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Limits on bilingualism revisited: Stress 'deafness' in simultaneous French–Spanish bilinguals

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ABSTRACT

We probed simultaneous French–Spanish bilinguals for the perception of Spanish lexical stress using three tasks, two short-term memory encoding tasks and a speeded lexical decision. In all three tasks, the performance of the group of simultaneous bilinguals was intermediate between that of native speakers of Spanish on the one hand and French late learners of Spanish on the other hand. Using a composite stress 'deafness' index measure computed over the results of the three tasks, we found that the performance of the simultaneous bilinguals is best fitted by a bimodal distribution that corresponds to a mixture of the performance distributions of the two control groups. Correlation analyses showed that the variables explaining language dominance are linked to early language exposure. These findings are discussed in light of theories of language processing in bilinguals.

1. Introduction

How many languages can be sustained efficiently in a single brain? Much research has been devoted to the acquisition of a second language by monolingual individuals, and in particular to the negative correlation between the age of acquisition and the outcome of second language learning: Late learners typically have worse performance in their second language than early learners (Flege, Yeni-Komshian, & Liu, 1999; Johnson & Newport, 1989; Weber-Fox & Neville, 2001), even though considerable individual variation exists and it has been argued that native-like performance can be attained by some individual late learners (Birdsong, 2007; Bongaerts, 1999). Little research, in contrast, has been devoted to the study of *simultaneous bilinguals*, that is, individuals who are immersed from birth in a bilingual environment. Given the above-mentioned findings with late learners, the expectation is that given a relatively balanced exposure to both languages, simultaneous bilinguals should easily attain native-like performance in both languages. Yet two studies, concerned with French–English and Spanish–Catalan bilinguals, respectively, claimed that simultaneous bilinguals may not reach native-like performance in one of their languages (Cutler, Mehler, Norris, & Segui, 1989, 1992; Sebastián-Gallés, Echeverria, & Bosch, 2005). Both showed that the performance of even extremely proficient bilinguals who pass for perfect monolinguals in both of their languages in ordinary language situations may be below native levels in at least one of the languages when tested with sophisticated laboratory techniques.

Cutler et al. (1989, 1992) raised the possibility that a bilingual brain processes only one language with optimal efficiency; the other language is processed using routines of the primary language, hence yielding non-native performance. Given a group of simultaneous bilinguals, this hypothesis predicts that for each of the two languages performance does not follow a normal, monomodal, distribution, but rather a bimodal one, with participants in the best

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mode performing as monolinguals, and participants in the other mode performing as second language learners. This prediction is not strongly supported by empirical data: Both Cutler et al. (1989, 1992) and Sebastián-Gallés et al. (2005) used several measures of *dominance*, defined through a subjective questionnaire or a biographical interview, to divide their bilingual participants into two groups. At least one of these measures yielded groups with performance differences. However, this does not imply that the bilinguals' performance followed a bimodal distribution. Indeed, the same difference could result from a monomodal distribution with a large variance, hence with only few (if any) bilinguals performing like monolinguals of one or the other language. Moreover, whereas Cutler et al. (1989, 1992) found that – as predicted – the performance of the best group was like that of monolingual speakers and that of the other group like that of second language learners[1], Sebastián-Gallés et al. (2005) reported contrasting results. They found, firstly, that the performance of the best group was *worse* than that of native speakers, suggesting that the performance in the dominant language is influenced by the other language, akin to what has been found for speech production in both early and late bilinguals (Caramazza, Yeni-Komshian, Zurif, & Carbone, 1973; Flege, Schirru, & MacKay, 2003; Yeni-Komshian, Flege, & Liu, 2000). Secondly, they found that the performance of the other group was *better* than those of early Spanish–Catalan bilinguals, i.e. native speakers of Spanish who had started to learn Catalan around the age of four. Taken together, their results thus suggest that if the performance of simultaneous bilinguals is bimodal (which remains an open question), then the two modes are different from those defined by the performance of monolinguals on the one hand and that of second language learners on the other hand.

