acquisition and word frequency ($r = -.31$, $p < .01$), suggested that the Mandarin words were also of high frequency.

**Table 1.** Participant information.

| | | Bilingual participants | | | | | | Monolingual participants | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Participant | Gender | Age | Maternal education | NVIQ | PPVT[a] | L2 use[b] | Years(;months) in China | Age | Maternal education | NVIQ | PPVT |
| 1 | M | 6;10 | 22 | 120 | n/a[c] | .78 | 5;1 | 7;1 | 18 | 106 | 115 |
| 2 | F | 8;5 | 18 | 114 | 132 | .53 | 5;4 | 8;4 | 16 | 120 | 128 |
| 3 | F | 6;10 | 18 | 127 | 102 | .56 | 0 | 7;1 | 18 | 132 | 125 |
| 4 | F | 7;0 | 18 | 107 | 99 | .55 | 5;5 | 6;9 | 16 | 102 | 117 |
| 5 | F | 7;8 | 18 | 126 | 109 | .62 | 0 | 7;10 | 14 | 98 | 102 |
| 6 | M | 5;7 | 16 | 106 | 107 | .68 | 0[d] | 5;7 | 16 | 103 | 147 |
| 7 | F | 6;11 | 18 | 116 | 118 | .45 | 4;11 | 7;1 | 22 | 103 | 125 |
| 8[e] | M | 7;5 | 18 | 143 | 111 | .39 | 3;0 | 7;7 | 16 | 137 | 123 |
| 9 | M | 5;10 | 16 | 107 | 118 | .73 | 0 | 5;7 | 18 | 103 | 124 |
| 10 | F | 8;1 | 16 | 113 | 95 | .3 | 7;0 | 8;3 | 18 | 116 | 110 |
| 11 | M | 7;11 | 18 | 127 | 124 | .68 | 0 | 7;9 | 16 | 89 | 110 |
| 12 | M | 6;9 | 18 | 102 | 98 | .84 | 0 | 6;7 | 18 | 101 | 105 |
| *M* | 6M, 6F | 7;1 | 17.83 | 117.33 | 110.27 | .59 | 2;7 | 7;1 | 17.2 | 109.2 | 119.25 |
| *SD* | | 0;10 | 1.91 | 11.82 | 11.71 | .16 | 2;10 | 0;11 | 2.1 | 14.7 | 11.93 |

*Note.* NVIQ = nonverbal IQ; L2 = second language; M = male; F = female.

[a]Standard scores on the Peabody Picture Vocabulary Test (PPVT). [b]Percentage of English use out of the total amount of language use. [c]We do not have a score for this child because he did not finish the PPVT. [d]This American-born child spent his summer (approximately 3 months/year) in China starting from age 2. This was not indicated in the table to avoid confusion of his birth place. [e]Participant 8 first started systematic English learning in South Africa at age 3. He stayed in South Africa until age 5;4, at which time he came to the United States with his parents.

The final set of stimuli consisted of 72 pairs of translation equivalents evenly distributed across the adjective, noun, and verb classes.[1] The 72 pairs were divided into two matched lists of 36 pairs. The two lists are compared in Table 2 in regard to English and Mandarin age of acquisition, age-of-acquisition discrepancy between languages, and English word frequency. *T* tests confirmed that the lists were equated for all the above variables ($p > .1$). In addition, across the two lists, nouns were balanced on category membership, verbs on transitivity, and adjectives on polarity. Mandarin and English morphology was controlled so that equal numbers of morphologically simple and complex words appeared on the two lists. Within each list, the adjectives, nouns, and verbs were matched for English and Mandarin ages of acquisition and English word frequency.

*The Peabody Picture Vocabulary Test*. The Peabody Picture Vocabulary Test—III (PPVT–III; Dunn & Dunn, 1997) was used as a measure of children's English receptive vocabulary and general proficiency. The PPVT—Revised, an earlier version of the test, has been translated into Mandarin (Lu & Liu, 1998); however, the inadequate norming efforts and other inherent problems with this directly translated test (Lin & Johnson, 2003) rendered it inappropriate.

[1]A complete list of the words is available by request from Li Sheng.

## Procedure

*Bilingual children*. All bilingual children were tested in Mandarin and in English during two separate sessions, with a different version of the word association test used each time. The two sessions were at least 2 days and no more than 1 week apart. Language of the first session and version of the word association test were counterbalanced across children. A native English speaker tested the children in English, and a native Mandarin speaker tested the children in Mandarin. Children were instructed to use only the language of the day.

The word association test was administered at the beginning of each session. The examiner provided instructions and examples of paradigmatic and syntagmatic word associations, after which the child responded to three practice items (an adjective, a noun, and a verb). To demonstrate that the items would be repeated, the examiner presented one of the practice items a second time and prompted the child for a novel response. The examiner provided feedback to the child during the practice period and encouraged only single-word responses. The list of 36 words was administered to the participants in two parts, each containing 18 words. In the first part, the child responded to all 18 words three times in its entirety, with intervening short breaks between each round of elicitation. This presentation method was chosen over a method in which

