Semantic and Conceptual Knowledge Underlying Bilingual Babies' First Signs and Words

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We addressed the question of how babies exposed to two languages simultaneously acquire the meanings of words across their two languages. In particular, we attempted to shed new light on whether babies know that they are acquiring different lexicons right from the start, or whether early bilingual exposure causes them to be semantically

confused. We propose a collection of research methods that, taken together, can answer these questions, which have hitherto received scant attention. Six hearing babies were videotaped for one hour on average seven times over one year (ages ranging from 0;7 to 2;2); three babies were acquiring French and English, and three French and LSQ. These populations offer unique insights into the semantic knowledge underlying bilingual as well as monolingual language acquisition. We found that the babies (1) acquired their two languages on the same timetable as monolinguals and (2) produced translation equivalents in their very first lexicons. Further, their early words (signs) in each language (3) were constrained along kind boundaries, (4) showed fundamentally similar semantic organization across their dual lexicons, and (5) reflected the meanings of their favorite things first. We also discuss why attributions that young bilinguals are delayed and confused have prevailed and we show that they are neither at this point in development. Finally, the present findings show how research of this type can provide a method for making bilingual norms wholly attainable.

Determining the meaning of words is a problem that has perplexed philosophers and scientists for centuries and remains an active topic of debate to this day. Determining how the young monolingual acquires word meanings—especially words for objects—is even more puzzling and has spawned a vibrant subdiscipline of study in child language. Researchers studying babies acquiring two languages from birth have also been faced with the problem of determining how these young bilinguals acquire the meanings of their very first words. But here, unlike studies of monolinguals, our understanding of what young bilinguals know about the meanings of words across their two languages has received surprisingly little scientific scrutiny. In the present article, we hope to offer three fundamental insights into (1) how bilingual babies acquire early word meanings in each of their two languages over time, (2) how word meanings are conceptually constrained and semantically organized for each language, and

(3) what research methods might best help us gain this knowledge. To achieve these goals, we focus our attention on a fascinating group of young bilinguals—babies acquiring French and Langue des Signes Québecoise (LSQ)—in addition to babies acquiring French and English, because, together, they offer us an unique lens into the semantic landscape of the young bilingual mind.

How Does the Monolingual Child Acquire Word Meanings?

In his classic observation, the philosopher Quine (1960, 1980) noted that there are numerous possible meanings for any word defined by ostension. If, for example, a mother points toward a rabbit in a room that also contains a cat and a dog, and says "rabbit," how does the child know that (1) she is referring to the rabbit in the room, as opposed to the cat or the dog, and (2) she is referring to the whole rabbit and not a part; for example, its whiskers, color, or ears? These and other problems of word learning have stimulated decades of research that have provided insights into how children acquire word meanings. While we cannot capture the full richness of this literature here, below we provide but a brief sketch of key reasoning and refer the reader to the following for important contemporary discussion of this topic (e.g., Bloom, 2000; Carey, 1982; Golinkoff & Hirsh-Pasek, 1999; Hollich, Hirsh-Pasek, & Golinkoff, in press).

Taylor and Gelman (1989) proposed that perhaps children rely on heuristics and strategies to induce the meanings of early words. One strategy that children may employ to grasp the meanings of new words is by identifying clues from linguistic form class (e.g., Carey, 1982; Taylor & Gelman, 1989). In English, for example, syntactic form class can help children distinguish between common nouns and proper nouns. Katz, Baker, and Macnamara (1974) illustrated this point in their landmark study by presenting 18-month-old girls with a doll named "Dax." These girls proceeded to call only this particular doll "Dax" and refrained from calling all other dolls by the name "Dax." Subsequently, when another group of baby girls was introduced to the same doll as "*a* Dax," the

children applied the name "Dax" to all dolls. Thus, the children acquired the meaning of "Dax" by recognizing that the determiner "a" marks common nouns as distinct from proper nouns in English.

Markman (1992) identified another possible strategy used by children to induce the meanings of new words called the mutual exclusivity constraint, which biases children toward acquiring a single label for each object in the world. One advantage of this constraint is that children can acquire new words for objects by inference. Thus, in the example above, according to the mutual exclusivity constraint, if the child knew the labels for *cat* and for *dog*, then she would infer that "rabbit" refers to the other animal in the room for which she did not have a name (the rabbit). While the strategies proposed by Taylor, Gelman, Markman, and others may enable children to acquire the meanings of new words, these strategies assume both a basic vocabulary and a basic knowledge of syntactic structure and, as such, may be problematic for babies acquiring the meaning of their very first words (see also Clark's 1988 "principle of contrast" below).

How Can Researchers Study the Bilingual Child's Word Meanings?

Researchers studying babies acquiring two languages simultaneously have also been concerned with how the babies acquire word meanings and, in particular, researchers have been concerned with the intricacies faced by bilingual babies when acquiring the semantic concepts behind two languages. One possibility, for example, is that bilingual babies "know" that they are acquiring two distinct language systems (i.e., termed the "differentiated language system hypothesis;" c. f. Genesee, 1989; for other proponents, see Deuchar & Quay, 2000; Genesee, Nicoladis, & Paradis, 1995; Lanza, 1992; Meisel, 1989; Petitto et al., 2001). Alternatively, young bilinguals may begin by thinking that words from their two different languages constitute a single language system that eventually becomes differentiated over the first few years of life (i.e., termed the "unitary language system hypothesis" by Genesee (1989), although he has not advanced this view; e.g., see instead,

Redlinger & Park, 1980; Vihman, 1985). This latter view implies that young bilinguals may be initially confused in sorting out the semantic concepts underlying early words across their two languages.

In the following section, we will outline a multifaceted approach to evaluate these competing hypotheses, and other issues surrounding the young bilingual's word meanings and their semantic and conceptual underpinnings, by using a combined methodology with several key components: analyses of the (1) presence of cross-language synonyms, which yields information about what young bilinguals know about the meanings (semantics) of words and their related underlying concepts across their two languages and sheds light on whether young bilinguals differentiate their two languages from the start; (2) conceptual underpinning of early lexical meanings, which yields information about whether word meanings are conceptually constrained; and (3) categorization of basic word meanings and concepts, which yields information about the young bilinguals' categorization of semantic concepts across each of its two languages over time, as well as identifies any universal patterns in what topics children select to talk about first. Two other methodological considerations are raised that we believe, if taken together with the above three approaches, can fundamentally advance our understanding of how bilingual babies acquire early word meanings and how word meanings are semantically and conceptually organized in each of their two languages. These considerations include arguments in support of (1) use of multiple data sources when studying young bilinguals and (2) comparisons of bilinguals to established monolingual norms.

Presence of Cross-Language Synonyms or Translation Equivalents (TEs). An intriguing and recurring question in the research literature about young bilingual babies' early two lexicons is whether they can possess a word for a specific object like a doll in, for example, French "*poupée*", and, at the same moment in development, also posses the word for this identical object in their other language, for example, English "doll." This is not a

matter of whether, like monolinguals, they possess words with overlapping meanings (like "cup" and "glass"), but whether they can have an identical word, like "cup," for an identical referent (a cup) in each of their two lexicons at the same time, especially in their set of first words.

Because in their classic study of bilingual children Volterra and Taeschner (1978) did not observe such "cross-language synonyms," or more recently called "translation equivalents" (TEs), for nearly two decades a prevailing view had been that young bilinguals do not and ostensibly cannot produce them. This was presumably because bilingual babies initially possess a single, fused linguistic system that contains largely semantically undifferentiated words from both languages, with all of the underlying conceptual confusion that this would imply.

Are bilingual babies' early lexicons semantically and conceptually undifferentiated? Are they semantically and conceptually confused? If, as some had claimed, bilingual babies do not possess two lexical items for an identical referent (one from each of their languages), then this could be considered evidence that they are initially semantically and conceptually confused. Following from this very logic, however, we suggest that if young bilinguals do possess two lexical items for an identical referent in each lexicon at the same time, then this would provide evidence that they are not semantically and conceptually confused. We fully appreciate that TEs alone would not constitute the sole evidence needed to establish that young bilinguals have knowledge of one versus two linguistic systems, but it is an important part of the combined methodology that we offer here in an attempt to gain insight into what young bilinguals know about their two languages from the start. Said another way, the discovery of TEs in the vocabulary of young bilinguals, in combination with the other methods here, would imply that they are not confused by words from each of their languages that refer to the same referent (and to the same underlying concept, and mean the same thing) because they "know" that they are acquiring two distinct languages—which is precisely what we and several other recent researchers have argued after

having discovered TEs in the vocabularies of young bilingual subjects (e.g., Pearson, Fernandez, & Oller (1995); Petitto et al., 2001; see also Nicoladis, 1998, and Quay, 1995, who report the existence of TEs in a Portuguese-English child and in a Spanish-English child, respectively). Nicoladis (1998) further proposed that children's understanding of appropriate pragmatic use of their two languages may be linked to their knowledge that their TEs belong to two distinct linguistic systems.

An important clue that bilingual babies may not possess underlying semantic and conceptual confusion when acquiring word meanings across two different languages emerged from a key study by Pearson et al. (1995) that examined the presence or absence of TEs in the vocabularies of young bilinguals. They studied 27 Spanish-English bilingual children, and reported that on average approximately 30% of an individual bilingual child's early vocabulary words was judged to be semantic TEs. Further, to explain the apparent paradox as to why young bilinguals could learn two different lexical forms for the same item in the first place—especially given the literature's proposal of "constraints" to block this from occurring in monolinguals—the researchers considered several possible explanations, one which we find especially ingenious: Specifically, they invoked Eve Clark's (1988) "principle of contrast," which states that monolingual children will reject the acquisition of synonyms due to their bias toward acquiring a single label for each item in the world: The researchers reasoned that this principle must apply within one of a young bilingual's two languages, thereby blocking within language synonyms, but not across their two languages, thereby permitting cross-language synonyms or semantically related TEs.

