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Cross-language synonyms in the lexicons of bilingual infants: one language or two?*

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ABSTRACT

This study tests the widely-cited claim from Volterra & Taeschner (1978), which is reinforced by Clark's PRINCIPLE OF CONTRAST (1987), that young simultaneous bilingual children reject cross-language synonyms in their earliest lexicons. The rejection of translation equivalents is taken by Volterra & Taeschner as support for the idea that the bilingual child possesses a single-language system which includes elements from both languages. We examine first the accuracy of the empirical claim and then its adequacy as support for the argument that bilingual children do not have independent lexical systems in each language. The vocabularies of 27 developing bilinguals were recorded at varying intervals between ages 0;8 and 2;6, using the MacArthur CDI, a standardized parent report form in English and Spanish. The two single-language vocabularies of each bilingual child were compared to determine how many pairs of translation equivalents (TEs) were reported for each child at different stages of development. TEs were observed for all children but one, with an average of 30% of all words

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coded in the two languages, both at early stages (in vocabularies of 2–12 words) and later (up to 500 words). Thus, Volterra & Taeschner's empirical claim was not upheld. Further, the number of TEs in the bilinguals' two lexicons was shown to be similar to the number of lexical items which co-occurred in the monolingual lexicons of two different children, as observed in 34 random pairings for between-child comparisons. It remains to be shown, therefore, that the bilinguals' lexicons are not composed of two independent systems at a very early age. Furthermore, the results appear to rule out the operation of a strong principle of contrast across languages in early bilingualism.

INTRODUCTION

A key question in the investigation of the developing lexicon of simultaneous bilingual children concerns the extent to which the children code concepts and linguistic functions in one language or two. A widely-cited claim by Volterra & Taeschner (1978) proposes that, at the earliest stage of vocabulary development, children who are learning two languages as a first language reject cross-language synonyms. According to this argument, if children already have a lexical representation for a concept in either language, they will not be motivated to learn or use the word's translation in the other. Only in a second stage, after the children's recognition that they are dealing with two languages, are they thought to begin learning translation equivalents (or 'doublets'), which they then acquire for 'almost every word' (Volterra & Taeschner, 1978: 312), or for about a third of their vocabulary items (a subsequent modification in Taeschner, 1983: 33).

This view of the early avoidance of doublets is reinforced by Clark's (1987) PRINCIPLE OF CONTRAST in lexical acquisition, which states that children assume each word must have a distinct meaning. According to Clark, the principle of contrast leads very young bilingual children to accept only one term from 'whichever language they happen to pick up on first', at least during the first few months of vocabulary acquisition, until the children have a vocabulary of about 150 words (Clark, 1987: 13).

Volterra & Taeschner make an empirical claim that children reject doublets, and from there, they take a theoretical position, that children have a single lexical system which includes elements from their two languages. Clark, too, uses Volterra & Taeschner's empirical evidence as one class of support for her theoretical argument which, like the original claim, implies an interrelationship, or 'interdependence' between the children's two lexicons. Our first concern in this paper is the ACCURACY of the empirical claim and how the evidence bears on a general model of bilingual development. We then examine the ADEQUACY of the empirical claim as a basis for the theoretical position it underlies.

We must first consider what would count as evidence for or against Volterra & Taeschner's empirical claim. A direct demonstration of the avoidance of doublets by young bilinguals would be to show that children actually reject learning some words in favour of using the already established equivalent in the other language. Volterra & Taeschner (p. 318) relate one such anecdote in which a child insisted that a hairpin was not a *molletta* (Italian), but a *Klammer* (German). Confusingly, the child in question is described as already being out of the stage where, according to the model, translation equivalents are rejected. Specific word-learning instances which might be studied in this regard are not easily observable or predictable, however, especially in one-year-olds, the age of Volterra & Taeschner's Stage 1. A demonstration along these lines has not to our knowledge been made. (See Dromi, 1987, especially p. 64, on the problems of experimental observation of early word learning.)

The claim could, though, receive indirect support, as Volterra & Taeschner propose, from the observation of the specific elements in young bilinguals' vocabularies. Having no doublets is a necessary, but not sufficient condition for the claim that doublets have been rejected. If children learning two languages were shown generally to have no doublets in their earliest vocabularies, it would strengthen the inference that some factor, like the principle of contrast, was working against the children's learning them, although it would not in itself demonstrate that children had ACTIVELY rejected translation equivalents in their learning.

On the other hand, Volterra & Taeschner's empirical hypothesis can be falsified in a number of ways. One might show that some young bilinguals do in fact have translation equivalents in their early vocabularies. Or, one might see that children do not go through the proposed stages. For example, some children might have a constant proportion of translation equivalents at the earliest stage as well as later in Volterra & Taeschner's Stage 2 when, according to the model, translation equivalents are accepted. Or the number of translation equivalents might be shown to decline over time.

Volterra & Taeschner's own evidence consisted primarily of the observation that three children (Taeschner's two daughters and Hildegard Leopold (Leopold, 1939)) 'almost always did not have a corresponding word with the same meaning in the other language' (1978: 312) at one point between ages 1;6 and 1;11, but at another point, about seven months later, they had a large number of words with corresponding meanings in the two languages. The authors did not rule out, however, the possibility that the children, who were all learning one of the languages primarily from one parent and the other from the other parent, simply might have had no need for equivalent terms in the two languages. Nor did they provide evidence that these three children were representative of bilingual children in general. If even one child at Stage 1 could be shown to have large numbers of translation

equivalent terms, their claim would be thrown into doubt. If many children learning two languages in a variety of circumstances could be shown to have doublet vocabulary, the children observed by Volterra & Taeschner might be seen as ATYPICAL in their avoidance of translation equivalents. Clearly, it is important to evaluate possible doublet vocabulary in a larger group of young bilingual children than has been investigated thus far.

Until now, careful documentation of early bilingual lexical development has been reserved almost exclusively for the progeny of linguists. There are only a few published and unpublished word-lists representing the vocabulary at various ages for bilingual infants, including the already-mentioned Volterra & Taeschner (1978), Taeschner (1983), and Leopold (1939), as well as Vogel (1975), Vihman (1985), Jekat (1985), Mikes (1990), Yavas (1991), and Quay (1993). (See De Houwer, 1990, for a review.) Since all the authors report their information somewhat differently, it is hard to make direct comparisons across studies. In addition, without detailed information from a wide range of children, it is difficult to gain a broad perspective on what is typical and what is exceptional in early bilingual development.

Observation of early lexical development has been facilitated recently by new diagnostic and research tools. The development of standardized inventory forms for vocabulary from ages 0;8 to 2;6 (Dale, Bates, Reznick & Morisett, 1989; MacArthur CDI, 1989) allows parents without special training to make a scientifically useful record of their children's earliest words. In longitudinal studies, parents check off the words their child uses at each sampling point. Such inventories, which are becoming available in several languages, including English and Spanish, create the basis for a valuable new data source on the composition of early lexicons. For the present study, comparisons of the two single-language inventories at a number of time points permit us to discover, within certain limitations, when and to what extent translation equivalents are present in the children's lexicons.

