Verbal information processing in Portuguese/French bilinguals in a dichotic listening task

A. M. OLIVEIRA*
S. L. CASTRO**
L. DE SOUSA***
****ESEV Viseu, Portugal***
*****Department of Psychology, University of Porto, Portugal***
******Biomedical Institute, University of Porto, Portugal***

Most studies on information processing by bilinguals address the issue of how the two languages are organized in the CNS and how information is stored in memory. Results obtained in dichotic listening and tachistoscopic tasks, Wada tests, and E.E.G. have led to the suggestion that in the bilingual brain the representation of linguistic functions is less lateralized to the left and that there is a higher involvement of the right hemisphere for the second language (Albert and Obler, 1978; Vaid, 1983).

Paradis (1987) proposed to consider four main aspects in the analyses of bilingual lateralization models: (1) differences in the age of L1 and L2 acquisition; (2) differences in the type of bilingualism ; (3) the hypothesis of greater right hemisphere involvement in bilingual language; (4) the study of aphasia in bilingual patients, namely the patterns of recovery for each of the different languages of a bilingual. It has been suggested that the greater the difference between L1 and L2 and the contexts where they were acquired, the greater the lateralization of L2 will differ from the left dominance pattern of the native language (Vaid, 1983).

Other studies have found a greater bilateral involvement for L1 (Gordon, 1980), for L2 (Sussman, Franklin and Simon, 1982) or for both languages (Genesee, Hamers, Lambert, Mononen, Seitz and Starck, 1978). Starck et al. (1977) developed a dichotic listening test using numbers in English with trilingual children (French/English/Hebrew) and English monolinguals. The results showed that the total number of correct answers increased with age while the degree of REA decreased for both groups. An interesting developmental a developmental study was done with German-Swedish bilingual students (Magiste, 1992). Measures in the two languages were taken at the word level for tachistoscopic tests and at both word and sentence level for dichotic listening. In the balanced group, participants had learned both languages before puberty and had a native competence in them. In the German-dominant group, German was handled with the competence of a native speaker, while Swedish was not. A dichotic listening task of 80 simple arithmetical items was used in both German and Swedish. Results have revealed that there was more LH-involvement in German and Swedish for the German-dominant group, and about equal LH- and RH-involvement for both languages in the balanced group. Proficiency in L2 increases native-like competence, as is the case in the German-Swedish balanced group that actively use both languages daily, and LH-performance is slightly better than RH-performance, indicating nearly perfect bilateral involvement. According to Magiste, because the balanced group solved more arithmetic operations in either language than the German-dominant group, bilinguals who are adept at two languages will have more brain activity in general.

As the brief survey above has shown, laterality differences due to bilingualism are not consistently found (see also Galloway & Scarcella, 1982; Piazza & Zatorre,1981). The present study was aimed to establish whether or not laterality differences were found between Portuguese/French bilinguals and Portuguese or French monolinguals, using a variation of the dichotic listening task. This variation involved presenting to the participant an extra dichotic listening task, where one member of the dichotic pair is presented in one language and the other member is in the other language.

METHOD

Participants

Thirty-five Portuguese/French bilinguals, 51 Portuguese monolinguals and 29 French monolinguals took part in this experiment. All participants in the bilingual group had learned both before 12 years of age. The majority of participants (25 in 35) have acquired both languages before 6 years of age. All participants were right-handed and reported normal hearing.

Materials

Three dichotic listening tests have been prepared, one in French, another in Portuguese and the third combining both languages (hereafter, monolingual Portuguese, monolingual French and bilingual tests, respectively). Each test was composed of 20 word pairs, that were presented twice with reversed channel assignment in the second time.

A mixed set of common Portuguese and French bi-syllabic words were selected. Words were spoken by a feminine voice and digitized with a sampling frequency of 44 Khz using the Sound Designer II System in a Macintosh II Ci. Words with the best auditory quality were chosen, and edited to compose stereophonic pairs such that for each pair word onsets were aligned within 5 miliseconds, and the acoustic salience of each syllable was roughly equivalent in both word pairs. Words of the same pair had approximately the same duration.