Most recently, TEs have even been discovered to exist "cross-modally," that is, in young bilinguals acquiring both a spoken and a signed language from birth. Based on age and vocabulary achievement, Petitto and her students (2001) matched a bilingual child acquiring French and LSQ and a bilingual child acquiring French and English with two of Pearson and colleagues' (1995) subjects acquiring Spanish and English. They observed that their

subjects produced TEs, and at a comparably high rate as those observed in Pearson's study. Specifically, Petitto's French-English child's TEs constituted 50% and 36% of the child's total vocabulary at ages 1;2 and 1;5, respectively; but compare this to the child observed by Pearson and her colleagues whose TEs also constituted 50% and 36% of its total vocabulary at the same ages. Similarly, Petitto's LSQ-French child had TEs that constituted 40% and 51% of the child's total early vocabularies at the same ages, with another of Pearson's subjects producing 41% and 36% at these two ages. Taken together, these recent cross-linguistic and cross-modal studies of semantically related TEs provide insight into what young bilinguals know about the meanings of words across their two languages and, together with the other methods offered here, suggest that bilinguals know they are acquiring two languages from the start.

Conceptual Underpinnings of Early Lexical Meanings. No studies to date have specifically examined the semantic and conceptual underpinnings of a bilingual infant's two lexicons (beyond the TE analyses above) and, thus, we must turn to these particular studies of monolinguals to gain insight into how we might study the semantic and conceptual knowledge that underlies early bilingual acquisition.

In an earlier study, Carey (1982) suggested that the semantic content of the linguistic context directs the child's attention. Carey's proposal implies that by capturing the context surrounding babies' productive vocabulary, and by examining babies' patterns of word use, researchers may infer children's early word meanings (see also Mandler, 1981). Though developed independently, Huttenlocher & Smiley (1987) and Petitto (1988) applied this basic reasoning and developed a common methodology for studying the semantic and conceptual underpinnings of monolingual babies' first words. Using a similar videotape transcription and coding procedure, the researchers inferred the meaning of deaf (Petitto, 1988) and hearing (Huttenlocher & Smiley, 1987; Petitto, 1988) babies' first words (signs) by examining each lexical item and the range of referents over which it was applied, as well

as the reverse (examining all referents and each lexical item used with them). Together, these studies provided a method for obtaining insights into the conceptual knowledge underlying babies' very first words by examining both "correct" and "incorrect" pairings of lexical forms and their referents (be they "referents" that are extensional or intensional; the word "context" here refers to every contextual event and/or situation surrounding the babies' production of each sign and/or each word). In the earliest stages of language acquisition, babies may overextend the meanings of words across multiple referents and thus "mislabel" common objects. For example, having acquired the label *dog* children may refer to all four-legged animals (including cows, horses, cats, and the like) as *dogs*. Children's tendency to overextend words in this way has elicited controversial views in the literature (see Bloom, 2000 for an excellent review). Earlier studies, for example, indicated that children rarely overextend their earliest words; Hildegard, a child observed by Leopold (1939–1949), for example, overextended only approximately 20 words out of a total number of over 300 words, while Rescorla's (1980) research indicated that one third of children's early vocabulary may be overextended (see also Clark, 1973; Volterra & Taeschner, 1978).

In a more recent study, Petitto (1992) applied previously established methods (Huttenlocher & Smiley, 1987; Petitto, 1988) to investigate whether overextensions reflected constraints on an emerging conceptual organization. Researchers' earlier assertions suggested that word meanings are constrained along kind boundaries (e.g., kinds of objects, events, locations, possessions, and so forth), and tend not to violate these boundaries (e.g., Clark, 1973; Huttenlocher & Smiley, 1987; Keil, 1989; Leopold, 1939–1949; Rescorla, 1980; Volterra & Taeschner, 1978). Petitto examined monolingual babies acquiring either a signed or a spoken language and found virtually no violations of kind boundaries; only 3/577 tokens constituted possible violations (e.g., the lexical form "open" was used only to refer to the *action* or *event* involved in opening objects, and was not used to *name* the object being opened). Thus, Petitto's study suggests that these constraints hold across both

the signed and spoken modalities in monolinguals, but whether this is also true of babies *simultaneously* acquiring a signed and a spoken language remains unknown.

Categorization of Basic Word Meanings and Concepts. Babies' first words are thought to be governed by their personal interests, such as their favorite toys, friends, and foods (Dromi, 1987; MacWhinney, 1998; Mervis, 1984; Nelson, 1973; Ninio & Snow, 1988; Slobin, 1985). In her classic study, Nelson (1973) proposed a procedure for categorizing these first words as a means of better understanding babies' underlying conceptual organization. The hierarchical procedure involved organizing monolingual babies' first 50 words into various conceptual domains, as Nelson believed that babies differentiated these conceptual categories from the onset of language production. Irrespective of the limitations inherent in subjectively organizing babies' first words into "semantic trees," Nelson's procedure proves useful in comparing categories of word meanings across infants. Furthermore, Nelson's semantic categorizations of her subjects' productions do reflect similar findings by at least one bilingual researcher, with the classic studies of Leopold (1939–1949) providing the one case in point. Though Leopold developed his system approximately 40 years prior to Nelson's, he created a hierarchical procedure similar to hers in his semantic classification of Hildegard's English and German vocabularies. Despite the different language(s) being acquired (including, the vastly different time periods, language contexts, and rearing conditions), both Nelson's monolingual subjects and Leopold's bilingual subject demonstrated remarkable similarities in the types of early vocabulary items produced (the things that they talked about across all languages) and, most importantly, in the semantic groupings that cohered them. Thus, this lone study of a bilingual child raised in the 1940s by Leopold suggests a pattern of conceptual organization common to both monolingual and bilingual babies that transcends an impressive array of linguistic and contextual differences between the two groups. Crucially, it compels us to study this issue more closely, as

(to the best of our knowledge) no one has considered this issue since Leopold.

   Use of Multiple Data Sources. Pearson (1998) rightly noted that there are currently no standardized methods for measuring bilingual babies' early linguistic achievements. Earlier case studies, for example, have examined the development of two languages over time using diaries as the primary source of data (e.g., Leopold, 1939–1949; Ronjat, 1913; Taeschner, 1983; Volterra & Taeschner, 1978). The problems of generalizability and reliability associated with relying exclusively on journal or diary entries, however (see Deuchar & Quay, 2000; Dromi, 1987, for further discussion) have more recently prompted researchers to use either (1) videotapes (e.g., Genesee, Boivin, & Nicoladis, 1996), or (2) parental checklists/ reports (e.g., Pearson et al., 1993, 1995), or (3) a combination of sources (e.g., Deuchar & Quay, 1999, 2000; Petitto et al., 2001; Quay, 1995; Vihman, 1985) to overcome these limitations in their investigations of one or more bilingual children's productions. Pearson (1998) also stated that using multiple sources to obtain data from bilingual babies' early productions is a definite improvement over measures employed in the past because they provide a more representative measure of bilingual babies' achievements, while cautioning that they may not always give the bilingual infant full credit in terms of linguistic knowledge. Sensitive to such caveats, in Petitto and students' study (2001), as well as in the present study, three sources of data collection were used—in addition to a fourth crucial check on the three—to ensure that the data were representative of the bilingual child's linguistic achievements at any given time: extensive videotape recordings made at every experimental session (primary source data of the actual children), use of the MacArthur CDI's (parental checklists/ secondary source data), and detailed videotaped interviews conducted with parents and family at every experimental session (parental reports/secondary source data). In addition, detailed experimenter notes were made both during and immediately after a session and used as an important external validity measure of the three data sources above (e.g., to check that at least one of the above three

data sources contained a vocabulary item that may have been observed off-camera; as a basis to know whether the child was on the cusp of an important language milestone and consequently to ensure proper scheduling of the next visit; as a means to assess critical developmental, cognitive, and social developmental milestones). What our use of combined methods has taught us is that such methods can and do provide the richest and most comprehensive profile possible of the young bilingual, and are best situated as the foundation upon which bilingual research must rest.

Comparisons of Bilinguals and Established Monolingual Norms. The above concerns raised by Pearson (1998) regarding the assessment of bilingual babies' linguistic development are commensurate with earlier caution raised in the bilingual field at large. Grosjean (1989), for example, in his important research with bilingual adults, made the well-known assertion that the bilingual is not two monolinguals in one person. While acknowledging that there are clearly differences and variations in early linguistic development of bilingual babies relative to monolinguals, Nicoladis and Genesee (1997) have nonetheless provided evidence for similarities between the two groups. In terms of linguistic milestones, for example, Nicoladis and Genesee found that no differences exist between the developing monolingual child and the developing bilingual child, providing that both of the bilingual child's two languages are taken into account. Although this issue is far from settled, several recent studies of bilingual babies acquiring a myriad of languages (including signed languages), and including those directly comparing bilingual and monolingual groups, have generally corroborated this new perspective: if we take the young bilingual's two languages into consideration, we will find that, combined, their linguistic milestones are comparable to the well-established monolingual norms (e.g., Nicoladis & Genesee, 1997; Pearson et. al., 1995; Petitto et al., 2001; Quay, 1995), with the classic monolingual milestones being the achievement of the first-word milestone between ages 0;09 and 1;02 (e.g., Capute et al., 1986; Vihman & McCune, 1994), the first two-word combinations between ages 1;05 and 2;02 (e.g., Brown, 1973;

Bloom, 1975; Petitto, 1987), and the first 50 words (types) at approximately 1;07 (e.g., Charron & Petitto, 1991; Nelson, 1973; Petitto, 1987). Therefore, direct comparisons of a young bilingual's productions with monolingual norms should continue to be fruitful as long as each of the bilingual child's two languages are evaluated and as long as the focus rests squarely on discerning both the similarities *and* the differences between the two groups.

Objectives

The overarching goal of the present research is to contribute new information regarding the semantic and conceptual knowledge underlying bilingual babies' first words. Specifically, we ask how bilingual babies acquire early word meanings in each of their two languages, and how word meanings are conceptually constrained and semantically organized for each language. It is also our objective to uncover a set of key research methods that together will best help us gain this knowledge. To achieve these goals, we examine bilingual babies, firsthand, prior to the onset of their first words until approximately age two across multiple language contexts, including those in which we varied novel and familiar language users. We examine both bilingual babies acquiring two spoken languages (English and French) simultaneously and bilingual babies exposed to a spoken and a signed language (LSQ and French). The latter signing-speaking group was studied to gain insight into the semantic knowledge underlying all bilingual language acquisition. For the sake of clarity, we first outline our hypotheses and predictions relative to the order that the analyses are presented in the Results section of this article, followed by a brief discussion of the special questions that the study of young signing-speaking bilinguals permit us to address.