From this broader base of data, it is possible to address Volterra & Taeschner's theoretical claim (p. 317) that the bilingual children's double-language lexicons at the earliest stage constitute a single, interdependent language system with elements from both linguistic codes. These data may also be used to examine a competing theoretical position which states that even very young bilinguals have a two-language system with two lexicons in the mind, each operating independently of the other (Bergman, 1976; Heredia & McLaughlin, 1992). Likewise, the data from the CDIs can be used to seek evidence of Clark's principle of contrast, as manifest in early avoidance of doublets.

Indeed, these questions involve two separate constructs which can be thought to vary independently. Their combinations, as shown in Table 1, lead to different predictions with respect to doublet vocabulary. (Of course,

TABLE 1. *Single- and double-language systems and the Principle of Contrast*

	Principle of Contrast	No Principle of Contrast
Single-language system (interrelated)	1. No doublets	2. Doublets (and within-language synonyms)
Double-language system (independent)	3. Doublets (no within-language synonyms)	4. Doublets (and within-language synonyms)

a finding of 'no doublets' could also result 'accidentally' from the complete functional separation of the languages for an individual child, that is, if opportunities to learn translation equivalents were never presented. The likelihood of that explanation, however, gets smaller as the number of children observed or the number of words learned in each language grows.)

For Case 1, we might imagine that, in order to avoid learning a translation equivalent, the child must access whether an equivalent term is already known in the other language. If, for example, the child were presented with the opportunity to pair the concept of dog with the Spanish label *perro*, the pairing would presumably be blocked if the concept 'dog' were already associated in the child's mind with the English label, *dog*. For the other cases, whether or not the concept 'dog' was coded in English, the Spanish *perro* would be learned by the child if the opportunity and motivation were present (and the word did not violate any phonetic constraints thought to be operating on children's early word learning, Schwartz & Leonard, 1982; Yavas, 1991).

If the empirical claim is upheld, that is, if bilingual children do in fact appear to avoid doublets, Case 1 will be supported. If, on the other hand, translation equivalents are found in the earliest stages of bilingual lexical development, then Volterra & Taeschner's own argument for a single interrelated system at Stage 1 will be left without support, and EITHER the principle of contrast OR the single-language lexicon OR BOTH will be thrown into doubt. In order to better test the existence of a principle of contrast in bilingual acquisition, a way to compare the number of cross-language and within-language synonyms is needed. This information is not provided by the CDI as parents are not asked about multiple words for the children's concepts. One can, however, use the doublet data to address the question of whether the two languages appear independent of each other. That is, the doublet proportions observed for bilingual children can be compared to doublet percentages in lexicons known to be independent of each other.

The most 'independent' circumstance for the two lexicons of a bilingual child would be if they resembled in this respect the lexicons of two separate children. The amount of lexical overlap observed BETWEEN children,

therefore, can provide a baseline, a 'null hypothesis', for the degree of independence between two vocabularies WITHIN a single child. If the null hypothesis is not rejected, that is, if bilingual children are shown to have neither a larger nor smaller proportion of synonymous lexical items in their two single-language lexicons than two separate children compared in the same way, then 'independence' will not be rejected. Conceptualized this way, having two independent lexicons within the same child is the most 'random' circumstance. No statistical argument could be made FOR independence as independence would not differ from chance, but such an argument could be made AGAINST interdependence.

The present study seeks to test the empirical and theoretical claims of Volterra & Taeschner (1978) and by extension, the applicability of Clark's (1987) principle of contrast to bilingual children. Our first goal is to replicate Volterra & Taeschner's findings with respect to translation equivalents in a larger group of children than has been studied before. In order to achieve that goal, we propose a method for examining the bilingual vocabularies of a larger group of children and then documenting the extent of doublet vocabulary at different stages of lexical development. Our second goal is to consider the impact of our findings on the arguments about the interdependence of the early lexicons of bilingual children as put forth by Volterra & Taeschner (1978) and Clark (1987).

METHOD

Subjects

Twenty-seven children being reared in English-Spanish bilingual homes, 13 females and 14 males, provided the data for this study. For 18 children between ages 0;8 and 2;6 there were 72 longitudinal observations (between 2 and 10 per child) at approximately two- to four-month intervals. An additional nine children were observed just once during the same age range, bringing the number of observations to 81. The subjects were recruited soon after birth for a longitudinal study on vocal development through health department records and word-of-mouth solicitation. All but two children came from middle-class homes. The children were of normal intelligence with an average Bayley (1969) score at 1;6 of 111 (S.D. = 11·9) for 17 of the children participating in the vocal development research. Two children were approximately five weeks premature with no other health problems.

All of the subjects had significant exposure on a regular basis to both English and Spanish through their various caretakers, who were native speakers of one or both languages. In some households, children of parents who were monolingual in one language had caretakers who were speakers of the other language. More often, one parent and his or her extended family were native speakers of one language and bilingual to varying degrees while

the other parent was a speaker of the other language. In still other households, both parents were bilingual, and they had various childcare arrangements, generally involving monolingual-Spanish grandmothers or nannies.

Although all parents expressed a desire to provide an environment equally balanced between the languages, and the conditions of their households appeared to support that desire, only one longitudinal child had approximately equal exposure to both languages during the period of observation. Parent estimates of language exposure, updated at regular intervals, averaged between 60 and 65% of one language and 35 and 40% of the other; three children had an exposure estimated as less balanced than 75/25. Nine of the 18 children with more than one observation experienced a relatively consistent language environment throughout the data collection period, while nine children experienced changes in the percentage of time they were exposed to each language, including four who experienced switches in the predominant language. For the other 14 children, nine spent more time in a Spanish environment, four in an English environment, and the last child (as noted above) heard equal amounts of both languages.

Materials

A standardized parent report instrument, the MacArthur Communicative Development Inventory (CDI), Toddler and Infant forms (1989) and its Spanish adaptations, the Toddler and Infant 'Inventario del Desarrollo de las Habilidades Comunicativas' (Jackson-Maldonado & Bates, 1988) were used to assess the vocabularies of the subjects. The Infant English form contains 395 words frequently produced and understood by infants between ages 0;8 and 1;3, arranged in 22 semantic categories. The Toddler form, for use between ages 1;3 and 2;6, contains 679 words. Instructions on the Infant form tell parents to mark words comprehended by the child and in a separate column to mark words both comprehended and spontaneously produced; on the Toddler form parents mark only the words that their child has produced. The vocabulary scores are the numbers of words marked by the parent, one number for comprehension, another for production. All vocabulary reported here is PRODUCTION vocabulary.

The Spanish version of the CDI was developed by adopting the format of the English (and Italian and Japanese) Inventories, with Spanish word-lists and research studies to dictate the items included (Jackson-Maldonado *et al.* 1993). It lists 428 words on the Infant form and 732 words on the Toddler form. The version of the Spanish CDI used in our study was modified slightly to include lexical items used by the Cuban-American population of Miami (Fernández & Umbel, 1991).

The CDI vocabulary list for a given child is not a true inventory, as the form does not exhaust the list of possible words children might say. Rather,

like vocabulary tests at later ages, it requires an extrapolation of the total vocabulary based on a controlled sample. In the research reported here, the comparison of one language to the other using the same measure is of more importance than the precise number of words known.

