Commentary

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Bilingual Language Acquisition

Commentary on Sebastian-Galles

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Bilingualism is a fascinating area of study with the potential to contribute much to the understanding of language learning, production, comprehension and processing. Nuria Sebastian-Galles' paper [this issue] provides some interesting evidence on the early speech perception of bilingual language acquisition. I first make some comments on the data she presents before moving on to a somewhat broader consideration of the problems and possibilities raised by research into bilingual language acquisition.

Distinguishing the Sounds of the Native Language(s)

We know that monolingual infants have very early abilities to discriminate between the speech sounds of languages and that this ability becomes 'fine-tuned' to the language they are hearing over the first year of life. The two widely researched skills that seem available to newborns are the ability to discriminate between the speech sounds of many languages and the ability to detect differences in the prosodic structures of languages. Since the infants in Sebastian-Galles' studies are exposed to two, closely related, but different languages from birth, important questions arise in relation to their ability to discriminate the languages and how this might feed into their later language development.

Newborns raised in monolingual environments can discriminate their mother's voice from other female voices [De Casper & Fifer, 1980] and can discriminate between their 'mother tongue' and a rhythmically distinct language (e.g., Spanish and English) [Moon, Cooper, & Fifer, 1993]. Presumably this is the result of the low-pass-

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filtered speech that can be heard in the last trimester of fetal development. As Sebastian-Galles reports, a recent study by Byers-Heinlein, Burns and Werker [2010] finds that the newborn infants of mothers who spoke both English and Tagalog (a) could discriminate these languages and (b) showed no preference for listening to either, unlike the monolingual newborns who preferred to listen to their single 'mother tongue'. Two issues for future research arise here: first, would this discrimination ability in infants born into bilingual environments also hold at birth if the mother spoke two rhythmically related languages such as Spanish and Catalan? Second, if the mother speaks only one language but another language is equally frequent in the home, would newborns also be able to discriminate two languages? This latter question would illuminate whether relevant sound input comes only from the mother or more widely.

Languages differ in their rhythmic structure and fall into 3 main classes: stress-timed languages in which stressed syllables with strong vowels alternate with unstressed syllables with reduced vowels (English, Dutch); syllable-timed languages in which each syllable receives equal stress (Italian, Spanish), and mora-timed languages which are evenly timed but the unit of timing is the mora, counted in terms of whether syllables are long or short (Japanese, Luganda). Although infants born into monolingual environments can discriminate between languages on the basis of their rhythm, this is only the case if the languages come from different rhythmic classes [Christophe & Morton, 1998; Nazzi, Bertoncini, & Mehler, 1998]. But by 4.5–5 months, infants can discriminate within rhythmic class provided one of the languages is their own [Bosch & Sebastian-Galles, 2001; Nazzi, Jusczyk, & Johnson, 2000] indicating an effect of the ambient language. In the study by Bosch and Sebastian-Galles [1997] which tested Spanish and Catalan monolinguals and bilinguals, this was also true of the bilinguals, indicating that having two rhythmically similar languages in the ambient environment did not hinder the development of these skills. Although Sebastian-Galles suggests that there is some evidence in these infants for greater discrimination skills in bilingual than monolingual infants, the difference between 4.5 months in the Sebastian-Galles studies and 5 months in the Nazzi et al. studies is too small to be sure of this. But it is quite clear that hearing two rhythmically similar languages does not impede these infants' discrimination abilities.