Bilingual Language Milestones. First we evaluate whether the overall developmental language milestones are the same across the signing-speaking bilinguals as compared to our bilinguals acquiring two spoken languages (and as compared to the literature). In addition to answering when (what age) young

bilinguals attain the classic language milestones, this analysis also establishes crucial information about what the basic set of word meanings is for each child across each of his or her two languages over time. Following from Petitto and her students' (2001) study of a smaller sample of babies acquiring two spoken languages and babies acquiring sign and speech, as well as from the important studies of Nicoladis and Genesse (1997), Pearson and colleagues (1995), and others, we predict the following: All our bilinguals' achievement of the classic language milestones in *each* of their two input languages should be comparable, and, overall, the ages at which all infants achieve each language milestone should be comparable to those of monolinguals. If confirmed, the results would provide cross-linguistic and cross-modal empirical validity to the field's growing perspective that, developmentally, the bilingual child's two languages, together, are comparable to monolingual language development (e.g., Nicoladis & Genesee, 1997; Pearson et al., 1995; Petitto et al., 2001), as well as providing the essential data over which subsequent semantic analyses can proceed.

Cross-Language Synonyms. Having established the basic vocabularies and their meanings for each child across each of his or her two input languages over time, we can analyze the data for the presence or absence of cross-language synonyms or TEs. One goal was to evaluate the important observation from previous findings that TEs are indeed a robust phenomenon constituting approximately one-third of a child's total combined lexicons. Here, however, we conduct our analyses using both (1) the multiple data sources described above, including the use of primary data from our bilingual babies because Pearson and colleagues' (1995) observations were drawn exclusively from secondary sources involving parental checklists, and (2) a larger sample of babies because Petitto and students (2001) examined TEs in two babies. Another goal is that we sought to gain key insights into the semantic underpinnings of their early lexicons. If TEs are found in our babies' vocabularies, then it would suggest that they are not semantically confused and provide further support for the view

that bilingual babies can differentiate their two language systems as early as the first-word stage. If, on the other hand, the babies are semantically confused, then this might be evidenced by a marked absence of TEs.

Conceptual Underpinning of Early Lexical Meanings.   To understand the underlying conceptual "glue" that binds early lexical items and their meanings, we compare and contrast the relationship between all lexical items in each language and the range of referents over which they apply (and vice versa), paying special attention to the nature and extent of "overextensions" and/or other semantic "errors" of meaning. The import of this analysis rests both in its first-time application to the dual lexicons of bilinguals and in the insights that follow from it: specifically, this analysis provides a fascinating window into the core conceptual principles that guide early word learning. It especially permits us to test two prevailing hypotheses about the underlying principles that bind words and their meanings in early monolingual language acquisition: early lexical meanings are constrained along "kind boundaries" (e.g., kinds of objects, kinds of events, kinds of locations; or taxonomically) and/or according to associative lists of meanings (e.g., the word "cookie" means: the object cookie, the container that they are kept in/jar, the location where they are stored/top of refrigerator; or, thematically). Should we find that each of a bilingual child's lexicons is constrained, and constrained similarly, we will gain insights into the underlying conceptual principles that bind the child's lexical knowledge. Additionally, such a finding will suggest testable new hypotheses about possible universal conceptual principles that bind early word learning across all language acquisition.

Categorization of Basic Word Meanings and Concepts.   Working hand in hand with the above analysis, we ask how word meanings (and corresponding semantic concepts) may be categorized in each of a young bilingual's two lexicons. Specifically, we asked whether bilingual children "talk" about the same types of things as monolinguals, and do they do so in each of their two languages. Dromi (1987), MacWhinney (1998), Mervis (1984), and

Slobin (1985) have hypothesized that children first acquire names for things that are of personal interest. Using a procedure similar to that developed by Nelson (1973) for monolingual babies, our goals here are twofold: First, our goal is to establish whether the dual lexicons of young bilinguals exhibit fundamentally similar categorical organization as would be revealed through similar Nelson-type semantic trees. Our second goal is to investigate whether bilingual babies first acquire meanings for things that are related to them and, if so, to examine whether they do so in each of their two languages. While this possibility has been suggested for babies acquiring a single language from birth, to date no studies have examined this question in bilingual babies. As above, should we find important similarities in the categorization of word meanings across bilinguals (involving each of their lexicons) and monolinguals, we will have gained insight into possible universals regarding the types of things that children will talk about—those that may underlie all early language acquisition.

Special Insights from Studying Young Signing-Speaking Bilinguals

Analyses of signed languages have revealed that, like spoken language, they are lateralized in the left hemisphere (e.g., Bellugi, Poizner, & Klima, 1989) and utilize identical brain tissue as hearing speakers when processing identical linguistic functions (e.g., phonetic-syllabic units in sign are processed in the identical secondary auditory tissue as hearing people; Petitto et al., 2000). Signed languages also exhibit the same levels of language organization (e.g., phonemic, morphological, syntactic, discourse) and are acquired in similar ways as spoken language (e.g., Newport & Meier, 1985; Petitto, 1987, 1992; Petitto & Marentette, 1991). Further, recent developments in bilingual research have suggested that bilingual babies acquiring both a signed and a spoken language do so along the same maturational time course as monolingual babies (e.g., Petitto et al., 2001). We may thus conclude that a child exposed to a spoken and signed language from

birth is indeed in a bilingual situation similar to a child exposed to two spoken languages from birth.

At the same time, unlike the baby acquiring two spoken languages, there exists a key dramatic difference: the signing-speaking baby's two languages are produced and perceived in entirely different modalities (manual-visual versus oral-aural, respectively). It is this very difference that can be employed to shed new light on the semantic and conceptual underpinnings of babies' early productions. For example, because some individual signs in signed languages are "iconic" (pictorial, representational; e.g., a cupped hand shape raised to the lips is the formal sign for TASSE or cup in LSQ), and because some other signs are outright "indexical" (e.g., pointing to self is the formal sign for MOI or me in LSQ, and pointing to other is the sign for TOI or you) it could be that this type of bilingual child's sign lexicon may constitute a fundamentally different class of lexical items than in his or her speech. While it has already been well established by Petitto (e.g., 1987) and others that sign iconicity does not play a major role in monolingual deaf children's acquisition of signs, the key question here is whether we will discover sign and speech lexicons conveying vastly different semantic meanings in these young signing-speaking bilinguals. If there are true universals in underlying semantic and conceptual knowledge, then they should reveal themselves with common semantic relations expressed across sign and speech, thereby overriding modality differences.

In summary, the study of bilingual signing-speaking babies enables us to test specific hypotheses about bilingual acquisition. In particular, we hope to shed new light on whether young bilinguals differentiate their two languages from the onset of language production and further make establishing bilingual norms attainable. Moreover, we asked what bilingual babies know about their two languages and precisely when they know it, including whether their early word meanings are constrained, and how their early concepts are organized. By comparing the bilingual babies acquiring a signed and a spoken language from birth to bilingual babies acquiring two spoken languages, we attempt to answer these

questions in order to enhance knowledge of the semantic and conceptual foundation upon which bilingual language acquisition rests.

Method

Participants

Six hearing babies participated in this study. Three hearing babies were acquiring French and English, and the other three hearing babies were acquiring French and LSQ. The babies acquiring the two spoken languages served both as a control group with which to compare our experimental group (the babies acquiring a signed and a spoken language), as well as an experimental group with which to compare to other studies of young bilinguals—with all six babies also being compared to the well-documented norms of monolingual language development. All the babies had regular and consistent exposure to both of their input languages from birth, and each parent of each child identified himself or herself as using primarily one language with his or her child.[1] Nonetheless, all six babies had a parent who stayed at home and a parent who worked outside of the home during the day, a situation that predicts variation in the amount of lexical items across the babies' two languages (i.e., we would expect a baby to have more French words if she stayed at home with her French mother during the day; we elaborate more on this topic in the Discussion section of this article).

The babies were studied over a one-year period: Videotaped sessions took place monthly before the production of their first words (first signs) in each of their input languages. Once the "first-word" linguistic milestone was achieved, the babies were subsequently videotaped tri-monthly until approximately two years of age. Note that the babies were studied before the production of their first words and were followed beyond their first 50 words in each of their two languages. The babies were videotaped

in a comfortable living room designed for babies and parents at McGill University. Table 1 provides information about the babies.

Procedure

All experimental sessions with the babies and their families were videotaped by a research assistant. The research assistant filmed the babies through a window and did not participate in the sessions. Our sessions were designed to provide interesting and multiple contexts (involving multiple language users), and a setting as natural as possible, during which we could observe a child's dual language productions, over time. In each session parents were instructed to use the language that they "normally" use with the child when addressing the child, each other, or the experimenters, which in all cases was the adult's native language. Two monolingual experimenters (each a native speaker of one of the babies' native languages) also played with the babies during the sessions (at different times) in order to ensure that an opportunity existed for the child to use each of his or her languages, and to do so with adults other than immediate family members. Past studies have shown that employing novel monolingual experimenters (who do not understand the child's second language) is a highly effective way of eliciting productions in the experimenter's language since babies tend to accommodate the interlocutor in order to make themselves understood (e.g., Genesee, Boivin, & Nicoladis, 1996).

In a typical session, first, the child interacted freely with both parents and experimenters. Parental reports of the babies' linguistic development were obtained at this time in the form of an on-line videotaped interview. Then the baby was left alone to play and converse with one parent, and then the other parent was left alone to play and converse with the baby. After this, the baby was left to converse and play with an experimenter who was a native speaker (signer) of one of the baby's languages, and, following this, the baby played with a different experimenter who spoke (signed) the baby's other language. Finally, all experimenters and parents present played together with the baby; each of these situations

Table 1

Ages of subjects at videotaped sessions

English-French	LSQ-French
Ed	Amy
1;00.16	0;11.30
1;01.16	1;01.03
1;02.20	1;02.15
1;04.01	1;05.13
1;05.11	1;08.06
1;07.00	1;11.02
1;10.20	
2;01.04	
Jane	Val
0;07.23	0;11.19
0;10.06	1;00.12
0;11.10	1;02.10
1;00.13	1;05.17
1;01.07	1;08.23
1;02.08	1;11.04
1;04.30	
1;08.08	
1;11.06	
Sue	Oli
1;00.14	0;11.20
1;01.15	1;03.14
1;02.11	1;07.00
1;03.18	1;10.00
1;04.22	2;01.06
1;07.29	
1;11.02	
2;02.14	

lasted for approximately 10–15 minutes. Thus, approximately one hour of primary videotape data per baby was captured for each baby per session. The entire length of the videotaped sessions of all six babies was then fully transcribed, and the babies' verbal and manual productions were attributed lexical status according

to the "transcription and coding" procedures outlined by Petitto et al. (2001).