**Table 2.** Characteristics of the stimulus words in the two equivalent lists.

| | English age of acquisition (in years) | | Chinese age of acquisition | | Age of acquisition discrepancy | | English log frequency | |
|---|---|---|---|---|---|---|---|---|
| List | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| List A | 3.53 | 0.91 | 3.59 | 0.91 | 0.42 | 0.31 | 1.98 | 0.65 |
| Range | 2.20–6.07 | | 2.33–5.67 | | 0–1.00 | | 0.60–3.19 | |
| List B | 3.48 | 0.88 | 3.71 | 1.06 | 0.50 | 0.64 | 2.03 | 0.53 |
| Range | 1.87–5.87 | | 1.80–6.00 | | 0–1.00 | | 1.14–3.23 | |

children gave responses to the same word three consecutive times. Pilot results indicated children were more likely to produce chain responses when the same word was repeated (e.g., *spoon–scoop, ice–cream, yum*). The 18 words were randomized in the three repetitions and presented in the same order to all children. If the child repeated his or her response from an earlier elicitation, the examiner reminded the child of the rule and requested a novel response. After a longer break, the second part of the word association test was administered following the same steps. The English PPVT was administered after the word association test during the English session, and the K-BIT was administered at the end of the first session.

*Monolingual children*. Monolingual children were tested once by a native English speaker. Half of the children received one version of the word association test, and half received the other. Administration of the tests followed the same steps as in the bilinguals. For the monolingual child, the session began with the word association task, followed by the PPVT, and ended with the K-BIT.

## Data Analyses

Paradigmatic and syntagmatic word associations were coded. A paradigmatic response could be a synonym (*sleepy–drowsy*); an antonym (*jump–land*); a coordinate (*cat–dog*); a superordinate (*spider–bug*); a subordinate (*shoe–slippers*); or, in the case of adjectives, a direct negation (*pretty–not pretty*) of the stimulus (Lambert & Tucker, 1972).[2] Syntagmatic responses were words that followed the prompts in the syntactic stream (*stand–up, read–book*) or words that bore thematic relationships with the prompts (*sick–medicine, horse–saddle, catch–baseball*).

A few participants responded to the homonyms of *eye* (*I*) and *sell* (*cell*), and these items were discarded, resulting in an unequal number of responses across children. Therefore, the dependent variable was the proportion of responses that were paradigmatic. We conducted *t* tests and Kolmogorov–Smirnov tests (used when the cell size was smaller than 10) to determine whether the two versions of the word association test elicited similar performance and whether the bilingual children performed similarly during the two sessions. We found that performance was comparable on Versions A and B for both the bilingual and the monolingual groups; in addition, bilingual children performed at a similar level during the first and the second sessions ($p > .10$ in all cases).

Reliability of coding was verified by having a native English-speaking research assistant and a fluent Mandarin–English bilingual independently score 15% of the English and the Mandarin data, respectively. Item-by-item agreements were 90% for the English data sets and 92% for the Mandarin data sets. Inconsistencies were resolved through discussions.

# Results

Children's performance on the PPVT is presented in Table 1. One bilingual participant did not finish the PPVT, thereby reducing the group size to 11 for that test. The 9-point difference in PPVT scores between the bilingual and the monolingual children was similar to that found in other studies with comparably matched groups (Ben-Zeev, 1977; Bialystok, Majumder, & Martin, 2003; Windsor & Kohnert, 2004) and did not reach significance, $t(21) = 1.68$, $p = .11$.

Mean proportions of paradigmatic and syntagmatic word associations are shown in Table 3. A majority of the children's responses (ranging from 71% in the monolinguals at Trial 3 to 94% for English in the bilinguals at Trial 1) belonged to these two categories. There was

[2]In Mandarin and in English, polarity can be expressed by generating the true opposite of an adjective (*pang4de–shou4de*: *fat–thin*; numbers indicate tone), or by simply adding the negative marker *bu2* in Mandarin or the word *not* in English to a word stem (*pang4de–bu2 pang4de*: *fat–not fat*). In English, simple negation as a response strategy phased out early in development (Heidenheimer, 1975). No relevant data exist for Mandarin. However, in Mandarin, the negative marker *bu2* is a highly productive particle and occurs before almost any adjective and a large number of verbs (Li & Thompson, 1981). As an expression, *bu2* + adjective is widely used in conversational speech. Because *bu2* is a particle, such an expression is often naturally perceived as a single word. These factors may have caused the bilingual children to rely on this strategy for a prolonged period of time when generating responses for Mandarin adjectives.

**Table 3.** Mean proportions (*SD*s) of paradigmatic and syntagmatic word association responses of bilingual and monolingual children during the first, second, and third elicitations.

| | Bilingual children | | | | | | Monolingual children | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mandarin | | | English | | | English | | |
| Response type | Trial 1 | Trial 2 | Trial 3 | Trial 1 | Trial 2 | Trial 3 | Trial 1 | Trial 2 | Trial 3 |
| Paradigmatic | .43 (.24) | .31 (.22) | .18 (.19) | .50 (.18) | .33 (.12) | .23 (.08) | .40 (.23) | .32 (.18) | .25 (.17) |
| Syntagmatic | .44 (.23) | .50 (.18) | .55 (.18) | .44 (.19) | .54 (.16) | .60 (.11) | .45 (.22) | .50 (.21) | .46 (.20) |

*Note.* Pairwise comparisons for paradigmatic performance indicated that Trial 1 > Trial 2 > Trial 3 for bilingual Mandarin and bilingual English performance; Trial 1 > Trial 2 = Trial 3 for monolinguals. No other pairwise comparisons reached significance.