Another main area of investigation in research on speech perception in infancy concerns the ability to discriminate phonetic contrasts in infants' own, and other, languages. Very young infants can discriminate phonetic contrasts that are phonemic in other languages but not their own native language (e.g., the prevoiced-voiced contrast in stop consonants in Thai by English-hearing infants) [Aslin, Pisoni, Hennessy, & Perey, 1981]. However, with development and exposure to the ambient language, infants show decreased sensitivity to non-native contrasts. Thus, 6- to 8-month-olds could discriminate non-native consonant contrasts but 8- to 10-month-olds less so and 10- to 12-month-olds not at all [Werker & Tees, 1984; comparing the English contrast /ba/, /da/ and the contrast /k'i/, /q'i/ in Thompson, an indigenous, Salish language of British Columbia]. At the same time, infants show increased sensitivity to contrasts in their native language. For instance, 9-month-olds preferred to listen to consonant clusters permitted in their native language but 6-month-olds did not [Best, McRoberts, & Sithole, 1988]. There is also an important reorganisation that takes place for the recognition of vowels. Although infants can detect differences between vowels (both native and non-native) from very early in

life, the representation of the vowel space goes through a reorganisation into a prototypical structure by about 6 months of age. Initially, infants aged 4 months (and rhesus monkeys) make the discrimination on the basis of the objective distance between the referent and comparison stimuli [Polka & Werker, 1994]. However, infants tested at 6 months show a prototype structure with sensitivity to 'good' and 'bad' exemplars. Do bilingual children show the same development? Hearing two languages could presumably either speed or slow their discrimination abilities within and across phonemic contrasts.

Some evidence suggests that bilinguals can be ahead of monolinguals in detecting a consonant contrast that is realised differently in French and English. However, in a study of a Catalan vowel contrast using a head-turn preference procedure with a familiarisation phase, Sebastian-Galles reports that while Spanish-Catalan bilingual infants and monolinguals in both languages can make this discrimination at 4 months, at 8 months the bilinguals could not, though Catalan monolinguals could [Bosch & Sebastian-Galles, 2003]. By about 12 months, the bilinguals had 'recovered' the contrast. Interestingly, a recent study, also by Sebastian-Galles' group [Albareda-Castellot, Pons, & Sebastian-Galles, in press] using a visual cueing procedure in which the infants had to predict the appearance of a target from behind an occluder as a function of which stimulus they heard, showed that in this set-up, bilingual Spanish-Catalan infants of 8 months could indeed discriminate the vowels.

These results raise some important issues. In the conclusion of the latter Sebastian-Galles study, there is the suggestion that the particular languages being learned may drive bilingual children down somewhat different discrimination pathways. For instance, in the case of Catalan and Spanish, the authors suggest that Catalan-Spanish bilingual infants may give less weight to vowel differences than to consonant differences and that this reflects the greater differences between the consonant inventories than between the vowel inventories of the two languages. Clearly much more research is needed here but it does suggest that rather than treating bilinguals as monolinguals with two languages, and comparing them to monolinguals with one language, we may need to reconceptualise bilingual development and how to study it.

Second there is the fundamental problem in developmental psychology of understanding how the task demands of different experimental set-ups interact with the specific representations available to children at any particular point in development. Experiments using looking preferences often show very early discrimination abilities while those requiring more active responses seem to show much later success. Examples abound in the developmental literature: the development of object permanence is one [Baillargeon, 2004]. Another comes from children's comprehension of word order in the English active transitive. Here the results of preferential looking experiments [e.g., Gertner, Fisher, & Eisengart, 2006] contrast to some extent with those of act-out or production studies [Chan, Lieven, & Tomasello, 2009; Chang, Dell, & Bock, 2006; but see Noble, Rowland, & Pine, submitted]. Do we account for the difference by an appeal to peripheral 'performance factors' or to changes in the strength or type of representation to which the child has access? Changes to the type of representation could reflect an increasingly complex network structure and/or the sort of representational reorganisation discussed by Karmiloff-Smith [1994].