Evidence of the CDI's reliability and validity is reported in Fenson *et al.* (1991), Dale *et al.* (1989), and Dale (1991).[1] In addition, its validity and reliability are being corroborated by the extensive observation of vocabulary growth for children in this age range recently completed by Hart & Risley (1995). Hour-long monthly samples of productive vocabulary of 45 children recorded in naturalistic settings show remarkable agreement with the CDI, its Technical Manual, and the LEX Database derived from it (Dale & Fenson, 1993) in terms of the words chosen and the general picture of the sequence of their acquisition.

Nonetheless, it seems possible that parents of bilinguals filling out two forms might be more likely than monolingual parents to inflate their children's scores by crediting knowledge in one language that was actually demonstrated in the other. Since this might be more likely to happen in the comprehension measure, where the evidence parents use to make their judgments is less concrete than in production (where they can often quote the child's word), the analyses here are based only on production data.

Certain other caveats must also be issued for the interpretation of the CDIs, especially with respect to the doublet question. First, it should be cautioned that the information provided by the CDI is approximate in that the parent is not asked to specify the referent of a word. At these ages, children's meanings for words are often either overextended or under-

[1] The CDI has shown high internal consistency producing Cronbach's alpha values of 0·95 for Infant Comprehension and 0·96 for Infant and Toddler Production. Test–retest reliability is also high, yielding Pearson coefficient values in the 0·8–0·9 range for Infant Comprehension and Production and values exceeding 0·9 for Toddler Production (Fenson *et al.* 1991).

In addition to demonstrating high reliability, the CDI has shown high concurrent and predictive validity (Dale *et al.* 1989; Dale, 1991). Dale tests concurrent validity correlations between CDI expressive vocabulary and performance on the Expressive One Word Picture Vocabulary Test (EOWPVT), the Index of Productive Syntax (IPSyn), and information obtained from language samples. Correlations to lexical and syntactic measures ranged between 0·68 and 0·78, $p < 0{\cdot}01$; to the number of different words in a 100-utterance sample, 0·74; to the IPSyn, 0·78; to the EOWPVT raw scores, 0·73; and to Mean Length of Utterance, 0·68. Similar correlations for our sample for measures from 24-month laboratory samples to 2-year CDI production yielded the following values: to number of types in a 50-utterance sample, $r(29) = 0{\cdot}66$, $p < 0{\cdot}001$; and to the PPVT-R (Dunn & Dunn, 1981) at age 2;6, $r(20) = 0{\cdot}77$, $p < 0{\cdot}001$.

Additionally, vocabulary scores from 228 children tested by Fenson and his colleagues at two different times (Time 1 – ages 1;4–2;0, Time 2 – ages 1;10–2;6) were correlated at 0·71 ($p < 0{\cdot}0001$), indicating relatively high stability, but allowing for differential growth over that period. Throughout the age range measured by the CDI/Toddler, correlations between successive ages are substantial and reasonably stable (Fenson *et al.* 1991).

extended, as compared to the adult definition. *Ball*, for example, may overextend to 'anything round' or 'anything one throws', whereas a word like *zapatos* may underextend to refer only to one particular pair of sneakers. No claims are made in the use of the CDI that the children's words reported have identical meanings to adults', just that they have begun to use them meaningfully in ways that their caretakers can recognize. Second, no information about the child's pronunciation of the words is given. These two factors mean that the comparison to Volterra & Taeschner, and indeed to the other case studies listed above, will be less direct than one would like. Our ability to compensate for these two pieces of information is considered below in Procedure and Discussion.

Procedure

The children's parents filled out two CDIs within the same week, one in each language. At the same time, they updated a language background questionnaire. The number of observation points per child depended on the length of time the family took part in the longitudinal study of vocal development and also on the parents' level of cooperation. In some cases, one individual filled out both language forms for the child; in others, one parent did the inventory for one language and the other parent (or caretaker) did it for the other language.

In the instructions to parents, it was emphasized that the vocabulary inventories were measures of spontaneous vocabulary production rather than prompted repetition. As indicated in the CDI instructions, the parents were told to mark words that their child said even if the pronunciation was incorrect. Thus the consistent pairing of a certain sound with a particular meaning was sufficient for the parents to mark off that word even if their child's production of the word was different from the adult pronunciation. Wordforms which were used for more than one concept within a language, such as 'ba' for *ball* and 'ba' for *baby* were counted separately because they reflected two sound-meaning pairings.

For the translation equivalent analysis, it was necessary to determine how many words the child had coded in only one language and how many were coded in both. To know when a word checked on one form was similarly checked on the other, one form had to be mapped onto the other to the extent possible (Pearson, 1992). The first step in the mapping process was to compare the English and Spanish versions of the CDI and determine which words could be termed translation equivalents, or doublets. For the most part, this was fairly straightforward. The English and Spanish words in each pair were both assigned a unique 'pair number'. For instance, *dog* and *perro* were both given the number 214, *table* and *mesa* were assigned number 927, etc. However, due to cultural and linguistic differences between Spanish and English and, in some cases, simple gaps on one form or the other, not all

words could be paired. In all, about 80% of the words were matched with a translation equivalent on the other form. For the children examined here, words without a potential pairword on the other language form tended to be less commonly used, and so we were able to conduct an analysis of translation equivalents on an average of 88% of each child's reported vocabulary.

Further, since phonetic information is not given on the CDI, phonetic similarity of the doublet pairs was estimated by referring to tape recordings of the bilingual subjects made during the same period and by questioning the parents. For the most part the animal sounds and a small set of cognate terms common in child speech, like *mama*, *choo choo*, etc. were counted as 'English-Spanish' words. The English-Spanish words, although marked on both CDIs, were counted as only one word in Total Vocabulary and in the doublet lists. In our investigations, the English-Spanish words represented around 7% of the children's total words or about one-fifth of the doublets found.

The following example illustrates how these key terms were arrived at: total vocabulary, doublets, possible doublets, doublet percentages, and singlets. At each time point, the young bilinguals had two single-language production measures, one from each form. Consider a child with the following words at age 1;2.

English	Spanish
mama	***mama***
bear	***oso***
duck	*abuela*
more	*agua*
daddy	*sí*
no	*araña*

The child would be considered to know 6 words in Spanish and 6 words in English, or 12 words total. If *mama* were reported by the mother to be pronounced the same in both languages, the child's total vocabulary would be 11 words. Doublets would be *mama* and *bear-oso*, equalling 3. If all the words had potential pairs on the CDIs, the denominator for our calculation would be 11, so the child would have 3/11 or 27% doublets, and 4/11 English singlets and 4/11 Spanish singlets (36·3%). As it happens, *araña* appears on the Spanish list, but *spider* is not a choice on the English CDI, so the number of doublet opportunities is 10. *Araña* is excluded from the calculation as we had no way of knowing from these data whether the child knew *spider* or not. Therefore, removing *araña* from both the doublet opportunities and the list of singlets, the child would have 3/10 or 30% doublets and 7/10 singlets. This is the number used in our calculations.