an inverse relation between paradigmatic and syntagmatic responding: As paradigmatic responses decreased over elicitations, syntagmatic responses increased. The rest of the responses were sound associations (*bus–bust, milk–silk*), repetitions of the prompts, inflectional transformations of the prompts ( *jump–jumped*), skips, or unclassifiable (*easy–boat*). Cases of code-switching were also noted in the bilingual children. Code-switching was nonexistent in English and minimal in Mandarin, with mean proportions (*SD*s) for the three elicitations respectively averaging .05 (.10), .07 (.13), and .12 (.19). When children did switch languages, they usually asked for permission from the examiner or explicitly stated that they did not know how to say the particular word in Mandarin, indicating that these occurrences were not automatic intrusions from English. Instead, children used it as a conscious strategy to compensate for lexical gaps. Also, our inspection of the code-switching data did not yield any pattern associated with particular stimulus items. Code-switched responses were coded by their meaning relationships to the stimuli and included in the between-group best-performance comparison but excluded from the L1-versus-L2 comparison within the bilingual group. Because paradigmatic responses are developmentally more mature, and because they are directly and inversely related to syntagmatic responses, we focused on paradigmatic responses only.

## Comparing L1 and L2 in Bilingual Children

To achieve the first goal of this study, that is, to compare lexical–semantic organization between a bilingual child's two languages, we examined bilingual children's L1 and L2 paradigmatic performance by means of analysis of variance (ANOVA) and correlational analyses.

*ANOVA*. Two parallel 2 (Mandarin and English) × 3 (first, second, and third trials) × 3 (adjective, noun, and verb) repeated measures ANOVAs were conducted, one with the proportion of paradigmatic responses (averaged over children) as the dependent variable (*F1*), the other with the proportion of paradigmatic respondents—children who responded paradigmatically (averaged over items)—as the dependent variable (*F2*).

Paradigmatic performance did not differ significantly between bilingual children's L1 and L2, $F1(1, 11) = 1.17$, $p = .30$, and $F2(1, 138) = 2.07$, $p = .15$. There was a main effect of trial, $F1(2, 22) = 66.45$, $p < .0001$, $\eta^2 = .86$, and $F2(2, 276) = 87.59$, $p < .0001$, $\eta^2 = .39$. When the three word classes were collapsed, there was a steady decrease of paradigmatic responses. Mean proportions of paradigmatic responses were .46, .32, and .21 for the first, second, and third trials ( $p < .001$ for all pairwise comparisons), respectively. A nonsignificant word class effect indicated an overall similar level of performance for adjectives, nouns, and verbs when languages and elicitation trials were combined, $F1(2, 22) = 1.18$, $p = .33$, and $F2(2, 138) = 2.26$, $p = .11$.[3] A Trial × Word Class interaction indicated that patterns of paradigmatic responding varied by word class, $F1(4, 44) = 2.57$, $p = .051$, $\eta^2 = .19$, and $F2(4, 276) = 4.98$, $p < .001$, $\eta^2 = .07$. According to both by-subject and by-item analyses, paradigmatic responding in the initial trial was higher for adjectives than for either nouns or verbs ( $p < .05$). Furthermore, both analyses demonstrated that for adjectives, paradigmatic responding decreased reliably over trials ( $p < .03$). Mean proportions of paradigmatic responses equaled .55, .35, and .20 for the three trials, respectively. For nouns, whereas by-participant analyses yielded a significant decrease between Trial 1 ($M = .42$) and Trial 3 ($M = .23$, $p < .001$), by-item analyses revealed significant differences between the first ($M = .41$) and the second ($M = .34$) versus the last elicitations ($M = .22$;

[3]A significant Language × Word Class interaction emerged when adjective negations were excluded, $F(2, 22) = 3.86$, $p < .04$, $\eta^2 = .26$. Although the children never produced simple negations to English adjectives, they applied this strategy to Mandarin adjectives 6% of the time when averaged across participants and trials. Post hoc tests for the interaction revealed an L2 ($M = .41$) paradigmatic advantage over L1 ($M = .27$) for adjectives, $F(1, 11) = 9.94$, $p < .01$, $\eta^2 = .47$, but not for nouns or verbs. This finding illustrates the impact of methodological decision making on research results. Had we rejected simple negations as paradigmatic responses, we would have concluded that the adjective lexicon was unevenly developed in the bilingual children's L1 and L2.

Trial 1 = Trial 2 > Trial 3, $p < .005$, for both comparisons). For verbs, the decrease in paradigmatic responses had leveled off at Trial 2 (Trial 1 > Trial 2 = Trial 3, $p < .02$), with means for the three elicitations averaging .41, .27, and .19, respectively. On the other hand, mean proportions of paradigmatic respondents decreased significantly over trials for verbs ($p < .03$), with means of .40, .27, and .19 for the three trials.

To summarize, paradigmatic performance was similar in L1 and L2. Generating paradigmatic responses became progressively more difficult across trials, and adjectives initially elicited superior paradigmatic performance to nouns and verbs. These findings are illustrated in Figures 1 and 2.

*Correlation between L1 and L2 performance*. We conducted correlational analyses to examine the extent of overlap in paradigmatic responding between the bilingual children's two languages. Because our participants represented a relatively wide age range (5;7 [years;months] to 8;5), partial correlations were conducted to factor out any possible mediating effect of age. The tendency to produce paradigmatic responses was similarly high between languages for each trial. Correlations between the proportions of paradigmatic responses in children's L1 and L2 equaled .61, .69, and .61 for Trials 1, 2, and 3, respectively ($p < .05$), after partialing out the effect of age. Furthermore, the tendency to make paradigmatic associations was highly similar for L1 and L2 nouns ($r = .93$, $p < .0001$), less so for adjectives ($r = .60$, $p < .05$), and the least similar for verbs ($r = .55$, $p = .08$), after controlling for the effect of age.