Detailed notes were taken by experimenters of their observations of the babies' linguistic abilities, noting comprehension and production in each language, both during and immediately following each videotaped session. After every session, parents were asked to complete MacArthur Communicative Development Inventories (CDI; Fenson et al., 1991) for babies (designed for ages 0;08 to 1;04), for each of the babies' two languages, noting both the words (or signs) that they produced and comprehended. The French parents were given a CDI that was both translated into and adapted for French (Trudeau, Frank, & Poulin-Dubois, 1997). Following Petitto and her students (2001; see also Deuchar & Quay, 1999, 2000; Quay, 1995; Vihman, 1985), the on-line interview with the parents, experimenters' reports, and CDIs were used to ensure that the videotaped samples were representative of the babies' linguistic achievements and were commensurate with published standardized norms. Together, the CDIs and the productions captured on videotape were used to obtain the order of the acquisition of the babies' first word through their first 50 words in both languages, and the ages of the babies at each of the 1-, 10-, 30-, and 50-word milestones.

To gain insight into babies' early word meanings in each of their respective input languages, we coded every word or sign that the babies produced (as established by the criteria for attributing lexical status to infants' forms by Petitto et al., 2001), and the apparent item (referent) that it was used in relation to (extensionally or intensionally), as well as the reverse—for every referent, the entire range of words (signs) used in relation to it using standard CHILDES transcription format (MacWhinney, 1995). Thus, meaning was determined by examining the babies' use of a lexical item in relation to the range of referents over which it was applied (Petitto, 1992). Each lexical item–referent pairing was then coded as being either "appropriate" or "inappropriate." These terms were not intended to "pre-judge" the meaning(s) of the babies' productions, but rather to provide a manner by which the

"inappropriate" terms may be identified quickly as distinct from the hundreds of other forms produced by the babies. For example, if an infant produced the word (sign) "ball," and it was used in relation to a ball, it was coded as "appropriate." Whereas, if the word (sign) "ball" was used in relation to a cup, for example, it was coded as "inappropriate." Once each lexical item-referent pair was coded in this manner, all the "inappropriate" instances were individually scrutinized.

To shed light on how bilingual babies' first word meanings are organized, the babies' first 10, 30, and 50 words were categorized according to the semantic structure classification system used by Nelson (1973; see Figure 1). The procedure used here to classify the bilingual babies' early productions, however, differed from Nelson's procedure in two ways.

First, because Nelson (1973) herself acknowledged that her fourth level of semantic classification varied as a function of individual differences among children, we subdivided each of our bilingual babies' two lexicons into Nelson's first three levels only. Briefly, and as is illustrated in Figure 1, Nelson's semantic categorization system divided the first level into *Objects* and *Nonobjects*. The second level further divided Objects into *Animate* and *Inanimate* objects, and the category of Nonobjects was further subdivided into *Person-Related* and *Object-Related* categories. The third level of classification then split animate objects into *People* and *Animals*, and inanimate objects into *Personal* and *Impersonal*. The Person-Related Nonobjects category was split into *Action* and *Expressive*, and the Object-Related words into *Action* and *Properties*. According to Nelson, these first three levels of classification are common to all children. With regard to Nelson's fourth level of classification (not used here), this level varied across children and was dependent upon the child's lexicon and observed use. For example, all but one of Nelson's subjects, Lisa, had a category of "body parts," which was classified under Personal, Inanimate, Objects (see Nelson, 1973, for further examples of fourth-level subdivisions). We did not apply this fourth level of classification to our babies' early words because we were interested in gaining
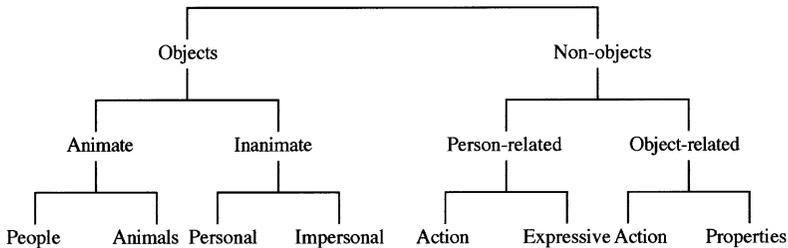
Figure 1. Nelson's (1973) semantic structure: Template

insight into how all children categorize their early concepts (and not into individual differences, which the fourth level of classification provides). Thus, we collapsed the fourth level of the semantic trees to gain a better understanding of whether all of the bilingual babies' first 50 words reflected their personal interests.

Second, we conducted first-time analyses of bilingual babies' first words in *both* languages until the 10-, 30-, and 50-word milestones were achieved yet Nelson (1973) studied only monolinguals.

Lexical items were arranged according to the semantic structure specified by Nelson (1973) for each baby (according to the template seen in Figure 1) at three different times: Time 1 (T1) = first 10 words, Time 2 (T2) = first 30 words, and Time 3 (T3) = first 50 words. Following the literature, we included the babies' words from each language at each time (Pearson et al., 1993; Nicoladis & Genesse, 1997). For example, a baby might have three French words and seven English words at the 10-word milestone. Although we held T1, T2, and T3 constant across each child, these times often occurred at different ages for different babies. Ed, for example, reached the 10-word milestone (T1) at 14 months, while Oli was only 12 months at T1. As a result, the intervals between T1, T2, and T3 also vary by infant.

Reliability

The videotapes of all experimental sessions were fully transcribed twice, each time by a native user of each respective lan-

guage heard or seen on the videotape; for example, an LSQ deaf signer transcribed each tape for the child's signed utterances and then a French speaker transcribed the tapes for the French utterances. Two additional transcribers (one for each language) performed reliability checks on lexical attributions, with respect to both the lexical gloss (type) and its tokens in addition to other coding judgments. Agreement among coders was initially 83% (regarding both agreement that a linguistic event had occurred and agreement concerning what occurred within the linguistic event or its linguistic content and classification of its content, including lexical attributions). Through discussion, all disagreement regarding both coding and lexical attributions was resolved and yielded 100% agreement.

Results

Analysis I: Early Linguistic Development: The Classic Milestones and Lexical Growth

The age of attainment of the bilingual babies' first words was determined at (1) the first-word milestone in each language, (2) the first 50-word milestone in each of the babies' languages, and (3) the age at which 50 words were attained using words from both languages (e.g., the time at which the infant has, for example, 20 English words and 30 French words). This analysis was performed to compare the babies' linguistic development across groups and to the well-established monolingual norms. The results are presented in Table 2; all six bilingual babies achieved the classic milestones in each of their native languages at approximately the same time. The babies acquiring French and English attained their first word between 0;11 and 1;02 years in each of their languages. Ed, an English-French infant, produced his first words in both languages at the same time; Jane produced a word in English first, followed approximately two months later with her first French word; Sue produced her first word in French and then

her first English word approximately one month later. The English-French babies produced their first 50 words between the ages of 1;04 and 2;02 in at least one of their languages. While only Sue produced 50 different words in each language, all babies acquiring the two spoken languages produced 50 different words using both languages between the ages of 1;04 and 1;11.

The LSQ-French babies produced all their first words in both languages at the same time and all at 11 months of age. All three babies had 50 words in French between 1;08 and 1;11 years. Only Oli had 50 words in both French and LSQ at 2;01, but all three babies had 50 words using both languages between ages 1;07 and 1;08.

The average age of attainment of the English-French and of the LSQ-French babies' first word and first 50 words (in both languages combined) are given in Table 3, and are compared to monolingual norms. While the LSQ-French babies attained both linguistic milestones on average slightly earlier than the English-French babies, all the bilingual babies' ages at the time of their early productions were commensurate with monolingual norms.

Table 2

Ages of subjects at attainment of the first-word and first-50-word linguistic milestones

	Milestone				
	First-Word		First-50-Word		
Child	English	French	English	French	English + French
Ed	1;02.20	1;02.20	—	2;01.04	1;10.20
Jane	0;11.10	1;01.07	1;04.30	—	1;04.30
Sue	1;02.11	1;01.15	2;02.14	2;02.14	1;11.02
	LSQ	French	LSQ	French	LSQ + French
Amy	0;11.30	0;11.30	—	1;11.02	1;08.06
Val	0;11.19	0;11.19	—	1;08.23	1;08.23
Oli	0;11.20	0;11.20	2;01.06	1;10.00	1;07.00

The number of types of words or signs produced by each young bilingual over time was also examined relative to monolinguals (see Figure 2). The "neutral" forms appearing in Figure 2 are lexical forms that could not be judged as being either French or English because of their immature phonology (e.g., a baby's production "ba" could refer to either the French adult form "balle" or the English form "ball"). A few proper names used in both languages were also included in the class of neutrals (e.g., Mickey, Big Bird) for the English-French babies, whereas modality differences in the LSQ-French babies made it clear which language was being used from their very first attempts at language production (signed versus spoken).[2]

The general trend for all of the babies was an increase in vocabulary types in each of their two languages over time. Only one LSQ-French subject, Val, did not follow that trend; she produced fewer words in her last session as compared to previous ones. Upon closer examination, however, the decline in vocabulary types in each of her two languages is proportional; she did not suddenly cease producing words in one language while productions in her other language flourished. For all the babies studied here, the rate and growth of vocabulary types in one language is

Table 3

Average age (or range of age) of subjects at attainment of the first-word and the first-50-word linguistic milestones

	Milestone	
Group	First-Word	First-50-Word
English-French	1;01	1;09
LSQ-French	0;11	1;08
Monolingual[a]	0;09–1;02	1;07

[a]The monolingual norms for the linguistic milestones were determined from:
(a) First-word: Capute et al., 1986; Vihman and McCune, 1994, and
(b) First-50-words: Nelson, 1973; Petitto, 1987; Charron and Petitto, 1991.