Next, since Volterra & Taeschner appear to have considered German/Italian words separately, we also calculated the percentage of Spanish/

English words. In this example, one word in 11 or 9% is a Spanish/English word. Subtracting the 9% from the 30% doublets would give roughly 21% doublets, which is saying, as we think Volterra & Taeschner would, that two words of the child's 10 clearly English or clearly Spanish words are translation equivalents. (This is, of course, just an approximation. The subtraction procedure yields a slightly different number from what would be obtained by doing the whole calculation excluding Spanish-English words from the start.) It should be kept in mind that the doublet percentages reported below depend on the exact definitions of the terms 'doublet' and 'possible doublet'. The percentages are higher than if they were based on a total vocabulary denominator and if they did not include the Spanish/English words in the numerator and the denominator.

To make a baseline for the number of shared items in completely independent lexicons, single-language lexicons from a subset of the children were randomly paired with a single-language lexicon of similar size from another child. That is, the 10-word Spanish lexicon of Child A was paired with say, the 10-word English (or Spanish) lexicon of Child B. In a few cases, the comparison was made to the lexicon of a monolingual child from the longitudinal study on vocal development referred to under Subjects. As indicated above for the within-child translation equivalent analyses, the percentage of shared items in the between-child comparisons is also based on only the words with potential pairs on the two lists. To maintain comparability, even the same-language pairings (e.g. Child A English to Child B English, where all words could conceivably be paired) were based only on words with translation equivalents on the other language list.

RESULTS

Doublet vocabulary was observed in all children but one, Subject 0D. The average percentage of doublets, including both Spanish/English words and phonetically distinct pairs, at all observations was 30·8% (S.D. = 20·5, *N* of observations = 79. Two of the original 81 were discounted for the doublet analysis because the children had produced only one word.). As seen in Fig. 1, the mean percentage of doublets changes very little in the range between 2 and 500 words, but the individual variation, as reflected in the standard deviation, is smaller where more children and words are observed. There is no noticeable boundary between a Stage 1 and Stage 2, at either the 65–85 words suggested by Taeschner (1983: 29) or the 150 words proposed by Clark (1987: 13). After 500 words in total vocabulary, the mean doublet percentage is seen to rise to about 59%, but since only five children with that number of words are observed, the trend must be interpreted with caution.

Individual children varied in the number of doublets they had in their vocabularies and in the pattern of their occurrence. Table 2 presents the

TABLE 2. *Doublet percentages by child according to lexical stage*

Sub. no.	Age	Total words[a] (balance)	TEs (%)	Spanish/ English words (%)	Sub. no.	Age	Total words[a] (balance)	TEs (%)	Spanish/ English words (%)
				PART I. STAGE 1 ONLY					
oD	2;6	46 (13:1)	0	0	6I	0;8	2 (*)	0	0
						0;10	13	58	8
61	1;3	10	0	0		1;3	15	13	13
	1;8	40	20	3		1;4	20 (1:6)	11	0
	2;1	65 (1:4)	19	0		1;7	32	34	13
66	1;6	46 (1:4)	11	4	71	1;7	19	33	21
						1;11	54	42	7
69	1;6	8	29	0		2;1	56	35	5
	1;8	40	33	5		2;3	76 (6:1)	14	0
	2;0	55	28	7					
	2;2	87	9	3	72	1;2	3	100	33
						1;4	22	26	5
6B	1;4	23 (9:1)	6	4		1;5	18	27	11
6C	1;6	20 (1:4)	5	5	V4	1;7	17 (*)	0	0
	1;11	58	36	4		1;11	46 (1:6)	5	0
				PART II. STAGE 2 ONLY					
23	2;2	537	55	10	V6	2;10	698	68	2
29	1;10	189	63	6	V8	1;9	173 (5:1)	20	3
V2	2;2	528	63	16	V9	2;2	330 (4:1)	37	2
						2;5	486 (4:1)	32	2
V3	2;3	739	34	6					

doublet percentages for each child with reference to the stages proposed by Volterra & Taeschner. Since we are examining the claim that children's lexical behaviour is different at different points of development, we had to clarify what Volterra & Taeschner's proposed stages were. The boundaries between the stages were not clearly operationalized (and were even discrepant within their writings), but since the children most carefully described in the 1978 article as being in Stage 1 had vocabularies of between 88 and 92 total words, 92 words is used in Table 2 as the upper bound for Stage 1. Part 1 lists children for whom all observations pertained to the so-called Stage 1, and Part 2 to Stage 2. The children listed in Part 3 had observations from both stages.

According to the hypothesis under examination (represented by Cell 1 of Table 1), 'almost no' doublets should be observed in Stage 1 (Volterra & Taeschner, 1978: 312), and the number and proportion of doublets observed

TABLE 2 (*cont.*)

Sub. no.	Age	Total words[a] (balance)	TEs (%)	Spanish/ English words (%)	Sub. no.	Age	Total words[a] (balance)	TEs (%)	Spanish/ English words (%)
				PART III. STAGES 1 AND 2					
64	1;4	51	57	13	64	1;8	489 (1:4)	34	2
						1;10	455 (1:4)	27	2
						2;0	573	58	2
						2;3	775	76	3
65	1;0	18	33	11	65	1;4	122 (1:4)	20	3
	1;2	53 (1:4)	18	4		1;6	207 (1:6)	13	3
						1;8	269 (1:6)	18	4
						1;10	334 (1:6)	13	3
						2;0	374 (1:6)	14	4
						2;2	419 (1:6)	11	4
						2;4	439 (1:6)	17	4
						2;6	460 (1:6)	9	3
67	1;6	73 (8:1)	8	1	67	1;9	163 (6:1)	15	1
						2;0	264 (4:1)	27	4
68	0;10	9	63	11	68	1;6	204	45	3
6A	0;9	2	0	0	6A	1;8	121	19	6
	1;0	15	17	0		1;10	163	36	8
	1;2	27	50	7		2;0	214	39	7
	1;4	51	36	7		2;2	280	34	4
	1;6	82	36	7					
6D	0;11	4 (*)	0	0	6D	1;6	101	28	7
	1;4	60	28	5					
6E	1;1	14	71	14	6E	1;9	136	42	6
	1;4	14	55	19					
	1;6	74	61	20					
V1	1;11	65	30	12	V1	2;3	150	36	8
						2;6	200	35	6
V5	2;3	84	19	4	V5	2;6	150	34	5
V7	1;3	27	41	19	V7	1;6	127	36	7
						1;9	191	43	6
						2;1	481	62	4

[a] Observations where language imbalance is greater than 3:1 are noted next to total number of words (English:Spanish in parentheses). Children with NO words in one language are marked with a '*'.

should be higher in Stage 2 than in Stage 1. (Volterra & Taeschner, 1978: 312, says 'almost every word' in Stage 2; Taeschner, 1983: 33, says 'about a third'). Since about one-third doublets was the mean over the entire period of our observations, we checked at what stage the children were found whose doublet percentages were more than a standard deviation above or below the mean, that is greater than 50% or less than 10%.