Representing the Sounds of Words

In the study of infant speech perception one puzzle is that, despite these very early abilities to make phonetic and phonemic discriminations, there is evidence that children do not initially represent words in their full phonemic detail. On the one hand, Jusczyk and Aslin [1995] found that 7.5-month-olds (but not 6-month-olds), tested using the head-turn preference procedure, listened longer to passages containing words with which they had been familiarised (e.g., *dog*). When familiarised with the real word and then exposed to passages with a change in onset *(bawg),* they did not show this preference, suggesting that they had encoded a considerable level of phonetic detail in the memorised word. However, in a detailed extension of this experiment, Swingley [2005] tested 11-month-old, Dutch-hearing infants on their discrimination of real words from a number of manipulations. These involved changes in onset, codas (final segments of syllables) and other mispronunciations. For example, for the stimulus [hɑnt] (Dutch *hand* 'hand'), related changes were [xɑnt] (onset), [xɑŋk] (offset) or [ha:k] ('non-word'). The results showed that the infants were sensitive to non-words and to changes in onsets, though not to changes in offsets [see also Vihman, Nakai, DePaolis, & Hall, 2004]. It seems that this is related to children's developing lexicons because a group of infants with larger receptive vocabularies, measured later at 1 year and 4 months, did show sensitivity to offsets. What will happen in bilingual children who have to learn both within-language discriminations and across-language discriminations, sometimes between sounds that are very close?

By 12 months, Catalan monolinguals and Catalan-Spanish bilinguals can discriminate the /e/ and /ɛ/ vowels of Catalan when presented in isolation, while Spanish monolinguals cannot. Thus, Catalan monolinguals found words with /e/ and /ɛ/ substituted harder to recognise, reflecting the phonological status of these vowels in Catalan, while Spanish monolinguals did not detect this change, but were sensitive to changes that involved contrasting Spanish vowels. However, bilingual 18-month-olds did not react differently to canonical and deviant forms of words involving exchanges of /e/ and /ɛ/, though there was a trend toward such an effect in children with a greater proportion of Catalan exposure. This effect of exposure became more apparent at later ages when bilingual 3- and 4-year-olds behaved differently depending on which language was predominant at home. The Catalan-dominant children recognized words with exchanged /e/ and /ɛ/ poorly, like the Catalan monolingual toddlers; but the Spanish-dominant preschoolers showed no sign of detecting the mispronounced vowels.

Further evidence for the development of the phonemic representations of words comes from studies using the 'switch task'. The switch task involves training children on two different word-object pairings (e.g., /bih/ for one object and /dih/ for the other) until they habituate. At test, there are 2 types of trials: 'same' trials on which the infant hears the familiar word-object pairing and 'switch' trials where they hear the opposite pairing. If children can tell the difference between the two words, they should show surprise in the 'switch' trials [Curtin & Werker, 2007]. At 14 months, English-hearing children do not discriminate words with minimal phonetic differences (e.g., /bih/ and /dih/), though they do show discrimination between two phonetically very different words (e.g., /lif/ and /nim/). They do not succeed in discriminating the phonetically similar 'words' until 17 months [Stager & Werker, 1997; Werker, Fennell, Corcoran, & Stager, 2002]. Curtin and Werker [2007] explain this

in terms of task demands, suggesting that mapping a word to a referent is a more complex task than simply discriminating between two auditory stimuli, and that infants' attentional resources are limited. One study of bilinguals in this task suggested that they might be delayed in the ability to distinguish phonetically similar words until 20 months. However, as Sebastian-Galles reports, the results of the study by Mattock, Polka, Rvachew and Krehm [2010] indicate that their performance is equivalent to that of monolinguals provided that the stimuli are extracted from the speech of an adult bilingual asked to provide them in carrier phrases spoken in one language or the other. It seems that the problem in the previous experiment was that the stimuli were extracted from neutrally pronounced speech which would have been acceptable in either language, thus leading to confusion on the part of the bilinguals. Mattock et al. [2010] point out that discriminating speech sounds is different for a bilingual than for a monolingual in two possible ways: if the phonetic representations of the two languages are independent, then the child needs to have speech sounds sorted by language and if the two representations are similar or interdependent, then the child is facing a 'more crowded phonological space'. In their experiment, the presentation of the vowels pronounced in the 'appropriate' language allowed the children to distinguish them. The important conclusion from all this is that the bilingual developmental experience is different from the monolingual developmental experience and requires the presentation of appropriate stimuli if we are to be able to describe their representation of speech sounds accurately and to make sensible comparisons between the two developmental pathways.