## Comparing Bilingual and Monolingual Children

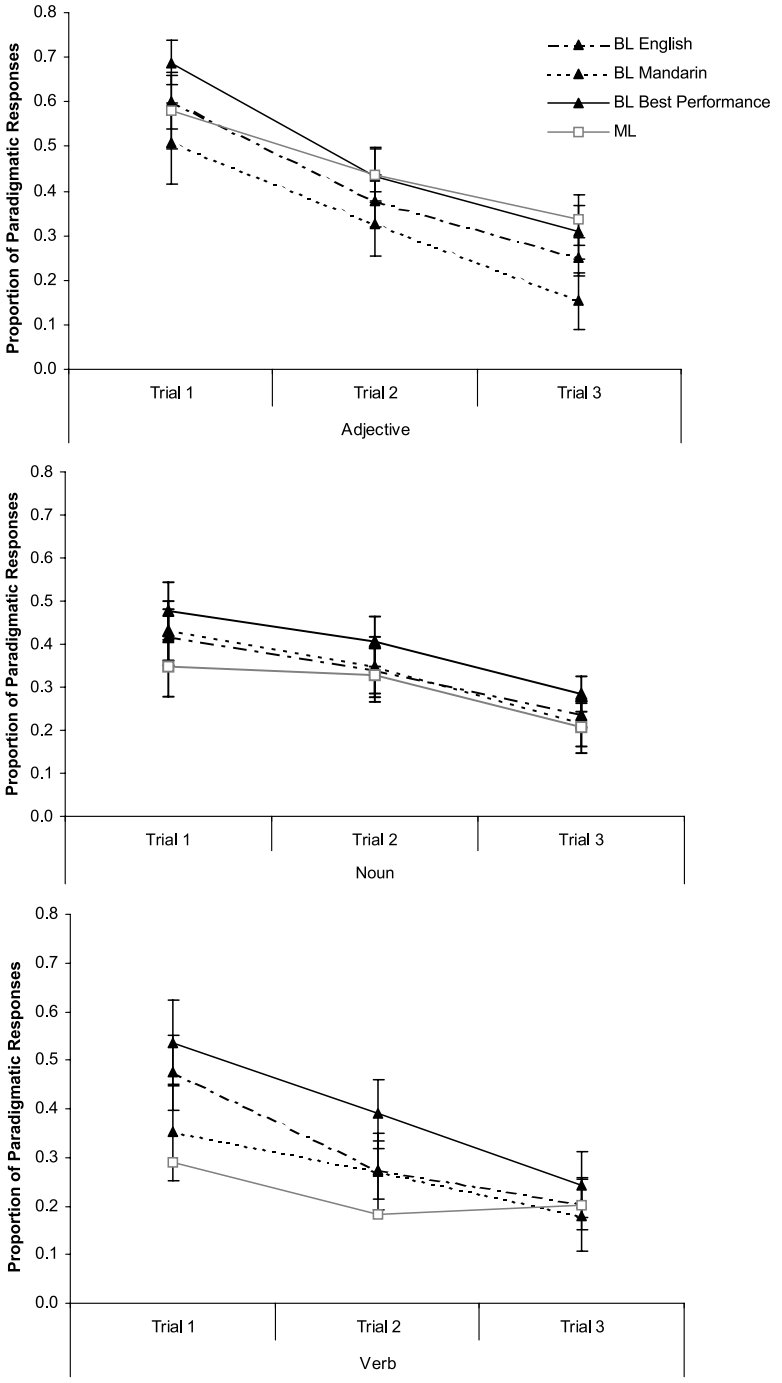
To address the second goal of the present study, we compared bilingual and monolingual performance via two ANOVAs, one comparing the English performance of each group and the other comparing best performance of bilinguals to English performance of the monolinguals. For each comparison, data were submitted to the same 2 (bilingual, monolingual) × 3 (Trials 1, 2, and 3) × 3 (adjectives, nouns, verbs) mixed-model ANOVA. Both by-participant and by-item ANOVAs were presented for the English comparison. Because best performance was drawn from the higher performing language of each individual, by-item analyses were irrelevant for this comparison. We also performed 2 × 3 × 3 analyses of covariance for all by-participant comparisons, using maternal education, English receptive vocabulary, and nonverbal IQ as covariates when pertinent because these variables were not perfectly matched between groups ($p < .5$). Because the analyses of covariance yielded identical results to the corresponding ANOVAs, below we present only the ANOVA results.

*Comparing English performance*. Children's English word association performance is presented in Figures 1 and 2. The overall rate of paradigmatic responding was similar between the bilingual and the monolingual groups, $F1(1, 22) = 0.22$, $p = .65$, and $F2(1, 69) = 1.34$, $p = .25$. However, by-item analyses demonstrated significant interactions between group and trial, $F2(2, 138) = 4.06$, $p < .02$, $\eta^2 = .06$, and group and word class, $F2(2, 69) = 5.2$, $p < .01$, $\eta^2 = .13$, suggesting subtle differences in performance between the bilingual and the monolingual children. Follow-up between-group comparisons revealed that the Group × Trial interaction was caused by a bilingual advantage over the monolingual group during the first elicitation: For that trial, more bilingual children ($M = .49$) than monolingual children ($M = .41$) responded paradigmatically, $F2(1, 71) = 6.47$, $p < .02$, $\eta^2 = .08$. The Group × Word Class interaction resulted from a bilingual advantage for verbs: More bilingual children ($M = .31$) than monolingual children ($M = .22$) responded paradigmatically to verbs, $F2(1, 23) = 10.81$, $p = .003$, $\eta^2 = .32$. The increased sample size ($n = 72$) in the by-item analyses as compared to the by-participant analyses ($n = 24$) made the former more sensitive to group differences.