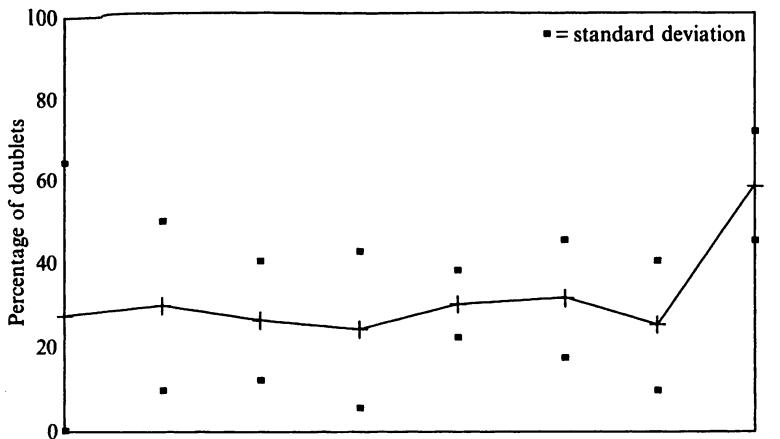

Fig. 1. Doublet percentage by number of words.

Parts 1 and 2 of Table 2, with data from children who were in either Stage 1 or 2 and did not change stage during the period studied, show some observations which are consistent with this interpretation of Volterra & Taeschner's hypothesis. Of the 26 data points in Part 1, eight (from seven different children) show doublet percentage between 0 and 10%. However, also in Part 1, there are Stage 1 observations for two different children that show over 50% of all words as doublets (Subject 61 at age 0;10 and Subject 72 at 1;2), and three children (Subjects 69, 71, and 72) who show a declining percentage of doublets as they add more words.

(The data in Part 2 of the table are consistent with the hypothesis being examined, but also with the other three possibilities raised in cells 2 to 4 of Table 1. This part is included, therefore, only as a confirmation of the information in Fig. 1, not as a test of the hypothesis.)

Part 3 of Table 2, with data on children who changed stage during the observation period, is more informative. Subjects 67 and V5 show a pattern generally consistent with Volterra & Taeschner's hypothesis, with fewer doublets early and more later in Stage 2. The other children, however, contradict the hypothesis. Subjects 65, 68, and 6E show a declining percentage of doublets; Subjects 64, 6D, V1, and V7 a relatively stable percentage across the two stages; and Subject 6A shows changes out of phase with the predicted stages. In general, while the patterns of translation equivalents observed for a few children appear similar to the children observed by Volterra &

Taeschner, for the most part, the larger group of children provide little evidence supporting Volterra & Taeschner's hypothesis.

Table 3 presents data to investigate the second goal of the study, to determine whether the bilingual children's monolingual lexicons appear independent of each other. The table indicates between-child vocabulary overlap percentages for children paired on the basis of vocabulary size.

The average percentage of items shared in these randomly-paired comparison-lexicons was 29·9% overall (S.D. 13·3). A plot of the between-child lexical overlap percentages showed them to be normally distributed ($p(W) = 0{\cdot}9$). A t-test comparing the average percentage of lexical overlap for the two kinds of comparisons (that is, the pairing of two lexicons from a single child for the within-child comparisons and one lexicon each from two children for the between-child comparisons) was non-significant ($t = 0{\cdot}23$, $d.f.$ 26, 33, $p > 0{\cdot}8$). (Since observations of the same child at different ages may not be independent, degrees of freedom for the set of within-child comparisons were counted for the number of children rather than the number of observations. The p value was 0·81 at the higher degrees of freedom, and so this consideration appears to be academic.)

Thus, the doublet percentages observed for the bilingual children's two lexicons were quite comparable to percentages of overlap derived from comparisons of monolingual lexicons of randomly-paired children of similar-sized lexicons. Therefore, we cannot infer from the occurrence of doublets in the range found in this study that these children either avoid them or seek them.

Indeed, we saw only one child of the 18 longitudinal children who showed a marked preference for acquiring doublets, what one might call a 'doublet strategy', consistent with Volterra & Taeschner's Stage 2. In this case, 334 words were reported for the child, so he was well beyond even the 150 words singled out by Clark as the time for entering Stage 2. At ages 1;10 to 2;0, Subject 64 experienced a rise in total vocabulary, English vocabulary, and doublets, while his Spanish singlets dropped; that is, he was adding almost exclusively the English equivalents for words he already knew in Spanish. We know from the mother's report that the child was being prepared for a change in his language environment. His mother was, in effect, teaching him to switch his vocabulary to the other language. In addition to Subject 64, one other child from the longitudinal study of vocal development, Subject 6G, showed a comparable pattern of doublet growth in his comprehension vocabulary. That is, total vocabulary and vocabulary in English grew, while his Spanish singlets declined. Since he was not producing any words at that time, we cannot say that he was in either Stage 1 or Stage 2. None of the other 17 longitudinal children showed a similar concentration on doublets, although everyone who was not actually losing words in one language was adding some doublets at each observation.

TABLE 3. *Between-child lexical comparisons: percentage of occurrence of the same lexical items in the monolingual lexicons of randomly-paired children*

Subject numbers CHI A/CHI B (Age-language)	Vocabulary sizes CHI A/CHI B	Words appearing in both lexicons (%)
6E(1;1E)/6A(1;0E)	9/9	66
6I(1;3S)/66(1;6E)	11/10	19
6I(1;3S)/69(1;8E)	11/12	9
6I(1;3S)/71(2;4S)	11/10	0
66(1;6E)/69(1;8E)	10/12	23
66(1;6E)/72(1;6S)	10/12	30
66(1;6E)/72(1;6E)	10/10	50
66(1;6E)/71(2;4S)	10/10	30
66(1;6E)/71(1;8E)	10/9	42
66(1;6E)/6A(1;0S)	10/9	21
69(1;8E)/71(1;8E)	12/9	38
69(1;8E)/71(2;4S)	12/10	9 (28·1 av)
6B(1;4E)/6D(1;4E)	22/22	21·6
6B(1;4E)/71(1;11S)	22/23	15·0
6B(1;4E)/67(1;9S)	22/23	15·8
6B(1;4E)/V5(2;3E)	22/25	19·5
64(1;4S)/6A(1;4S)	33/31	39·7
64(1;4S)/V1(1;11S)	33/32	33·9
64(1;4S)/65(2;6E)	33/35	33·3
64(1;4S)/71(1;11E)	33/35	23·3
6E(1;6E)/22(1;11E)	40/38	34·6
6E(1;6E)/1C(1;5E)	40/34	22·9
V1(1;11E)/22(1;11E)	39/38	23·4
6D(1;6S)/V1(2;3S)	57/65	30·9
6D(1;6E)/V1(2;3S)	51/65	27·9
6D(1;6S)/67(1;6E)	57/66	32·4
6D(1;6E)/67(1;6E)	51/66	47·6
6D(1;6S)/67(2;0S)	57/54	42·4
6D(1;6E)/67(2;0S)	51/54	24·7
6A(1;6S)/67(2;0S)	53/54	31.8
V5(2;3S)/67(1;6E)	62/66	48·3
V5(2;3S)/V1(2;3S)	62/65	35·7
64(1;8E)/V5(2;6E)	96/95	38·7
69(2;2E)/V1(2;3E)	63/91	35·7 (30·9 av) (29·9 av)

DISCUSSION

Overall, the children in this study do not provide support for Volterra & Taeschner's (1978) and Clark's (1987) claim that young bilinguals avoid translation equivalents. However, before comparing these results to the observations in Volterra & Taeschner's studies, several cautions should be observed.

