



The influence of initial exposure on lexical representation: Comparing early and simultaneous bilinguals

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Abstract

The representation of L2 words and non-words was analysed in a series of three experiments. Catalan-Spanish bilinguals, differing in terms of their L1 and the age of exposure to their L2 (since birth—simultaneous bilinguals—or starting in early childhood—early sequential bilinguals), were asked to perform a lexical decision task on Catalan words and non-words. The non-words were based on real words, but with one vowel changed: critically, this vowel change could involve a Catalan contrast that Spanish natives find difficult to perceive. The results confirmed previous data indicating that in spite of early, intensive exposure, Spanish-Catalan bilinguals fail to perceive certain Catalan contrasts, and that this failure has consequences at the lexical level. Further, the results from simultaneous bilinguals show: (a) that even in the case of bilinguals who are exposed to both languages from birth, a dominant language prevails; and (b) that simultaneous bilinguals do not attain the same level of proficiency as early bilinguals in their first language.

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How early must an individual learn a second language to attain native performance? Popular wisdom has it that puberty is the upper limit for “perfect” second language acquisition. This assumption received support from early models of language development. [Lenneberg \(1967\)](#) formulated the critical period hypothesis which held that language could be learned through some biologically determined mechanisms within a specific time window. Outside this window, learning was only possible through the use of other (non-specific) mechanisms. More recent approaches to this issue no

longer assume that there is a more or less sudden end to an individual’s ability to master a second language, but hold that the loss of the acquisition capacity is progressive ([Bialystok & Hakuta, 1999](#); [Birdsong, 1992, 1999, in press](#); [Birdsong & Molis, 2001](#); [Bongaerts, 1999](#); [DeKeyser & Larsen-Hall, in press](#); [Flege, 2003](#); [Flege & Hillenbrandt, 1984](#); [Flege, Yeni-Komshian, & Liu, 1999](#); [Hyltenstam & Abrahamsson, 2000](#); [Johnson & Newport, 1989, 1991](#); [Marler, 1991](#); [Mayberry, 1993](#); [Mayberry & Eichen, 1991](#); [Newport, 1990, 1991, 2002](#); [Sebastián-Gallés & Soto-Faraco, 1999](#); [Seliger, 1978](#); [Ullman, 2001](#)). Furthermore, the difficulties in attaining native-level performance are not related solely to individual differences such as age of acquisition or

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amount of exposure. It seems that certain aspects of the language system (such as vocabulary) can be learned at any age, while other aspects (such as the use of prepositions and syntax) remain particularly difficult (Neville & Bavelier, 2000; Neville, Mills, & Lawson, 1992; Weber-Fox & Neville, 1994, 1999).

One domain that seems particularly difficult to master in an L2 is the phonological system (Bosch, 2000; Flege & MacKay, 1999; Sebastián-Gallés & Soto-Faraco, 1999). The difficulties are found in both the production and the perception domains. Many bilinguals are “given away” by their foreign accent and they also tend to experience difficulty in perceiving particular non-native sounds. Most studies of these issues have analysed competence in the second language in relation to variables such as age of acquisition, age of arrival in the foreign country, etc. (for a review see Birdsong, *in press*). In general, the predominant view is that adults can acquire, with different degrees of success, even the most difficult foreign contrasts, as long as appropriate input is provided (Flege, 2003; Iverson et al., 2003; McCandliss, Fiez, Protopapas, Conway, & McClelland, 2002). On this view, since auditory processing would be unaffected by language exposure, it should be possible, at least theoretically, to acquire any foreign contrast at any moment in life. According to Flege (2003) “the capacities underlying successful L1 speech acquisition remain intact across the life span. These capacities include the ability to accurately perceive featural patterns in speech input.” (p. 327) In this context, the difficulties experienced by adult learners are caused by L1 interference effects and not from normal neural maturation. In fact, as Iverson et al. (2003) suggest, L1 interference effects would become progressively stronger as L1 develops; that is, the earlier L2 is acquired, the less the effects of the L1 will be observed because L1 categories would not be yet fully established. In this way, age of acquisition effects would be just an epiphenomenon of how L1 interference develops in time.

Hardly, any of the empirical data addressing the issue of age of acquisition and its consequences in speech perception mechanisms have analysed simultaneous bilinguals, that is, individuals who, from the very first day of their lives, have been exposed to two languages and have used them continuously. Due to this exposure from birth to both languages, the study of this population represents one of the endpoints in the age of acquisition-L1 interference continuum. Although the literature on adults is scarce, some developmental data are available that suggest that the early setting of phonetic categories in (simultaneous) bilingual infants does not follow the same path as that of monolingual infants (Bosch & Sebastián-Gallés, 2003; Burns, Werker, & McVie, 2002).

As early speech development studies reveal, the first months of life play an important role in the establishment of the native language categories. Research has

shown that in the second half of the first year of life infants shape the phonetic categories of their L1 (a development that will continue during childhood). Kuhl and coworkers (Kuhl, 1991; Kuhl, Williams, Lacerda, Stevens, & Lindblom, 1992) found that before six months of age infants do not show the “perceptual magnet effect,” that is, the difficulty that adults experience in perceiving small acoustic differences close to the prototypes of the phonemes of their native language. This difficulty is specific to the vowels of the maternal language, and is not observed for vowels of other languages. At about six months, infants show a pattern that closely resembles the adult one. Bosch and Sebastián-Gallés (2003) studied the developmental pattern of monolingual Catalan infants, monolingual Spanish infants and bilingual Spanish-Catalan infants in the perception of the Catalan-specific/e-ε/contrast. As expected, at four and a half months, all infants were able to discriminate between different tokens of disyllabic stimuli that differed only in terms of these two contrastive Catalan vowels. Also as expected, by eight months Spanish monolingual infants did not show any sensitivity to the contrast, while Catalan monolingual infants still showed it. Interestingly, bilingual Spanish-Catalan infants no longer showed any discriminative behaviour at this age (regardless of the language of the mother). By 12 months, bilingual infants had “regained” their capacity to discriminate the contrast. This differential pattern between monolingual and bilingual infants shows that the two populations have their own processes of category acquisition. Bosch and Sebastián-Gallés (2003) argued that the recovery of the discrimination behavior in bilingual infants at 12 months was related to their need to represent words in the lexicon in the proper way. It remains to be explored if this particular process of maternal language category development has any consequences in the long-term as regards the representation of the sound system in simultaneous bilingual adults. The main goal of the present series of experiments is to explore the speech perceptual capacities of simultaneous bilinguals by analysing how words are represented in their mental lexicon.

As mentioned above, research in second language speech perception indicates that (non-simultaneous) bilinguals have difficulty in perceiving some non-native contrasts. Several models have been put forward to explain why some segmental contrasts not present in the first language are easier to perceive in the second language than others (Best, 1995; Flege, 1995, 2003). The fact that bilinguals experience perceptual difficulties for some L2 sounds could mean that their lexical representations may not include as much detailed information as the processing and representation of words in the first language. Our previous research has shown that Spanish-dominant bilinguals, in spite of a high degree of linguistic competence, have difficulty in perceiving some

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