Across both groups, generating paradigmatic responses became increasingly difficult across trials, $F1(2, 44) = 38.82$, $p < .0001$, $\eta^2 = .64$, and $F2(2, 138) = 57.08$, $p < .0001$, $\eta^2 = 45$. Whereas 45% of children's responses were paradigmatic during the first trial, only 32% and 24% were paradigmatic during the second and the third trials ($p < .005$ for all pairwise comparisons). Paradigmatic responding differed for words from different form classes, $F1(2, 44) = 10.37$, $p < .001$, $\eta^2 = .32$, and $F2(2, 69) = 5.91$, $p < .005$, $\eta^2 = .15$. Specifically, 43% of children's adjective associations were paradigmatic, compared with only 31% and 27% of their noun and verb associations. Post hoc tests indicated that the adjective advantage was significant over nouns ($p < .01$) and verbs ($p < .001$). This main effect of word class was qualified by a Group × Word Class interaction from the by-item analyses, $F2(2, 69) = 5.2$, $p < .01$, $\eta^2 = .13$. In addition to the bilingual advantage for verbs, this interaction also involved an adjective ($M = .47$) advantage over both nouns ($M = .28$) and verbs ($M = .22$) in the monolingual children, $F2(2, 69) = 10.31$, $p < .001$, $\eta^2 = .23$, and a lack of between-class differences in the bilingual children, $F2(2, 69) = 1.50$, $p = .23$.

A Trial × Word Class interaction indicated that response patterns varied among word classes, $F1(4, 88) = 3.81$, $p < .01$, $\eta^2 = .15$, and $F2(4, 138) = 3.90$, $p < .005$, $\eta^2 = .1$. For adjectives, the proportion of paradigmatic responses decreased significantly from Trial 1 ($M = .59$) to Trial 2 ($M = .41$) and again from Trial 2 to Trial 3 ($M = .29$, $p < .05$, for all pairwise comparisons). On the other hand, paradigmatic responding to nouns persisted from Trial 1 ($M = .38$) to Trial 2 ($M = .33$), but decreased significantly

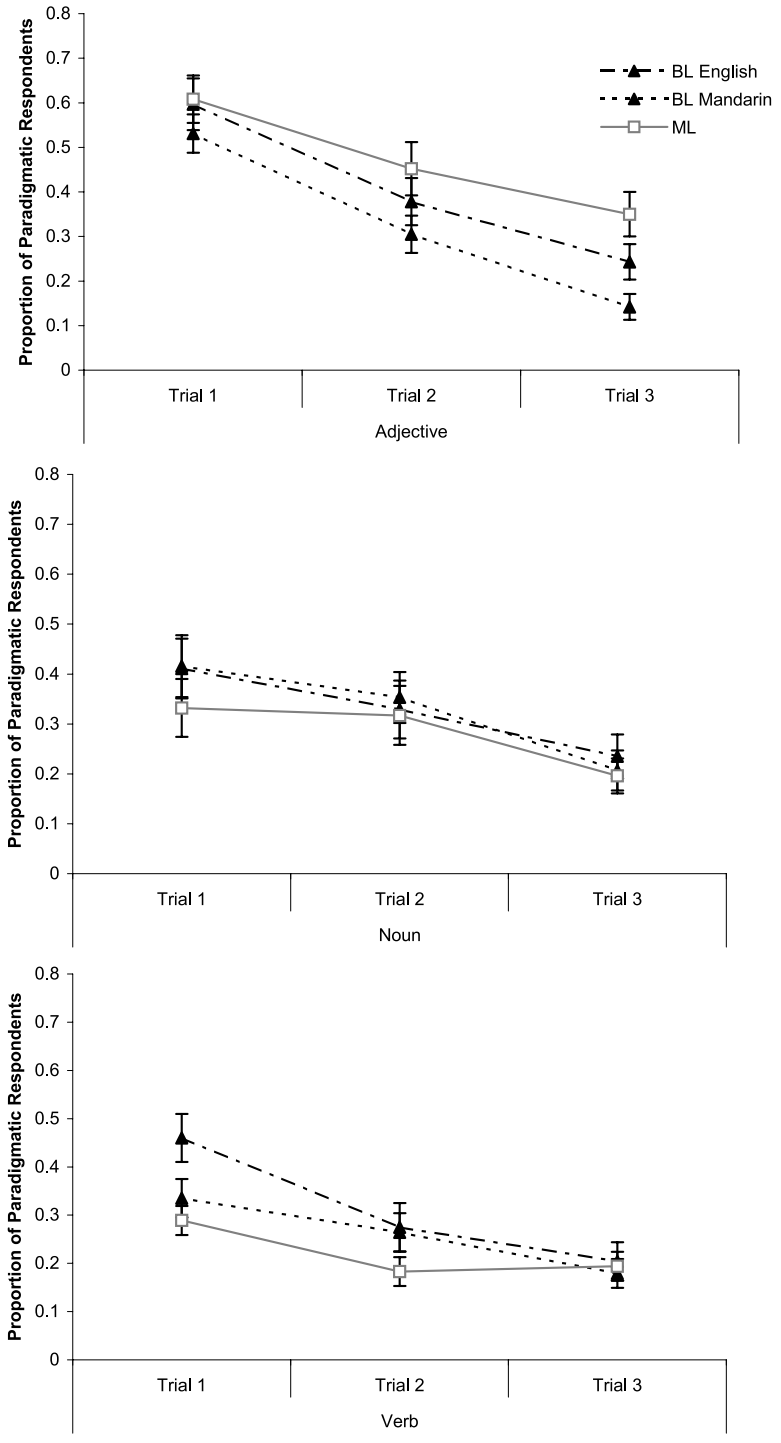
**Figure 1.** Mean proportion (and standard errors) of paradigmatic responses as a function of group, language, trial, and word class. BL = bilingual; ML = monolingual.