As has already been noted, the CDI data are not directly comparable to the case study data presented by Volterra & Taeschner. In particular, the status of words ambiguous between Spanish and English was different in our study. Volterra & Taeschner excluded from their analysis of translation equivalents words like *choo choo* or *pipi* and people's names that function equally well for children in the two languages. In the word-lists provided in Tables 2–4 in the 1978 article, such words comprised around one-quarter of the children's vocabulary, 27% for Lisa, 24% for Giulia, and 33% for Hildegard Leopold whereas 'true' translation equivalents, the ones the authors claim should not occur in Stage 1, amounted to 6/88 (7%) for one child, 12/92 (12%) for the second, and 8/89 (9%) for the third. By contrast, we specifically included Spanish/English words in order to understand the totality of the child's words and to make possible the second analysis in the study. There is some question, too, whether phonetically-similar pairs are not in fact distinct words for the child, regardless of the child's pronunciation of them. That is, *agua* and *water* are often said [wawa] in both Spanish and English babytalk, but the child who responds appropriately to [aɣwa] and [wɔɾɚ] may indeed have two separate lexical representations for the words. Our procedures, of course, provided no indication of whether Spanish/English words were distinct for the child, but since Volterra & Taeschner's hypothesis was formulated with respect to only the words which were clearly one language or the other, it might be illuminating to consider the results that obtain when the Spanish/English words of the children are excluded in the present study. A conservative interpretation of our doublet percentages would be to reduce them by the estimates of the Spanish/English words (given in column 5 of Table 2). Counted that way, a few more observations in Table 2 would be considered to show 'almost no corresponding words' in the two languages, but the overall developmental patterns observed, that is, doublets present at all ages for most children and no sharp stage shift in doublet percentage, would be unchanged.

It must also be noted that many of the children in this study had less balanced language exposure and production than the children on whose vocabularies Volterra & Taeschner's hypothesis is based. As language balance can dramatically affect the magnitude of the doublet percentages (when that figure is based on TOTAL vocabulary), one might want to include in the analysis only the children with substantial balance between their languages. Table 2 includes an estimate of language imbalance in the Total Words column. In an analysis limited to such linguistically balanced children, the percentages of doublets are typically higher than the means reported for the entire group (from Table 2). Nevertheless, even observations with imbalance between the languages can sometimes be informative with respect to doublets. For example, Subject V8 appears to have a relatively small doublet percentage for Stage 2, but one can derive from the table that

the doublet percentage observed is almost as large as if ALL the words in her second language (about 1/6 of 173) were translation equivalents for words known in the first language, as indeed they were. Therefore, despite the low doublet percentage, such a child would not be said to be rejecting doublets when the opportunity to learn them was present. A similar pattern can be observed for Subjects 64, 65, and 6I (especially at age 1;4, when two of her three English words were translation equivalents). By contrast, children like Subjects V4, 6B, and oD were probably not hearing enough of the second language to provide an adequate test of the doublet rejection hypothesis.

Another caution in comparing the present data to the Volterra & Taeschner data concerns the comparison of CDI and diary outcomes. If Leopold, for example (who gave the only data in Volterra & Taeschner, 1978, that included a wordlist in a language for which we have done this analysis), had used the CDI instead of a diary, the percentages given above for the doublets in Hildegard's vocabulary would have been slightly higher. The words *heart*, *oil* and *mitten* would not have been counted, as they do not appear on the CDI, and four other words, *cake*, *cookie*, *high chair*, and *peek-a-boo*, do not have a pairword on the Spanish form. Therefore, the denominator for her doublet percentage would be smaller and the percentage itself would be higher.

One can see that the 'translation' of Volterra & Taeschner's data into the terms of the present system would involve several steps. It is notable that, in our system, two of Volterra & Taeschner's three subjects themselves do not look like strong examples of children who avoided doublets. Both Giulia and Hildegard had translation equivalents for one word in five of their minor language. The present data offer examples of children who had even fewer doublets than the children described by Volterra & Taeschner.

Volterra & Taeschner discount the apparent doublets reported for their subjects by saying that potential equivalents were actually used by the children to denote different concepts. They discuss at length the lack of functional equivalence for the children of apparent doublets. Similarly, several of the parents in our study also related such examples: *barco* being used for sailboats and *boat* being used for all other boats, or *zapatos* being reserved for one special pair of sneakers and *shoes* being used for all the others.

On the other hand, we have no reason to believe that such lack of equivalence is common. Parents may relate these stories precisely because they stand out as exceptions. In our lab, we observed directly many examples of the child treating adult doublets as equivalents, asking for *keys* and *llaves*, playing one day with the *martillo* and another day with the same yellow plastic *hammer*. Quay (1993) addresses this question squarely for the young bilingual child who is the subject of her case study. Videotapes of the child using translation equivalents while interacting with the same books and

objects and participating in many of the same activities in both languages allow Quay to state with more authority than we can that the translation equivalent pairs observed for that child were indeed fully equivalent (1993: 6). Therefore, Quay's work effectively challenges the Volterra & Taeschner assertion that even apparent translation equivalents are not truly equivalent.

Even if one were to estimate that some fraction of the words counted in this study as doublets were referentially distinct for the children, and that another, larger fraction were English-Spanish words, it is still the case that almost all of the bilingual children observed here had at least a few words unambiguously lexicalized differently in the two languages. Two common examples are *doggie–perro*, and *apple–manzana*.

Indeed, doublets have been reported in other early bilingual lexicons. Quay, for one, created a careful lexicon from diary records and videotaped sessions made by Manuela's mother (a linguist) in both English and Spanish contexts between ages 0;11 and 1;10 (Quay, 1993). At 1;5, after six months of word learning, Manuela had 47 distinctly Spanish or English singlets, corresponding to Volterra & Taeschner's Stage 1, or the 'no doublet' stage. Yet, the child had 18 doublet words (9 pairs). Since no information is provided about the number of Spanish/English words at that point, we cannot analyse her lexicon according to our system, but using the frame of reference from Volterra & Taeschner's 1978 article, Manuela would have had 18/47 or 38% doublets. Indeed, her third word was a Spanish equivalent for a word she had first produced the week before in English (p. 7).