Another potentially important factor suggested by Sebastian-Galles is the question of what actual sounds bilingual children hear in their environment. For instance, if parents talk to one another or to the child in a language that is not native for one or the other, then the child may well be exposed to mispronunciations – and this could well affect the phonetic and phonological representations for each language that the child is building up. This raises the wider question of assessing the bilingual environment and, indeed, what it means to be bilingual.

The 'Input'

One major problem for studying bilingual development is characterising the input to the child. Clearly in sheer quantitative terms, the infant is likely to hear less speech in each of their languages than a monolingual, though this of course will be qualified by other factors including the amount of time spent with the child by speakers of each language.

In the studies on infancy cited above, researchers classify the child as bilingual on the basis of parental questionnaires: in most of the studies, children are accepted as bilingual if the parents reported a balance of not less than 35% of one language and not more than 65% of the other while the monolingual infants had to be reported as receiving over 80% of one language. Clearly this is pretty 'rough and ready' and is likely to make questions such as 'how much input is enough?' difficult to answer. This may well explain the rather mixed results when considering whether bilingual infants are 'ahead' or 'behind' in their development of each language.

A second consideration is that even if parents are using a 'one parent-one language' strategy in speaking to their children, this leaves out of consideration two

potentially very important factors: the language spoken to each other by members of the family and how well each speaker knows the 'non-native' language – this latter point is raised by Sebastian-Galles when she points out that bilingual children will likely be exposed to mispronunciation if neither parent is him/herself a native speaker of the other parent's language and this may well affect the development of fully separate phonemic inventories for the two languages. There is not much detailed information on the use of Catalan and Spanish in these homes but my impression is that this may be rather different from a number of other multilingual situations in that I suspect most Catalan native speakers also speak Castilian (Spanish) to a pretty high standard, though the same will certainly not be true of native Spanish speakers. The languages are also relatively close typologically and in terms of contact, with non-negligible rates of cognates and borrowing. Given all this, the rather mixed picture of the development of Catalan/Spanish bilingual infants' phonemic inventories seems hardly surprising.

How Is Bilingualism to Be Defined?

The infants in the Sebastian-Galles studies have grown up in bilingual environments from birth. But while the majority of children in the world probably grow up in multilingual contexts, these differ widely. Many functional bilinguals do not grow up with two languages relatively equally balanced right from the beginning while others grow up with more than two languages from the outset. There is a huge amount of research into the consequences for language development and literacy of these different language backgrounds [e.g. Gathercole & Thomas, 2009; Tabors & Snow, 2001]. Work by Bialystok [2001] suggests that early bilingualism can lead to advantages in cognitive 'flexibility' but there are important questions about how bilingual one has to be for this advantage to be present. For instance, we know rather little about the differences between neonatal bilinguals and early successive bilinguals, either in terms of their phoneme inventories, their lexical development or the effects on their cognition of learning more than one language.

Once children start to speak, the question of how to define a bilingual becomes even more complex. Many children brought up in a bilingual environment will actually be 'dominant' in one language or the other, sometimes variably at different stages of development, depending in part on the language environments in which they spend their time, but also on their own individual preferences. These children may have relatively full comprehension of both languages but be more variable in their production skills. Assessing the developmental continuities and discontinuities from the early stages of infant bilingualism to later comprehension and production becomes an extremely challenging task.

Conclusions

In principle, research on bilingualism holds the promise of illuminating many fundamental questions in theories of language learning and processing. However, there are formidable empirical problems in actually cashing out this promise. The work of Sebastian-Galles and her team on infant speech perception, using a relative-

ly ideal population of neonatal bilinguals, is not only helping to clarify the nature of speech representation in both monolingual and bilingual infants but also to remind us, as developmental psychologists, that each development builds on a previous stage and that children who start out life in a bilingual environment are not 'double monolinguals'.

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