from Trial 2 to Trial 3 ($M$ = .22, $p$ < .05). For verbs, the decrease in paradigmatic responses leveled off at Trial 2. Means for verbs for the three trials were, respectively, .38, .23, and .20 (Trial 1 > Trial 2 = Trial 3, $p$ < .001). Furthermore, we found that for the first trial, children produced more paradigmatic responses to adjectives than to nouns and verbs ($p$ < .001); for the second trial, the adjective advantage was manifested only in comparison to verbs ($p$ < .001); for the third trial, the three word classes were no longer different.

To summarize, monolingual and bilingual children achieved similar paradigmatic performance in the English word association test, despite some fine-grained bilingual advantage during the initial elicitation and for

**Figure 2.** Mean proportion (and standard errors) of children who provided paradigmatic responses as a function of group, language, trial, and word class.




verbs. For both groups, generating paradigmatic responses to the same words became increasingly demanding across trials, and generating paradigmatic responses for adjectives was easier than for nouns or verbs, especially during earlier trials.

*Comparing best performance*. To assess the highest level of development attained by the bilingual children (as opposed to the level reflected in one language only), we derived a merged score that represented a bilingual child's best performance. These scores were obtained

by comparing a bilingual child's English and Mandarin performance for each of the nine experimental conditions (three trials and three word classes) and selecting the higher score per condition. For example, during the first elicitation, if 49% of a child's responses were paradigmatic for English adjectives, and 55% of his or her responses were paradigmatic for Mandarin adjectives, then Mandarin responses would represent the child's best performance for this condition (adjectives for Trial 1). In cases of tied performance (i.e., an equal number of paradigmatic associations was generated in Mandarin and in English for a certain condition), the language of the first session was chosen. Out of a total of 108 scores (9 conditions and 12 participants), English contributed to the best performance score 57 times (53%) ($M$ = .53, $SD$ = .25). For the monolingual children, best performance was synonymous with performance in their only language. Note that as we discussed earlier, the bilingual children did not demonstrate a growth in performance as a result of being tested twice. Therefore, although it would be ideal to also test the monolingual participants twice to obtain their best performance scores in the same manner as was done for the bilinguals, such a measure is unlikely to change the results of the present comparison.

Best-performance measures are presented in Figure 1. As in the single-language comparisons, the bilingual and monolingual children achieved similar overall paradigmatic performance, $F(1, 22) = 1.77$, $p = .20$. There was a main effect of trial, $F(2, 44) = 54.59$, $p < .0001$, $\eta^2 = .71$, with paradigmatic responses consistently decreasing over trials. Mean proportions of paradigmatic responses were .49, .36, and .26 for the first, second, and third trials, respectively ($p < .001$ for all pairwise comparisons). An interaction between group and trial was also revealed, $F(2, 44) = 4.61$, $p = .015$, $\eta^2 = .17$. The two groups varied slightly in response pattern across trials: Within the bilingual group, there was a consistent decrease in paradigmatic responses across trials, with proportions of paradigmatic responses averaging .57, .41, and .28 for the three trials ($p < .001$ for all comparisons). Within the monolingual group, however, the decrease in paradigmatic responses was significant from Trial 1 ($M$ = .41) to Trial 2 ($M$ = .32, $p < .05$) but failed to reach significance from Trial 2 to Trial 3 ($M$ = .25). Between groups, the bilingual ($M$ = .57) advantage over the monolingual group ($M$ = .41) at Trial 1 was in the predicted direction but did not reach significance ($p < .08$).

There was also a main effect of word class, $F(2, 44) = 10.01$, $p < .001$, $\eta^2 = .31$, with adjectives ($M$ = .46) eliciting more paradigmatic responses than nouns ($M$ = .34, $p < .01$) and verbs ($M$ = .31, $p < .001$). Finally, there was an interaction between trial and word class, $F(4, 88) = 4.48$, $p < .003$, $\eta^2 = .17$. Post hoc results for this interaction were highly similar to those of the English comparisons and were not reiterated.

To summarize, when best performance was compared, the two groups produced similar numbers of paradigmatic associations. The bilingual advantage during the initial elicitation approached but failed to reach significance. Both monolingual and bilingual children generated more paradigmatic responses to adjectives than to nouns and verbs, especially during earlier attempts. For the bilingual children, each new elicitation resulted in a considerable decrease of paradigmatic responses; for the monolingual children, paradigmatic responding decreased significantly from the first to the second trial, with no further reliable decrease.