Similarly, Yavas (1991) lists the first 50 words of his Turkish- and Portuguese-learning child, along with broad phonetic transcription for child forms that differed from the adult pronunciations. D at 1;10 had 23 words in Turkish and 27 words in Portuguese, none of which was cognate or phonetically similar in the two languages. Seven pairs, or 14 words, were doublets: 28% in both our system and Volterra & Taeschner's. Another word list is available in Vihman (1985: 319–21), but she gives a complete listing only for the English words of her subject, so comparable percentages cannot be derived from her data. It is clear, though, that after the first 11 words (9 Estonian singlets and 2 English), her son acquired almost as many doublets as singlets; and he added some translation equivalents for the original 11 words within the next two months, well before the proposed Stage 2. Vogel (1975) also listed her subject's 140-word Rumanian-English vocabulary at age 2;0, a vocabulary size beyond Volterra & Taeschner's cut-off for Stage 1, but below Clark's. This child, too, had 30 doublet pairs or 43% doublets. Not counting phonetically similar pairs, which accounted for 7% of her words, she still had 48/134 or 36% doublets. Finally, three trilingual children observed by Mikes (1990: 112–13) are reported to have had 24, 36, and 38% doublets (or triplets) between ages 1;4 and 1;11.

There are simply no data which provide clear support for the position that

bilingual children reject translation equivalents. Rather the picture of early lexical learning that emerges from the present group of children and a review of literature on other children is more diverse. It appears that children (and their parents) use a variety of strategies with respect to translation equivalents, ranging perhaps from complete avoidance (like Subject 61 at 1;3) to open acceptance (like Subject 72 at 1;2). More children will need to be studied at close intervals for a more general model to be formulated. Factors that affect children's strategies will also need to be explored in further studies (Pearson, Fernández, Lewedag & Oller, 1993; Hutchins & Mervis, personal communication). But a blanket statement that bilingual children in general have no translation equivalents in their vocabularies under about 75 words would surely be inaccurate.

Referring back to Table 1, we see that, unlike the absence of doublets, the presence of doublets in early vocabularies does not help us distinguish between a single or a double language system. According to the figure, both a single lexical system WITHOUT a principle of contrast OR a double-lexical system WITH OR WITHOUT a principle of contrast would predict doublets. Any further determination is hampered by one's general lack of knowledge of what the one-year-old's concept of a word is, much less a translation of a word. For these very young bilinguals we have made no assumptions of the typical apparatus of a lexicon: semantic relations, part-of-speech tagging, or a phonetic organization which facilitates retrieval, to name just a few elements. In fact, our approach has assumed nothing more than a rudimentary model of an unordered list (cf. Chomsky, 1965) consisting of fast-mapped pairings (Carey, 1978; Rice, 1990) of a mental representation of a meaning linked to a mental representation of a sound and maybe the expectation that more information about the extension of the concept being paired would be filed there in the future. In the metaphor of a list, a single lexicon would have such pairings for both languages on the same list; a double lexicon would consist of two separate lists, one for language 1 and one for language 2.

Volterra & Taeschner seem to have said, quite naturally, that for a young child a single lexicon provides the simplest option. They imply that it would be unparsimonious to assume that a child has set up two lists until there is some evidence of separation of the languages in the child's mind. (To be fair, the scope of the Volterra & Taeschner article, 1978, is much broader than just lexical development, but the lexical argument is the foundation, or first instance, of their claim.) The principle of contrast, which is thought to apply to the monolingual lexicon at all stages, including the adult stage (Clark, 1987), meshes nicely with this model. Developing bilinguals are presented as an interesting special case. The principle of contrast would apply to both languages, blocking doublets, only as long as they were stored on a single list. Then, after the child's realization that there are two languages, the domain

of the principle's application would be seen to shift, i.e. it would apply for each list, but not across lists, so cross-language doublets would be permitted.

The single list metaphor, however, may NOT be the most parsimonious assumption regarding early bilingual vocabularies (except in cases where there has been exposure to only one language model for a given word). Once the child has exposure to and the possibility of learning a given word in both languages, the single list metaphor without translation equivalents requires some mechanism, like the principle of contrast, to suppress the learning of the word in one language but not the other. The simpler model, with no conceptual apparatus linking the learning of the second term to knowledge in the other language, would be for the child to learn both words if they are presented, a situation consistent with our data and those of others cited above. We have used the word 'independent' not as a physical term indicating the existence of two independent lists in a child's memory, but as a functional term indicating that each word-learning event appears independent of other word-learning events. The result would be that each monolingual lexicon appears independent, AS IF there were two lists.

Various psycholinguistic paradigms, such as interlingual semantic priming, list recall using translation equivalents, and tachistoscopic word identification, have sought to establish whether cross-linguistic synonyms share the same conceptual organization. There is some indication that semantic priming works across languages, which might favour interdependence (Schwanenflugel & Rey, 1986; Chen & Ng, 1989). Similarly, some list recall work in adults has shown that translation equivalents require more processing than two exemplars of the same word, but less than two different words (Paivio & DesRochers, 1980). Other evidence favours independence (Grainger & Beauvillain, 1988; Monsell, Matthews & Miller, 1992). But no such work, to our knowledge, tells us about the organization of such systems in babies.

With respect to the principle of contrast, the presence of doublets in very early bilingual vocabularies could only be consistent if the two languages are separate systems right from the start. Then two languages would not be the proper domain for the principle of contrast, which might be seen to operate within each language, but not across languages (Quay, 1993). On the other hand, if there are early doublets AND a single system, the principle of contrast would be untenable. That is, at very early stages of lexical acquisition, before children give any sign of phonological differentiation, before they exhibit any language-specific morphology, or any metalinguistic understanding that they are dealing with two languages, it is very hard to see how a child would be equipped to know when a potential synonym was in one language or the other. What would allow the child to accept the Spanish *papi* as another name for his or her *daddy*, but not *father* or *Dan*? This paper has provided evidence

against there being a single lexicon with a principle of contrast, but the single lexicon without a principle of contrast remains as a possibility.

Still, the notion of the single system is put into doubt. That is, given a larger base of data, the double language hypothesis has not been ruled out and may be more tenable in that it requires fewer assumptions. However, the type of independence argued for here is at the level of the word-learning event, not the internal organization of the mental lexicon once the words are learned. The number of doublets observed in these children's vocabularies appeared not to differ from what might have been expected to occur by chance, if one considered their experience in one language as independent of their experience with the other. No mathematical statements of probabilities of occurrence are available for even the 400 or 500 most common child words (as identified, for example, by the CDI or the Language Development Survey, Rescorla, 1989). Given the variability in the contexts of children's everyday interactions, there are no words in such frequent use and of such general meaning that they have been observed in all children's vocabularies yet recorded of say 50 to 75 words (Nelson, 1973; B. Hart, personal communication). In general terms, though, we can expect that ALL early lexicons, in whichever language, will be made up mostly of very common child words – *mommy*, *daddy*, *baby*, *no*, or *shoe*, for example (Hart, 1991; Jackson-Maldonado *et al.* 1993) – as well as some words that reflect the idiosyncratic nature of the child's attention and interest. The proportions of common and idiosyncratic words that will actually be observed, though, cannot be predicted *a priori*. Therefore, for this study, as a first approximation, the chance prediction was quantified by observing the percentage overlap in two lexicons presumed to be completely independent of each other in so much as they came from different children being reared by different people in different environments.