The resulting dichotic pairs were then recorded into audio tape with an ISI of 3 seconds. Stimuli were presented through headphones from a Sony DAT TCD-D8. Each test started with 3 extra pairs of words as training trials.

Procedure

Participants were tested individually in a quiet room. Tests were performed as follows. Monolingual Portuguese test and monolingual French test for Portuguese and French monolinguals, respectively. Bilinguals performed the same tests in that order and then completed the bilingual test. The order was fixed and each test was done in a different day.

Participants were instructed to listen to the words coming through the headphones, one word to the one ear, and another word to the other, and to report what they heard, as soon as possible.

RESULTS

The mean number of correct responses can be seen in Table 1. Performance was clearly better in the monolingual tests, and was close to the ceiling level in the French monolingual group.

Table 1 – Mean (and standard deviations) of correct responses (maximum possible is 40)

	Bilinguals		Monolinguals	
Test	Left Ear	Right Ear	Left Ear	Right Ear
Monol. Portug.	35.2 (2.9)	34.3 (3.5)	34.2 (5.9)[a]	34.2 (4.4)[a]
Monol. French	35.4 (3.0)	35.1 (3.4)	37.0 (1.9)[b]	36.8 (1.6)[b]
Bilingual	30.8 (4.5)	30.3 (4.4)		

Note. [a]These values were observed in Portuguese monolinguals; [b]These values were observed in French monolinguals.

A comparison between monolinguals and bilinguals in the Portuguese test showed that there were no significant differences ($t(84)=.68$, n.s.). However, monolingual French participants performed better than bilinguals in the French test ($t(52)=-2.83$, $p < .006$). In the Portuguese monolingual group there are no differences between number of correct responses given to the stimuli presented in each ear ($t(50) =.12$, n.s.), as well as in the French monolingual group ($t(28)=-.47$, n.s.). An ANOVA with Ear and Test (Portuguese vs. French vs. Bilingual) as within confirmed the significant effect of Test ($F(2,68) = 41.16$, $p < 0.001$), with worse results in the bilingual test. No laterality effects were found ($F(1,34)=1.89$, n.s.), nor the interaction Ear x Test ($F < 1$).

DISCUSSION

Like Starck *et al.* (1977), we also did not find sistematic differences between monolinguals and bilinguals on the total number of correct responses. The fact that there were no differences between the Portuguese monolinguals and the bilinguals performing the Portuguese test can be attributed to the fact that our bilingual group lives in a Portuguese context, and is thus at the same level of proficiency in Portuguese as the Portuguese monolinguals. The difference between our bilinguals performing in French and the French monolingual group (better results for the French monolinguals) can likewise be due to the same reason: since they live in a Portuguese context, their proficiency in French is not as high.

In the bilingual task, where participants were asked to attend to stimuli in both languages, there was more interference than in the tasks performed only in one language. This is reminiscent of the finding by Soares & Grosjean (1984), where bilinguals took longer to understand sentences with words in both languages, than sentences with words in only one language. Our results provide further evidence of the cost brought about by the being in the bilingual mode as compared to the monolingual mode.

Finally, in neither of the conditions observed did we find a lateral asymmetry. The fact that we failed to replicate the well-established REA for word stimuli prevents further comparisons on monolingual vs. bilingual lateralization patterns. It shows that lateral ear advantages do not reflect brain lateralization for language in a very direct and even robust manner (e.g., de Sousa, 1990; see also Castro and Morais, 1987) and that task difficulty and attentional demands must be set at an appropriate level in order for a reliable REA to emerge.

NOTES

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Correspondence concerning this article should be addressed to the Prof. Liliana de Sousa, ICBAS, Universidade do Porto, Lg. Prof. Abel Salazar, 2, 4050, P-4150 Porto.

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