more rapid than in the other, but the development of the two languages parallel each other (i.e., productions in both languages either increased, or in the case of Val, decreased proportionately over time). Taken together, these results indicated that all of the bilingual babies attained the classic linguistic milestones, and demonstrated lexical growth in each of their two languages, along
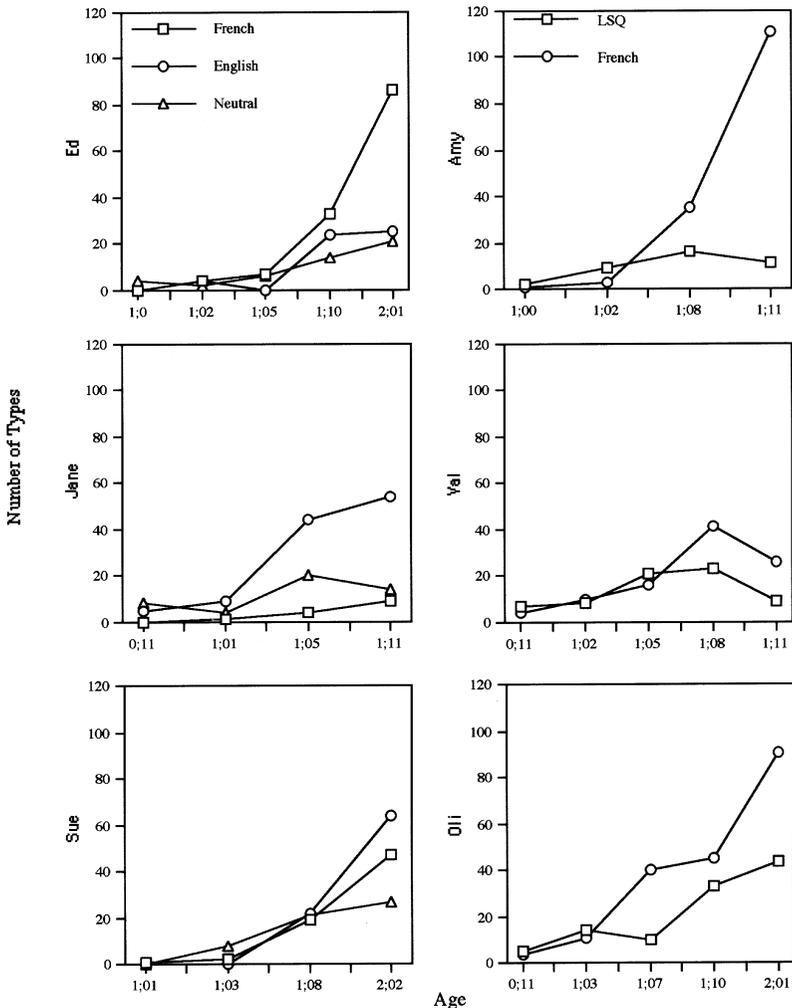
Figure 2. Types of words or signs produced in sessions over time: English-French and LSQ-French infants

the same maturational time course as monolingual babies (e.g., Capute et al., 1986; Vihman & McCune, 1994).

Analysis II: The Nature of Early Word Meanings: Do Young Bilinguals Produce Translation Equivalents?

Following Pearson and her colleagues (1995) and Petitto and her students (2001), the percentages of TEs present in the six babies' first 50 words were derived by counting the total number of TEs present in the babies' vocabularies and dividing it by 50. The results yielded similar percentages of TEs across the English-French babies, 25%, 28%, and 28%, and across the LSQ-French babies, 20%, 26%, and 42%. The average percentage of TEs present in the babies' total 50-word lexicons were thus remarkably similar at 27% and 29% for the English-French and LSQ-French groups, respectively. These averages were also similar to those reported for the bilingual babies in the Pearson and Petitto studies, and suggests that bilingual babies do possess two words (one from each language) that can refer to the identical referent that are used appropriately without apparent semantic or conceptual confusion and lends support to the hypothesis that they "know" that they are acquiring two languages.

Analysis III: The Nature of Early Word Meanings: Are Bilingual Babies' Early Word Meanings Constrained?

All forms produced by the babies that were deemed lexical from the criteria for lexical attributions established by Petitto and her students (2001), were further coded as to the range of referents in relation to which the lexical form was used (and vice versa). Each lexical item and referent pairing was then coded as being either appropriate or inappropriate. This analysis provided insight into whether the relationship between a child's lexical form and its apparent referent (be it intensional or extensional) was principled, and whether it was bound along "kind boundaries," both within one of his or her native languages and across his or

her two native languages, over time. "Kind boundaries" included, for example, kinds of objects, events, locations, and possessions (e.g., Clark, 1973; Huttenlocher & Smiley, 1987; Keil, 1989; Leopold, 1939–1949; Petitto, 1992; Rescorla, 1980; Volterra & Taeschner, 1978). For example, if the word *cup* was used for an object that can contain liquid, that we can lift to our lip, and from which we can drink, it was coded as "appropriate." If the word *cup* was used in relation to a plate, it was coded as "inappropriate;" these terms were not intended to prejudge the child but were used only as a heuristic in our computer database that enabled us to analyze many utterances and to quickly find such nonstandard (or "inappropriate") pairings for subsequent scrutiny. Referent–linguistic form pairings that were not used along particular boundaries were counted as "violations" of kind boundaries (again, used here as a heuristic to be able to find them, should they exist, in large corpora for subsequent scrutiny).

The findings regarding this analysis are presented in Table 4. Over the course of our examination of the babies, only 3.5% (259/7381) inappropriate tokens were observed or an average of 43 tokens per child (each individual infant produced between 15 and 70 inappropriate tokens each). Of the 148 inappropriate tokens produced by the French-English bilinguals, only six did not respect kind boundaries. Similarly, of the 111 inappropriate tokens produced by LSQ-French bilinguals, only nine did not respect kind boundaries. Each of the inappropriate productions was examined individually and the list of examples is provided in Table 5.[3] The most common type of inappropriate productions was overextended forms. Ed, for example, routinely overextended names of animals (i.e., he referred to a horse as *cow*, and to a rabbit as *duck*). Jane, on the other hand, often overextended names of fruits (i.e., she referred to both apples and cucumbers as *bananas*). The patterns of overextensions were similar for the LSQ-French babies as well. Amy overextended names of fruit (i.e., she used the French form *pomme* (apple) to refer to an orange), and Val labeled a horse by producing the French form *chien* (dog). The patterns of overextensions were observed across all babies, occurred in both of the

babies' two languages, and accounted for 94% (244/259) of the inappropriate tokens produced by all babies. The inappropriate forms produced by the babies that did violate kind boundaries were exceedingly rare (approximately 6% of all inappropriate forms) and did not exhibit any pattern or regularity (e.g., Amy referred to a banana as *bébé* (baby), and Oli referred to an apple as *nez* (nose)). Moreover, these kind violations were relatively evenly distributed through the babies' sessions: The English-French babies' six kind violations occurred at ages 14 (one violation), 16 (four violations), and 19 (one violation) months, and the LSQ-French babies' nine kind violations occurred at ages 12 (three violations), 14 (two violations), and 19 (four violations) months, respectively. Taken together, the results of this analysis suggest that babies do overextend their early forms, but these extensions are constrained within kind boundaries, and these constraints hold across both languages and modalities in the young bilingual over time.

Table 4

Numbers of appropriate and inappropriate tokens

Group	Tokens			
	Total	Appropriate	Inappropriate	Violations
English-French				
Ed	952	937	15	1
Jane	2113	2043	70	4
Sue	923	860	63	1
LSQ-French				
Amy	1344	1304	40	5
Val	706	689	17	0
Oli	1343	1289	54	4

Table 5

Examples of inappropriate tokens

Group	Tokens		
	Form	Referent	Kind
English-French			
Ed	*vache* (cow)	horse	animals
	duck	rabbit	animals
	bye	necklace	*
Jane	banana/e[a]	apple	fruits
	banana/e[a]	cucumber	fruits
	mouton (sheep)	cow	animals
	water	photo	*
Sue	woof	cat	animals
	shoe	sock	clothes
	ball	apple	*
LSQ-French			
Amy	CHAT (cat)	dog	animals
	pomme (apple)	orange	fruits
	bébé (baby)	bananas	*
Val	*chien* (dog)	horse	animals
	OISEAU (bird)	butterfly	animals
	BROSSE-DENT (toothbrush)	hairbrush	brushes
Oli	*auto* (car)	tractor	vehicles
	POMME (apple)	banana	fruits
	nez (nose)	apple	*

Note. French forms are in italics, LSQ forms are in capital letters, and English glosses are provided in parentheses. The asterisk refers to the inappropriate tokens that violated kind boundaries.

[a]Due to her immature phonology, it was unclear as to whether Jane was producing the English form *banana* or the French form *banane*.

Analysis IV: The Nature of Early Word Meanings: How Are Bilingual Babies' Early Word Meanings Organized?

Following Nelson (1973), three levels of semantic structure were arranged hierarchically to provide insight into how babies'

early concepts are organized. Specifically, we were interested in determining whether babies' first words reflect things that are of interest to them. In Nelson's study, a semantic tree was constructed following a template (Figure 1), with the babies' first 10 words (Time 1 = T1), first 30 words (Time 2 = T2), and first 50 words (Time 3 = T3). Similarly, we constructed a semantic tree for one English-French child, Ed (Figure 3), but unlike Nelson's monolingual subjects, Ed's semantic tree included words from both of his two languages including "neutral" forms (i.e., forms that could not be judged as being either English or French, including proper names). The first 10, 30, and 50 words were included here irrespective of grammatical category (i.e., we did not restrict our analyses in any way; nouns, verbs, adjectives, etc., were reported if they were in fact the babies' first words). The data from Ed's tree have been reproduced in the Appendix together with the data from the other two English-French babies, Jane and Sue, with the LSQ-French babies' data, Amy, Val, and Oli, and with three of Nelson's (1973) monolingual subjects, Ellen, Lisa, and Robert. The table in the Appendix preserves the semantic structure specified by Nelson, and is thus comparable to the semantic trees used by Nelson in her earlier study.

The semantic structure both within and across the English-French, LSQ-French, and monolingual groups was compared at T1, T2, and T3 by comparing the percentage of words produced in each category. The percentage of words in each category of the table (see Appendix) was calculated by taking the number of words in the category and dividing it by the total number of words at that time. So, for example, if a child had two words categorized under "animate objects" at T1 (i.e., 10 words total) then animate objects would constitute 20% (2/10) of the babies' total vocabulary at the 10-word stage. Percentages were taken as opposed to raw numbers because Nelson's subjects did not always have the same number of words at the various times (e.g., Lisa only had nine words at the 10-word stage).