Yet another possibility remains: that some children have a single language system and others have a two-language system, and that the two effects have cancelled each other in the outcomes reported. Some may seek doublets, and some may reject them, or an individual may vary in approach from month to month. The different patterns of bilingual vocabulary learning may mirror the myriad ways two languages can be organized in the child's environment. Such possibilities suggest that future research on this topic should more carefully monitor the child's input from each language and the relationship of different patterns of language exposure to the actual translation equivalents learned.

REFERENCES

Bayley, N. (1969). *Bayley Scales of Infant Development*. New York: New York Psychological Corporation.

Bergman, C. (1976). Interference vs. independent development in infant bilingualism. In

G. Keller, R. Teschner & S. Viera (eds), *Bilingualism in the bicentennial and beyond*. New York: Bilingual Press.

Carey, S. (1978). The child as word learner. In M. Halle, G. Miller & J. Bresnan (eds), *Linguistic theory and psychological reality*. Cambridge, MA: MIT Press.

Chen, H. & Ng, M. (1989). Semantic facilitation and translation priming effects in Chinese-English bilinguals. *Memory and Cognition* **17**, 454–62.

Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge, MA: MIT Press.

Clark, E. V. (1987). The principle of contrast: a constraint on language acquisition. In B. MacWhinney (ed.), *Mechanisms of language acquisition*. Hillsdale, NJ: Erlbaum.

Dale, P. (1991). The validity of a parent report measure of vocabulary and syntax at 24 months. *Journal of Speech and Hearing Research* **34**, 565–71.

Dale, P. & Fenson, L. (1993). LEX: A lexical development norms database (Computer program). Seattle, WA: University of Washington, Department of Psychology.

Dale, P., Bates, E., Reznick, S. & Morisett, C. (1989). The validity of a parent report instrument of child language at 20 months. *Journal of Child Language* **16**, 239–50.

De Houwer, A. (1990). *Acquisition of two languages from birth: a case study*. Cambridge: C.U.P.

Dromi, E. (1987). *Early lexical development*. Cambridge: C.U.P.

Dunn, L. & Dunn, L. (1981). *Peabody Picture Vocabulary Test – Revised*. Circle Pines, MN: American Guidance Service.

Fenson, L., Dale, P. S., Reznick, J. S., Thal, D., Bates, E., Hartung, J. P., Pethick, S. & Reilly, J. S. (1991). *Technical manual for the MacArthur Communicative Development Inventories*. San Diego: San Diego State University.

Fernández, M. C. & Umbel, V. M. (1991). *Inventario del Desarrollo de las Habilidades Comunicativas, Adaptación Cubana*. (Communicative Development Skills Inventory, Cuban Adaptation). Miami, FL: University of Miami, Mailman Center for Child Development.

Grainger, J. & Beauvillain, C. (1988). Associative priming in bilinguals: some limits of interlingual facilitation effects. *Canadian Journal of Psychology* **42**, 261–73.

Jackson-Maldonado, D. & Bates, E. (1988). *Inventario del Desarrollo de las Habilidades Comunicativas*. (Communicative Development Skills Inventory). San Diego: University of California, Center for Research on Language.

Jackson-Maldonado, D., Thal, D., Marchman, V., Bates, E. & Gutierrez-Clellen, V. (1993). Early lexical development in Spanish-speaking infants and toddlers. *Journal of Child Language* **20**, 523–50.

Jekat, S. (1985). Die entwicklung des wortschatzes bei bilingualen kindern (Frz-Dt.) in den ersten vier lebensjahren. Unpublished Master's Thesis. Hamburg: University of Hamburg, Dept. of Romance Languages. (Cited in De Houwer.)

Hart, B. (1991). Input frequency and children's first words. *First Language* **11**, 289–300.

Hart, B. & Risley, T. (1995). *Meaningful differences in the everyday experiences of young American children*. Baltimore, MD: Paul H. Brooks.

Heredia, R. & McLaughlin, B. (1992). Bilingual memory revisited. In R. Harris (ed.), *Cognitive processing in bilinguals*. Amsterdam: North-Holland.

Leopold, W. F. (1939). *Speech development of a bilingual child: a linguist's record* Vol. 1, *Vocabulary growth in the first two years*. Evanston, IL: Northwestern University Press.

MacArthur Communicative Development Inventory. (1989). San Diego: University of California, Center for Research in Language.

Mikes, M. (1990). Some issues of lexical development in early bi- and trilinguals. In G. Conti-Ramsden & C. Snow (eds), *Children's language* Vol. 7. Hillsdale, NJ: Erlbaum.

Monsell, S., Matthews, G. H. & Miller, D. C. (1992). Repetition of lexicalization across languages: a further test of the locus of priming. *Quarterly Journal of Experimental Psychology: Human Experimental Psychology* **44A**, 763–83.

Nelson, K. (1973). Structure and strategy in learning to talk. *Monographs of the Society for Research in Child Development* **38** (1-2, Serial No. 149).

Paivio, A. & DesRochers, A. (1980). A dual-coding approach to bilingual memory. *Canadian Journal of Psychology* **34**, 388–99.

Pearson, B. Z. (1992). Rationale for English-Spanish CDI mapping. Unpublished manuscript, University of Miami, Mailman Center for Child Development, Miami, FL.
Pearson, B. Z., Fernández, S. C. & Oller, D. K. (1993). Lexical development in bilingual infants and toddlers: comparison to monolingual norms. *Language Learning* **43**, 93–120.
Pearson, B. Z., Fernández, S. C., Lewedag, V. & Oller, D. K. (1993). Bilingual environment and lexical learning in bilingual infants 10–30 months. Paper presented at the 14th Symposium on Spanish and Portuguese Bilingualism, Fairfield, CT.
Quay, S. (1993). Bilingual evidence against the principle of contrast. Paper presented at the Linguistic Society of America annual meeting. Los Angeles, CA.
Rescorla, L. (1989). The language development survey: a screening tool for delayed language in toddlers. *Journal of Speech and Hearing Disorders* **54**, 587–99.
Rice, M. L. (1990). Preschooler's QUIL: Quick incidental learning of words. In G. Conti-Ramsden & C. Snow (eds), *Children's language* Vol. 7, Hillsdale, NJ: Erlbaum.
Schwanenflugel, P. & Rey, M. (1986). Interlingual semantic facilitation: evidence for a common representational system in the bilingual lexicon. *Journal of Memory and Language* **25**, 606–18.
Schwartz, R. G. & Leonard, L. B. (1982). Do children pick and choose? *Journal of Child Language* **9**, 319–36.
Taeschner, T. (1983). *The sun is feminine: a study on language*. Berlin: Springer-Verlag.
Vihman, M. M. (1985). Language differentiation by the bilingual infant. *Journal of Child Language* **12**, 297–324.
Vogel, I. (1975). One system or two: an analysis of a two-year-old Rumanian-English bilingual's phonology. *Papers and Reports on Child Language Development* **9**, 43–62.
Volterra, V. & Taeschner, T. (1978). The acquisition and development of language by bilingual children. *Journal of Child Language* **5**, 311–20.
Yavas, M. (1991). Phonological selectivity in bilingual development: a case study. Paper presented at the 12th Symposium on Spanish and Portuguese Bilingualism, Miami, Florida.