## Discussion

In this study, we examined the organization of lexical–semantic knowledge in bilingual and monolingual 5- to 8-year-olds via a repeated word association task. Our goals were to compare the development of paradigmatic semantic organization in bilingual children's two languages and to examine the effect of bilingualism on this aspect of lexical–semantic organization. We first discuss word association performance between bilinguals' L1 and L2; then, we examine the similarities between the bilingual and the monolingual groups and discuss the theoretical and clinical implications of these commonalities. Last, we address the differences between groups and provide interpretations as well as suggestions for future research.

### *Similarities in L1 and L2 Lexical–Semantic Organization*

With regard to our first goal, we found comparable and correlated performance in children's L1 and L2 on a word association task. This is consistent with previous studies of Spanish–English bilinguals of a similar age range using different semantic tasks (Peña et al., 2003; Peña et al., 2002). Our finding is also in consonance with that of Ordóñez et al.'s (2002) research, in which paradigmatic definitions produced by Spanish–English fourth- and fifth-graders correlated between languages. Additionally, we found that paradigmatic responding correlated the most for L1 and L2 nouns and the least for verbs, indicating that word associations for nouns proceed in a more similar manner across languages than for verbs, at least for comparisons involving English and Mandarin. This finding fits well with Gentner and Boroditsky's (2001) relational relativity hypothesis, which suggests greater cross-linguistic consistency in the meaning of nominal terms than relational terms. Placed within the framework of Cummins's (1979, 2001) linguistic interdependence principle, this finding suggests that semantic knowledge for nouns may be more readily transferable between languages than for verbs.

## Comparison of Bilingual and Monolingual Language Learners

*Points of convergence*. To examine the effect of bilingualism on lexical–semantic organization and test the bilingual advantage hypothesis, we compared bilingual and monolingual children's English performance and best performance on the repeated word association task. The two groups demonstrated comparable overall paradigmatic performance in both comparisons. The similarity in performance suggests that the two groups are using similar age-appropriate organizational principles to structure their mental filing systems.

To fully understand the complex relationships among bilingualism, language, and cognitive development, identifying areas of convergence between bilinguals and monolinguals is as important as identifying areas of divergence (Bialystok et al., 2003; Kohnert & Windsor, 2004; Windsor & Kohnert, 2004). From a theoretical perspective, findings of common ground between monolingual and bilingual children may reveal aspects of development that are robust and less susceptible to environmental influence. For example, Oller et al. (1997) examined speech development in monolingual and bilingual infants and found similarity between the two groups in the development of speech-like vocalization, such as ages of onset for canonical babbling (production of well-formed syllables), usage of vowel-like sounds, and volubility. Therefore, the course of infrastructural vocal development is predisposed to the biological heritage of the human organism and resistant to the effects of environmental variations.

In a similar vein, Bialystok et al. (2003) found that bilingualism had variable and limited influence on children's development of phonological awareness. They tested four groups of bilingual children and their monolingual controls in a series of three experiments. All four groups of bilingual children (English–French, French–English, Spanish–English, and Chinese–English) demonstrated performance comparable to that of the monolingual controls on a phoneme substitution task. However, performance diverged when the latter two groups of bilinguals were engaged in a phoneme segmentation task: The Spanish–English children performed better, whereas the Chinese–English children performed worse than the monolingual children. Hence, although certain language pairs (e.g., Spanish–English) may hasten the discovery of phonological structures, this advantage was not granted by bilingualism per se. Instead, it was attributable to the similarities in sound structures between Spanish and English and to the facilitative effect of the simple phonetic structure of the Spanish language. These results provide evidence for the complex and various nature of influences of bilingualism on aspects of children's metalinguistic awareness across languages.

In the current study, the robustness of lexical–semantic organization was substantiated by the similar word association performance shown in bilingual and monolingual children. We hypothesized that bilingualism may accelerate the preference for paradigmatic relations because early awareness that different words can label the same concept may drive an early development of same-class relations in the lexicon. Despite some fine-grained evidence that is consistent with this view, the bulk of the results did not support this hypothesis. Heightened knowledge about the arbitrary nature of language does not necessarily place paradigmatic word knowledge in the foreground when making word associations, and bilingualism itself may not accelerate the development of semantic organization.

From a practical point of view, determining points of convergence between mainstream monolingual children and children from diverse backgrounds can contribute to the development of clinical tools for the identification of typical and atypical second-language learners. For example, Kohnert and Windsor (2004) and Windsor and Kohnert (2004) found that, when performing nonlinguistic tasks, typical bilingual Spanish–English children resembled typical English-speaking children. On a picture naming task, however, the bilingual children performed similarly to English-speaking children with language impairment. These authors cautioned against the use of lexical processing tasks, such as picture naming, as the sole basis of diagnostic decision making and suggested that the design of nonbiased clinical assessment tools should integrate a component that taps basic nonlinguistic processing skills. The commonalities in bilingual and monolingual children's word association performance indicate yet another area in which development may be on a par between the two groups. If future work can identify lines of separation in performance between normal and impaired populations, then inclusion of similar semantic tasks as part of a nonbiased clinical assessment tool kit holds promise.