The first two levels of Nelson's (1973) semantic structure were compared within and across babies at all three times. The
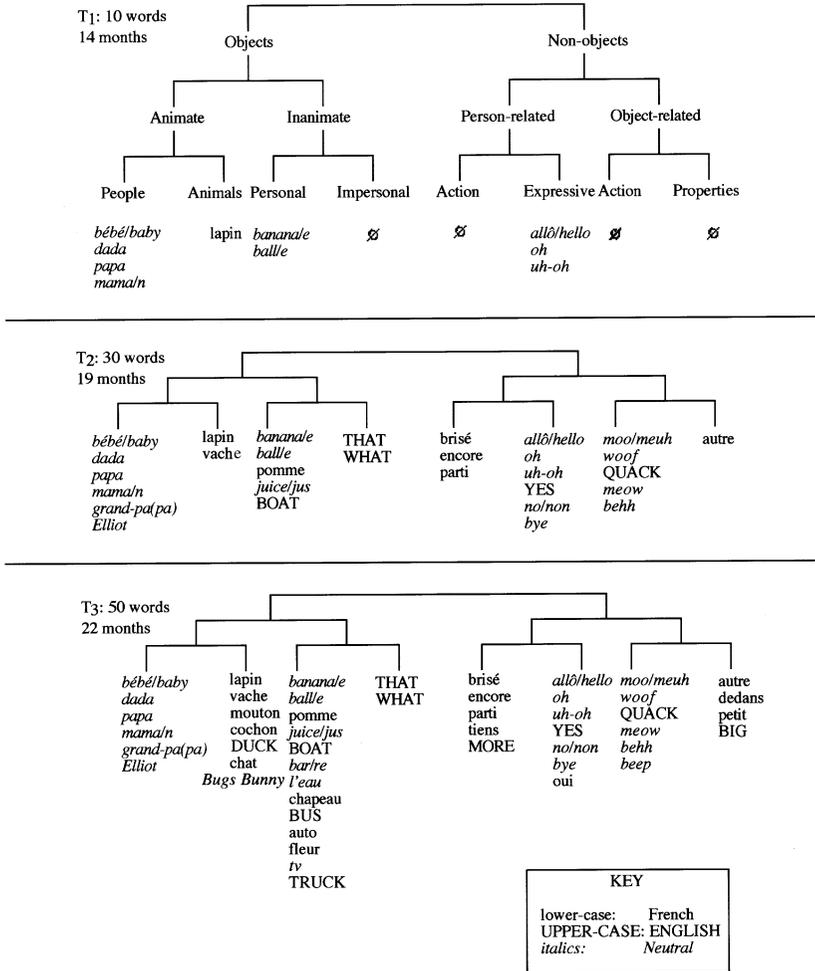
Figure 3. Nelson's (1973) semantic structure for one English-French child: Ed

results of the analysis at T1 indicated that all three groups of babies produced a large percentage of animate words as their first words, ranging from a total of 20–63% (see Table 6). Only one infant, Sue, did not produce any inanimate object words, whereas all the other babies produced a moderate percentage (ranging from 10–22%). All the babies produced a large percentage of person-related words, ranging from 25–70%. Only two babies, the English-

French speaking infant, Sue, and Nelson's monolingual subject, Lisa, produced object-related words at the 10-word stage.

At the 30-word stage (T2), the percentage of animate object words decreased from T1 for all but one LSQ-French subject, Amy (range: 19–35%; see Table 6). The percentage of inanimate object words increased slightly or remained the same for all the babies (range: 10–38%). The percentage of person-related words produced differed by infant at T2. Four babies (one English-French infant, one LSQ-French infant, and two monolingual babies) increased their production of person-related words at T2. In contrast, one English-French, two LSQ-French, and one monolingual infant(s) decreased their production of person-related words, and one infant, Ed, had no change in the percentage of person-related words at T2. The percentage of object-related words increased across all subjects but one, Lisa, at the 30-word stage.

At T3 (the 50-word stage), the percentage of animate object words that the babies produced remained relatively stable from T2 (range: 16–36%; see Table 6). The percentage of inanimate object words increased for all but one subject, Robert, while the percentage of person-related words decreased for all but one infant, Val. Finally, the percentage of object-related words remained relatively stable for all of the subjects at T3.

In summary, all the babies' productions at the first two levels of Nelson's semantic structure could be categorized in a similar manner with few exceptions, and followed similar trends across time. In general, the percentages of animate words decreased between T1 and T2 as more words in different categories were being acquired. At T3, however, the number of animate words produced by the babies remained relatively stable from T2, and accounted for approximately one-quarter of all words that the babies produced—compare the average percentage of animate words produced over time: T1 = 44%, T2 = 27%, T3 = 25%. In contrast, the average number of inanimate object words produced by all babies increased steadily: T1 = 15%, T2 = 23%, T3 = 32%. The average percentage of person-related words decreased slightly across time: T1 = 38%, T2 = 36%, and T3 = 30%, and the

Table 6

Percentages of words produced by all subjects at the 10-, 30-, and 50-word stage as categorized by the Nelson semantic trees

| | Objects | | | | | | Nonobjects | | | | | |
| | Animate | | | Inanimate | | | Person-Related | | | Object-Related | | |
Word Stage	10	30	50	10	30	50	10	30	50	10	30	50
English-French												
Ed	50	27	26	20	23	30	30	30	24	0	20	20
Jane	30	23	28	20	20	28	50	47	36	0	10	8
Sue	50	27	24	0	10	24	30	40	30	20	23	22
LSQ-French												
Amy	20	27	26	10	20	28	70	43	36	0	10	10
Val	40	27	22	20	27	28	40	23	32	0	23	18
Oli	50	33	36	20	20	34	30	37	24	0	10	6
Monolingual[a]												
Ellen	45	35	23	22	38	59	33	17	12	0	10	6
Lisa	45	19	16	11	27	37	33	46	37	11	8	10
Robert	63	27	27	12	23	21	25	42	41	0	8	11

[a]Monolingual subject data from Nelson (1973).

average percentage of object-related words fluctuated slightly over time: T1 = 3%, T2 = 14%, T3 = 12%.

To gain further insight into the nature of babies' first word meanings, we then analyzed the babies' productions at the third, more specific, level of classification. To test our hypothesis that babies' early words reflect their personal interests, the classifications of words within the "Object" and "Nonobject" categories of the semantic structure were divided into two categories: "person-related" and "non-person-related." The "person-related" category encompassed all words that were classified as inanimate, personal (object) words (e.g., doll, milk), and as person-related (nonobject) words (e.g., yes, hello). The "non-person-related" category included inanimate, impersonal (object) words (e.g., car, telephone), and object-related (nonobject) words (e.g., cold, good).

The findings from this analysis revealed that all the babies produced more person-related than non-person-related words at all three times (see Table 7). At T1, an average of 52% of all the babies' productions were person-related, as compared to a mere 5% average of non-person-related words. At T2, the average percentage of non- person-related words increased to 21%, but the average percentage of person-related words remained virtually the same at 51%. At T3, the average percentage of person-related words increased slightly to 55%, while the average percentage of non-person-related words decreased slightly to 20%.

Discussion

The semantic and conceptual knowledge underlying bilingual babies' very first words has been largely unknown. Here we asked how do bilingual babies acquire early word meanings in each of their two languages over time, how are early word meanings conceptually constrained and semantically organized for each language over time, and we further explored research methods that might best help us gain this knowledge. To answer these questions, we studied a fascinating group of bilinguals—young babies acquiring French and LSQ—and we compared them to bilingual babies acquiring French and English; we further compared all the bilingual babies to established monolingual norms. The signing-speaking babies' lexical productions in two vastly different modalities enabled us to offer new insights into the knowledge underlying early bilingualism in a manner not possible through the study of two spoken languages alone. Thus, our goal in studying the early semantic and conceptual underpinnings of bilingual babies was to shed new light on this hitherto mysterious aspect of simultaneous acquisition and understand the processes that underlie all early human language acquisition.

The general conclusion to emerge from our first analysis (Analysis I) regarding the age at which young bilinguals achieve the classic early language milestones in each of their two languages was that they exhibited normal language milestones. Over-

Table 7

Percentages of "person-related" and "non-person-related" words produced by all subjects at the 10-word (T1), 30-word (T2), and 50-word (T3) stages

	Time					
	T1		T2		T3	
Group	Person-Related	Non-person-Related	Person-Related	Non-person-Related	Person-Related	Non-person-Related
English-French						
Ed	50	0	47	26	50	24
Jane	60	10	64	13	60	12
Sue	30	20	43	30	46	30
LSQ-French						
Amy	80	0	60	13	62	12
Val	60	0	43	30	54	24
Oli	50	0	54	13	48	16
Monolingual[a]						
Ellen	55	0	41	24	57	20
Lisa	44	11	61	20	65	19
Robert	37	0	50	23	51	22

[a]Monolingual subject data from Nelson (1973).

all, each of their two languages was acquired on a similar timetable to the other, and this timetable was similar to that of young monolinguals. To be sure, none of our young bilinguals demonstrated any protracted or atypical linguistic development relative to monolingual babies.

   Regarding specifically the first-word milestone, the English-French babies as well as the LSQ-French babies acquired their first word *in each of their two native languages*, regardless of whether their lexicons were evaluated *separately or combined*, between the ages of 11 and 14 months, which falls within the precise maturational age range observed in monolinguals, or nine to 14 months (Capute et al., 1986; Vihman & McCune, 1994). For example, while a given infant might achieve her first word mile-

stone in one language at age 11 months and her first word milestone in her other language at 13 months, the key observation is that the infant achieved this classic first-word milestone in each language within the established maturational range for this milestone in all infants (ages 9 to 14 months), which, as will be made clear below, is the most accurate and best index of normal bilingual development.

Regarding the first-50-word milestone, here, on average, all our babies attained the first-50-word milestone if we considered both of their languages *combined* at around age 1;08, which is similar to the monolingual norm offered for the 50-word milestone of around 1;07 (although, surprisingly, to our knowledge no age range is provided; Charron & Petitto, 1991; Nelson, 1973; Petitto, 1987). If we considered their two languages separately, our young bilinguals' first-50-word milestone was attained between 1;04 and 2;02, but for reasons that we will discuss in a moment, this is not an accurate index of the maturational time course by which bilingual babies attain the 50-word milestone. Interestingly, separate consideration of their two lexicons vis-à-vis this and other milestones provides one source of the public's perception that young bilinguals are delayed. If, for example, we only examine one language of a given bilingual's two languages at age 1;07 and find that she has only 10 English words, we would indeed have cause for concern. But what must also be considered is that this child has 40 words in French and, thus, combined, she attained the milestone at the same time as monolingual babies attained the 50-word milestone.