The hypothesis that a bilingual brain processes only one language with optimal efficiency also raises a question concerning acquisition: which factor(s) determine(s) which of the languages spoken in the infant's environment will become his or her dominant language? No agreement emerges from the previous studies with respect to this question. The bilinguals tested by Cutler et al. could be partitioned into French-dominant versus English-dominant groups on the basis of their preferred language, whereas in the study by Sebastián-Gallés et al., the most relevant criterion for partitioning the bilinguals into a Catalan-dominant and a Spanish-dominant group was the language of the mother. Resolving this issue is important for theories of early language development and functional brain plasticity. Indeed, theories based on an early attunement of speech processes predict an effect of early exposure (Kuhl, 2000); theories based on the existence of a sensitive period (Weber-Fox & Neville, 2001) predict no (or little) effect of exposure that follows the sensitive period; and theories based on life-long plasticity predict either an effect of total exposure, or an effect of the later occurring exposure (Birdsong, 2005; Hakuta, Bialystok, & Wiley, 2003).

In the present study, we consider a group of French–Spanish simultaneous bilinguals and focus on their performance in one of their languages, i.e. French. Specifically, we test their on-line perception of word-level stress, a phonological feature that is used in Spanish but not French.[2] In earlier work, it was demonstrated that native speakers of French, as opposed to native speakers of Spanish, exhibit a robust stress 'deafness', that is, they have much difficulty perceiving stress contrasts (Dupoux, Pallier, Sebastián, & Mehler, 1997; Dupoux, Peperkamp, & Sebastián-Gallés, 2001), even after having learned Spanish as a second language (Dupoux, Sebastián-Gallés, Navarrete, & Peperkamp, 2008). The strength of the stress 'deafness' effect places us in a good starting position to analyze the underlying distribution of the simultaneous bilinguals' performance. In addition, we increase the statistical power of our data by calculating a composite score based on several tasks. The reasoning is as follows: any given paradigm is loaded with task-specific components (memory, attention, executive functions, metalinguistic skills), which are orthogonal to the particular processing level under study. Individual variation in these irrelevant components is bound to blur the shape of the distribution, making it difficult to distinguish between a monomodal and a bimodal distribution. Taking into account the results across distinct tasks should allow us to reduce the contribution of these task-specific components, but retain the contribution of the processing levels that are common to the tasks. This power will also enable us to test whether the two modes are similar to the modes of monolingual or non-native control populations.

In order to address the question as to which factor(s) determine(s) which of the languages spoken in the infant's environment will become his or her dominant language, we selected our simultaneous bilinguals in two different cities, one French and one Spanish; we conducted individual biographic interviews with each one of the bilinguals; we had them fill in a questionnaire concerning a subjective assessment of their language competences and preferences; and we had their parents fill in an extensive questionnaire concerning their early language exposure. We used these data to quantify the amounts of exposure to French and Spanish throughout the bilinguals' lives (prenatal influences, infancy, childhood, adolescence, adulthood), and to establish their fluency in French and Spanish as well as the importance they attach to their two languages.

2. Sample

Twenty-three simultaneous French–Spanish bilinguals participated. There were five men and 18 women, aged between 19 and 44 (mean: 25). Ten bilinguals lived and were tested in Paris, 12 lived and were tested in Barcelona, and one lived in Barcelona but was tested during a short visit in Paris. Fifteen bilinguals had a native French-speaking mother and a native Spanish-speaking father, while the

[1] Note, though, that no statistical analyses are shown to back up this finding.

[2] A pilot study with eight simultaneous French–Spanish bilinguals was reported in Peperkamp, Dupoux, and Sebastián-Gallés (1999). In this pilot, three bilinguals showed French-like results and the remaining five Spanish-like results, with individual performance being highly correlated with the country of birth.