A further point of convergence was the effect of trial. Both the bilingual and the monolingual children demonstrated the same decreasing pattern in paradigmatic responding across trials. This pattern was more consistent in the bilingual group. This finding suggests that the children's knowledge of hierarchical relational terms was similarly shallow so that generating paradigmatic associations became more demanding with each new elicitation. Although the focus of the study was on paradigmatic responses, it is noteworthy that both groups of children generated a large number of syntagmatic responses. Syntagmatic responses were

comparable in number to paradigmatic responses during the first trial and became the more dominant response type by the third trial. This is clear evidence that the semantic system is organized according to both paradigmatic and syntagmatic relations and, together, they construct a balanced pool of word associations. In the early school years, children's repository of paradigmatic responses is still small, and with repeated probing the balance quickly tips over to favor syntagmatic responses. This conclusion is in keeping with the view that both thematic and taxonomic relations are used to organize object kinds and the particular relations elicited in any given experiment depend on the children's age, the experimenter's instructions, the hierarchical levels (basic vs. superordinate), and the stimulus materials (pictures vs. objects; Walsh, Richardson, & Faulkner, 1993; Waxman & Namy, 1997). Our results suggest that versatile organization of the semantic lexicon in young children applies not only to object kinds but also to adjective and verb lexicons.

As predicted, children demonstrated ease in providing paradigmatic responses to adjectives relative to the other classes. This adjective advantage is consistent with previous studies (Cronin, 2002; Entwisle, 1966; Nelson, 1977). Certain characteristics of the adjective class, such as the existence of many antonyms, synonyms, and gradable continua, may promote more paradigmatic responding than nouns or verbs.

In summary, the highly similar performance between the bilingual and the monolingual children on the word association task suggests that paradigmatic semantic organization is a robust developmental phenomenon that is relatively unaffected by exposure to a second language.

*Points of divergence*. After examining the substantial similarities, we now focus on the subtle differences between the bilingual and the monolingual children's word association performance. Contrary to our predictions, we did not find a general bilingual advantage. However, there are two pieces of evidence and one trend in support of the bilingual advantage hypothesis. First, we found a group difference in the first elicitation of English word associations, with more bilingual children than monolingual children producing paradigmatic associations. Second, there was a bilingual advantage for English verbs, with more bilingual children responding paradigmatically than the monolinguals. Third, there was a trend toward a bilingual advantage for best-performance comparisons, with bilingual children generating more paradigmatic associations than the monolingual children during the first trial.

There was no main effect of bilingualism on the overall number of paradigmatic responses generated; however, the English and the best-performance measures converged in finding that at Trial 1 bilingual children had an easier time than monolingual children generating paradigmatic associations. Recall that for both groups of children there was a decrease in paradigmatic responding over trials, suggesting that the tendency to provide words from the same category was the strongest for the initial trial. Therefore, although the overall storage of paradigmatic information was similar in size between bilingual and monolingual children, this information was indeed more salient and accessible in bilinguals.

The bilingual advantage for English verbs also merits attention. There are two potential explanations for this finding. First, it may suggest a subtle but genuine bilingual advantage, manifested for the most challenging stimulus items. Consistent with previous reports (Cronin, 2002; Entwisle, 1966), children had more difficulty in generating paradigmatic responses for verbs in comparison to adjectives and nouns, indicating that paradigmatic responding to verbs emerges rather late in development. Future studies may include low-frequency and later acquired words to examine the extent of bilingual advantage for stimuli of various difficulty levels. On the other hand, the mean age of the children in the current study was over 7 years, an age at which considerable developmental changes in semantic organization have already taken place (Cronin, 2002; Nelson, 1977). Had we sampled children earlier in the developmental progression, we may have found adjectives or nouns to be more sensitive to a group difference.

An alternative explanation of the relatively restricted bilingual advantage suggests that factors other than bilingualism, such as the bilingual children's exposure to Mandarin, a verb-friendly language, may be at work. Compared with English verbs, Mandarin verbs are morphologically simpler, more likely to be in the salient sentence-final position, and more likely to be represented in children's early lexicons (Levey & Cruz, 2003; Tardif, 1996). Consequently, these factors may have caused the bilingual children to acquire heightened knowledge of paradigmatic relations for the verb lexicon. To isolate the effect of bilingualism from the effect of exposure to specific languages, future studies need to include a monolingual Mandarin control group, or a variety of bilingual groups, including bilinguals who speak languages that are equally verb friendly (e.g., Spanish–English, Korean–Mandarin).

*Conclusion and future directions*. The present study yielded the following findings. First, paradigmatic organization of the semantic lexicon is a robust developmental phenomenon not necessarily affected by the presence of a second language in the ambient environment. This is reflected in the parallel and overlapping performance on this task of lexical–semantic organization

in the L1 and L2 of the bilingual children, as well as an overall bilingual performance commensurate with same-age monolingual peers. Second, there were two points of divergence between the bilinguals and the monolinguals, suggesting a fine-grained bilingual advantage that warrants future study.

A number of future directions are derived from the current study. First, we may increase the task demands (i.e., use stimuli that are lower in frequency, later acquired, or semantically abstract) and use other language pairs to further test the bilingual advantage hypothesis. Second, we may recruit a more homogeneous sample of bilingual children so that the effects of varying proficiency levels on the development of the bilingual lexicon may be controlled. Further, we may recruit multiple samples of bilingual children with varying degrees of L1/L2 proficiency, so that proficiency levels may be systematically manipulated.

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Contact author: Li Sheng, Department of Communication Sciences and Disorders, 2240 Campus Drive, Northwestern University, Evanston, IL 60208. E-mail: lil-sh@northwestern.edu