We are justified in considering the young bilingual's combined linguistic achievements, especially as dual language acquisition proceeds over time, for the following reasons. First, we most certainly expected to see variation in the number of vocabulary items that a given infant might produce in one versus the other language of the type that was observed here whereupon, for example, some babies achieved the 50-word milestone first in one of their languages, and then thereafter in their other language. Such variation was expected because it is well known that differ-

ences between vocabularies are especially susceptible to environmental factors such as direct vocabulary instruction, drilling, and frequency of exposure, which can yield increases in the amount (number) of vocabulary items that an individual child produces in one language versus the other. At the same time, however, such environmental input factors cannot significantly change the biologically controlled *maturational age* range within which a normally developing child will achieve a particular language milestone (e.g., Gleitman, 1981; Gleitman & Newport, 1995; Goldin-Meadow, 1981; Petitto et al., 2001). For example, a young baby who is at home all day with her French mother (and who sees her English-speaking dad only at night and on weekends), will indeed end up in early life with more French vocabulary words than English.

Another factor that interacts with amount of environmental input is a child's tendency to produce one versus the other language—and one that can influence children's vocabulary count in either of their two languages—is the young bilingual's own emerging language preference (see Petitto et al., 2001, for a detailed discussion of this). In this study we observed that each child's most frequently used language (the preferred or dominant language) corresponded to the language of its primary sociolinguistic group. This is a fluid construct that could change over time, and whose constitution could change from child to child. In practice, however, a child's sociolinguistic group was the language of the person or group with which the child had both the strongest bond and the most constant contact (e.g., Meisel, 1989). For the children studied here, this was the language of their mother with whom they stayed home all day, but for other children this could be the language of their siblings and friends with whom they were in contact all day. For others still, this could be the primary language of the children and teachers at their full-time day care center. Crucially, we could predict the bilingual child's differential use of their two languages based on our knowledge of their sociolinguistic environment (Petitto et al., 2001).

Finally, there is a growing consensus that the bilingual child may be compared to the monolingual child in terms of development, provided both languages are taken into account (e.g., Nicoladis & Genesee, 1997, Pearson et al., 1995; Petitto et al., 2001). By doing so we see quite remarkably and contrary to earlier views (e.g., Grosjean, 1989) that the rate and pace of bilingual babies' development coincides with the well-established monolingual norms.

In summary, Analysis I revealed that the overall timetable by which young bilinguals' two languages develop is similar to each other, and similar to monolinguals. Crucially, we conclude that it is the maturational timing with which young bilinguals achieve the classic early language milestones (regarding each of their two languages separately and combined) that is the best yardstick by which we should evaluate whether bilingual acquisition is developing "normally" in young children, as opposed to the amount of vocabulary and/or the degree of language use in social contexts that one versus the other language exhibits.

In Analysis II, we examined bilingual babies' two emerging languages, paying attention to words in their dual lexicons with identical meanings (TEs). This provided new insight into the impact that acquiring two languages has on the nascent semantic and conceptual underpinnings of early language. Babies acquiring two languages simultaneously must solve the problem of discerning the semantic meanings and related concepts of two lexicons across their two languages. One strategy that bilingual babies may use is to reject the acquisition of TEs in their early lexicons. By initially rejecting TEs the young bilingual could avoid possible semantic confusion by having a single label for each underlying concept. And in studying young bilinguals, researchers have indeed used the ostensible absence of TEs in babies' vocabularies as an indicator that young bilinguals have an underlying semantic confusion regarding their two languages and do not differentiate between them until around age three (e.g., Redlinger & Park, 1980; Vihman, 1985). Alternatively, the presence of TEs in babies' lexicons has provided researchers with suggestive evidence that

young bilinguals can differentiate between their two linguistic systems and as early as their first lexical productions (see, especially, Petitto et al., 2001). Following established procedures (e.g., Pearson et al., 1995; Petitto et al., 2001), we calculated the percentages of TEs in all of our babies' vocabularies at the 50-word stage. Like Pearson and Petitto, we found that approximately one-third of the words (signs) in our babies' lexicons contained TEs, thereby corroborating earlier findings but, here, for the first time, we used multiple sources for data collection (cf. Pearson et al., 1995) and a larger sample of babies (cf. Petitto et al., 2001). Taken together, our findings support the hypothesis that bilingual babies do produce TEs and suggest that they do this because they know they are acquiring two distinct lexicons, which is true from their earliest lexical productions and suggest that early bilingual language exposure does not cause a child to be semantically and conceptually confused.

By building upon research methods used to study whether early word meanings in monolingual babies are constrained in any way (i.e., Huttenlocher & Smiley, 1987; Petitto, 1988, 1992), the bilingual babies in Analysis III provided new knowledge about the types of constraints that may underlie their first words in each of their two languages, over time. Examining the lexical-referent pairings of the bilingual babies enabled us to gain an appreciation of the "mistakes" that babies initially make (or as used within "inappropriate" lexical-referent pairings). First, like monolingual babies, we discovered that our bilingual babies rarely overextended their first words in either of their two languages (cf. Clark, 1973; Leopold, 1939–1949; Rescorla, 1980; Volterra & Taeschner, 1978). Moreover, this fact was true for both of their languages from their very first language productions and continued throughout development; lexical use did not become more adult-like (more constrained) as the children grew older, as each of the young bilinguals' early lexicons were constrained from his or her first entry into language production. In addition, for those rare cases when a lexical-referent pairing was judged to be "inappropriate," such pairings were highly patterned: For all six babies combined,

a mere 3.5% of the total productions were judged to be "inappropriate," or 259 inappropriate tokens out of a total of 7,381 produced. Of these 259 tokens, only approximately 6% (15 tokens) could be construed as being possible violations of kind boundaries. Thus, with few exceptions, a word used to connote an object was used only to stand for that object and/or the class of related objects, and was not also used to connote other associative or thematic properties of the said object (such as actions, locations, or possessors associated with the object). The present bilingual findings, coupled with evidence from similar findings (see Clark, 1973; Huttenlocher & Smiley, 1987; Keil, 1989; Leopold, 1939–1949; Petitto, 1988, 1992; Rescorla, 1980; Volterra & Taeschner, 1978), lead to the conclusion that early semantic and, thus, conceptual, knowledge underlying all language acquisition is highly constrained along kind boundaries, and together they point to the existence of universal conceptual principles that bind early word learning across all language.

By categorizing the babies' words (signs) *in each of their languages* within the hierarchical arrangement suggested by Nelson (1973) at three different time intervals, in our fourth analysis (Analysis IV) we established for the first time that bilingual babies' dual lexicons exhibited overall similar conceptual organization to one another and, crucially, together were highly similar to those of monolingual babies. We further established for the first time that bilingual and monolingual babies talk about very similar things in early life, with both findings suggesting the existence of universals underlying the ways children categorize their early word meanings. Specifically, like monolingual babies, we found that bilingual babies' first 50 words could be organized into four conceptual domains: objects (animate and inanimate) and nonobjects (person-related and object-related). While the number of words in each category differed by babies, this was also true of the monolingual babies studied by Nelson. Moreover, all the bilingual babies examined here produced approximately the same number of words (signs) in each of these conceptual domains as monolingual babies. At the 10-word stage, for example, animate words and

person-related words together constituted between 80 and 90% of all the bilingual babies' first words, and between 78 and 88% of the monolingual babies' first words. With few exceptions, the same general patterns across all babies held true at later stages in development as well; at the 30-word stage the percentage of inanimate words increased as did the number of object-related words for all but one infant, and at the 50-word stage the percentage of inanimate objects increased, while the percentage of person-related words decreased for all but one baby. As the babies' vocabularies increased over time, they next acquired the meanings for words in the two other conceptual domains, namely the categories of inanimate objects and object-related nonobjects. Given the similarities observed across both monolingual and bilingual subjects collectively, the new insight to emerge from the present findings is that babies first categorize their worlds into animate objects and person-related nonobjects.

To gain further insight into the nature of the bilingual babies' first words we tested a hypothesis put forth regarding monolingual babies—we evaluated whether babies acquire the meanings of words for their favorite things first (Dromi, 1987; MacWhinney, 1998; Mervis, 1984; Slobin, 1985). To do this we analyzed the third level of classification in the semantic structure, as Nelson (1973) stated that the first three levels of classification are common to all children. Further, we combined the two conceptual domains, inanimate, personal objects and person-related nonobjects, and created a new category termed "person-related" because these categories contained words that were of personal interest to the babies. We compared this newly formed category to "non-person-related" words, which contained items from Nelson's categories, inanimate, impersonal objects, and object-related nonobjects. These new categories permitted us to determine whether babies first acquire meanings for things that are related to them, and whether this changes over time. In this regard, the novel finding to emerge from the present study is that no significant differences were observed between groups of babies at any time, thereby indicating that all babies, irrespective of whether they were ac-

quiring one or two languages, and irrespective of whether the two languages were spoken or signed, appeared to show a preference for words connoting things that are person-related. This is especially true if one considers that from the very onset of language acquisition (production), approximately half of the babies' words (signs) were person-related. While words describing non-person-related items increased over time, the words that were person-related remained prevalent through to the 50-word stage. Together, we conclude that, like monolinguals, bilingual babies' preference for their favorite things is reflected in their early lexical productions and, further, these first meanings are highly organized within the same conceptual domains as monolingual babies.

In the present study we witnessed ways signing-speaking babies' language acquisition was similar to that of bilingual babies acquiring two spoken languages. Together, we saw how these two bilingual groups also provided a cross-linguistic, cross-modal lens through which to observe universals in the knowledge underlying all language acquisition. Despite such similarities, there exist significant differences between bilingual babies acquiring a signed and a spoken language and bilingual babies acquiring two spoken languages.

Babies acquiring two spoken languages do so within a single modality (speech), whereas language acquisition in signing-speaking babies spans two distinct modalities (sign and speech). It was hypothesized that the significant modality differences between signed and spoken languages could yield significant differences between the semantic content of these two languages. Fundamentally different lexicons with vastly different semantic content and organization may have been revealed because signed languages have some lexical items that are made with highly pictorial hand gestures (iconic) and some lexical items that directly pick out relations in front of the signer's body (indexical). Spoken languages, instead, have lexical items whereby their sound sequences are arbitrary in that they are not physically related to the object they connote. Although it has already been shown that iconic and indexical properties of the lexicon in signed

languages do not have an impact on monolingual acquisition of signed languages in profoundly deaf babies (e.g., Petitto, 1987), it could have been the case that such differences in the surface lexical forms of signs versus words yielded fundamental differences in the semantic content of signing-speaking babies' dual lexicons. Instead, what we observed here were striking similarities in the semantic content, underlying conceptual constraints, and semantic organization across these babies' signs and words, over time. This finding provides support for the existence of semantic and conceptual universals underlying all language acquisition (be it monolingual or bilingual)—universals that can even override such significant modality differences.

In summary, the results presented here show that babies exposed to two languages acquire the early linguistic milestones on the same maturational timetable across each language, and on the same timetable as monolingual babies. The bilingual babies produced translation equivalents in their very first lexicons. Their early words (signs) in each language were also constrained along kind boundaries. Further, the categorization of bilingual babies' dual lexicons demonstrated fundamentally similar semantic organization and were organized similar to those of monolingual babies; our data revealed that our bilingual babies communicated about the same general things across each language, which was similar to monolinguals, and they further acquired the meanings of words (signs) for their favorite things first (those that are person-related). Here we further suggested what might be the root of attributions that young bilinguals are delayed and confused and, crucially, we showed that they are neither and that they differentiate their two lexicons from their first lexical productions. We also presented a collection of research methods that, taken together, can be used to study the semantic and conceptual knowledge underlying both monolingual babies as well as bilingual children's dual lexicons over time—those that can provide data upon which meaningful comparisons between monolingual and bilingual children can be made. Given the unique insights that the bilingual babies acquiring a signed and a spoken language

provided us, and given the universal ways our bilingual babies acquired their languages relative to monolingual babies, we hope to have provided a means by which future research may make establishing bilingual norms wholly attainable.

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Notes

[1]The bilingual French-English parents did know and speak these two languages, even though each parent claimed to speak only one language with his or her child (specifically, the language that was his or her own native language from birth). Interestingly, the parents who were deaf and using LSQ were also "bilingual" in LSQ and French in that they did know (have competence in, as distinct from performance) both languages (i.e., the deaf parents did read and write in French). Here, however, they only "spoke" one of these languages with native fluency, that is, LSQ. (Some could produce very few high-frequency lexical items in spoken French, such as "Bonjour" meaning hello, although their pronunciations differed significantly from standard French); and, of course, they could *not* hear French because the deaf adults in this study were profoundly deaf from birth and acquired LSQ as their first language from their deaf parents or deaf family members. So as to not bias or encourage any infant-directed behavior modification, all the parents were simply told that this was a study designed to observe their babies' early language acquisition over time.

[2]A "neutral" form is a coding attribution designating forms produced by babies that are indistinguishable to researchers as belonging to one or another language. Neutrals have also been suggested to be the cause of babies appearing to be language "confused." For a discussion of why this is so, and how signing-speaking babies can shed light on this issue, see Petitto et al. (2001), and Petitto and Holowka (2002).

[3]For ease of interpretation, the examples given here and in Table 5 reflect the adult forms of the babies' productions.

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Appendix

Three English-French, Three LSQ-French, and Three Monolingual[a] Subjects' Words[b]
Produced at the 10-Word (T1), 30-Word (T2), and 50-Word (T3) Stages
According to Nelson's (1973) Semantic Structure

| | Objects | | | | Nonobjects | | | |
| | Animate | | Inanimate | | Person-Related | | Object-Related | |
Group	People	Animals	Personal	Impersonal	Action	Expressive	Action	Properties
English-French								
Ed	*bébé /*	lapin	*banana /e*	∅	∅	*allô /*	∅	∅
	baby		*ball /e*			*hello*		
	dada					*oh*		
	papa					*uh-oh*		
T1 = 10	*mama /n*							
	grand-	vache	pomme	THAT	brisé	YES	*moo /*	autre
	pa(pa)		*juice /*	WHAT	encore	*no /non*	*meuh*	
	Elliot		*jus*		parti	*bye*	*woof*	
			BOAT				QUACK	
							meow	
T2 = 30							*behh*	

		mouton cochon DUCK chat Bugs Bunny	*bar/re* *l'eau* chapeau BUS auto fleur *tv* TRUCK		tiens MORE	oui	*beep*	dedans petit BIG
T3 = 50								
Jane	*mama* *baby/bébé*	∅	*banana/e* TOMATO	THAT	AGAIN	HI BYE YES NO	∅	∅
T1 = 10								
	dada *mommy* *maman* *mom* *papa* bébé	BIRDIE	BOOK lait		DOWN UP tiens	non YEAH OKAY oui *bravo*	*beep*	MORE MINE
T2 = 30								
	grandpa YOU *Mitchie* ME I *daddy* *Erik* *Joshie*	*Big Bird*	APPLE JUICE WATER HAT nez	IT	SEE	WANT *ow* *yay* DON'T		
T3 = 50								

| Group | Objects | | | | Nonobjects | | | |
| | Animate | | Inanimate | | Person-Related | | Object-Related | |
	People	Animals	Personal	Impersonal	Action	Expressive	Action	Properties
Sue T1 = 10	*maman* *papa* *mama* *Sarah*	*Bugs Bunny*	∅	∅	∅	*allô* *hello/* *allô* *oh*	*meuh/* *moo* *woof*	∅
       T2 = 30		*Puffy* *Jack* ANIMAL ELEPHANT	T-SHIRT BALL BANANA JUICE		regarde encore	BYE-BYE HELLO WOW YEAH *ah* *no/n* oui *moi/mine*	*cheep* *boum-boum*	
      T3 = 50	bébé	PIG	SHOE SHOES WATER balle banane eau jus	THAT THIS c'est	WORK DRAW ça pique	NO		IN THERE IS A

LSQ-French

Amy	maman **BÉBÉ**	∅	**LAIT**	∅	**ENLÈVE** **OUVRE** **DODO** dodo	**BYE** **HÉ** **NON**	∅	∅
T1 = 10								
	moi bébé	**CHAT** **CHIEN** ours chat	**AUTO** auto **CHAPEAU** chapeau	ça	**ENCORE** bobo	non **OH NON** **OH** oh		**N'Y A - PLUS** **DEDANS** bon
T2 = 30								
	papa **TOI** **MAMAN**	cochon ourson	chan-dail suce **COLLIER** **SUCE** **BAIN** de - l'eau jus pomme		**MANGE** tombé	veux **OUI** oui		là-bas **OÙ**
T3 = 50								
Val	**MAMAN** mama papa bébé	∅	**BALLE** suce	∅	∅	**ALLÔ** **BYE-BYE** **OUI** **HÉ**	∅	∅
T1 = 10								

| Group | Objects | | | | Nonobjects | | | |
| | Animate | | Inanimate | | Person-Related | | Object-Related | |
	People	Animals	Personal	Impersonal	Action	Expressive	Action	Properties
	PAPA **BÉBÉ**	**CANARD** **CHIEN**	**EAU** de l'eau **CHAPEAU** **BROSSE-DENT**	fleur **TÉLÉPHONE**		bye-bye **BRAVO** non	meow	**FERMÉ** fermé **BELLE** **DEUX** **BON** là
T2 = 30								
	MOI	**OISEAU** chien	**LAIT** **POMME** banane lait pomme	lumière	**MANGE** regarde **ENCORE** **PARTI** parti tombé	allô **CHUT** oui	boum	belle
T3 = 50								
Oli	**PAPA** **MAMAN** papa maman	Pitou	**LAIT** balle	∅	∅	**OUI** **NON** **BRAVO**	∅	∅
T1 = 10								
	GARÇON	**CHIEN** **DAUPHIN** **OISEAU** singe	lait **NEZ** nez	**TÉLÉPHONE**	**MANGER** **MANGE** manger mange	allô non oui veux	**DODO**	**DU** **(LAIT)** du (lait)
T2 = 30								

	BÉBÉ bébé garçon	**SINGE** chien oiseau chat **CHAT**	**POMME** pomme ballon **BALLE** **BALLON** **CHAPEAU** chapeau	clés fleur téléphone **FLEUR**		oh		
T3 = 50								

Monolingual[a]

Ellen T1 = 10	DADDY MOMMY NANA	DOGGIE	DOLLY MILK	∅	GO-GO	HI HI-THERE	∅	∅
	JUDY CHIPPER BABY	MONKEY KITTY-CAT TURTLE	BALL EYES CRACKERS TOAST SHOES	BUS CAR SNOW THAT		HELLO NITE NITE	HOT	ALL - GONE ALL - DONE
T2 = 30								
	ALVIN		BIKE BLOCK BREAD BUTTER CHEESE FOOD EGG SPAGHETTI	TRUCK BOAT CLOCK		PLEASE		

| | Objects | | | | Nonobjects | | | |
| | Animate | | Inanimate | | Person-Related | | Object-Related | |
Group	People	Animals	Personal	Impersonal	Action	Expressive	Action	Properties
			TRAY SPOON PAPER-(CUP) NOSE EAR LEG SKIN					
T3 = 50								
Lisa T1 = 10	DADDY MOMMY	DAISY PUPPY	BALL	∅	SEE	HI YES	∅	WHERE
		DOG	DOLL FORK WATER	CAR KEYS THAT	OUT-SIDE GO EAT DRINK TICKLE	PLEASE THANK-YOU NOT NOW WANT	WOOF-WOOF	
T2 = 30								
	KENNY ME		TOAST JUICE BLANKET SHOE	TELEPHONE	SIT NAP UP	MINE		COLD HOT

			SOCK PILLOW POCKET BOOK					
T3 = 50								
Robert T1 = 10	DADDY MOMMY	DOG CAT TIGER	MILK	∅	HI	NO	∅	∅
T2 = 30	HEIDI I		EYES	CAR GOD THAT IT	SEE DOWN LOOK GO	OH OH BOY OKAY YES THANK-YOU HI	HOT	THERE
T3 = 50	POP POP SCOTT JACKIE HE	BEE	COOKIE JUICE	KEY	IN GOT OUT-SIDE GOING CRY	KNOW WANT	COLD	ALL-GONE HERE

[a]Monolingual subject data from Nelson (1973).
[b]English words = UPPERCASE,
French words = lowercase,
LSQ signs = **UPPERCASE (bold)**,
Neutral forms = *italics*.