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On the Nature of Speech Errors in Aphasia: Acoustic Analysis of the Speech Output of 8 Native Speakers of Spanish with Aphasia

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Background

In aphasiology, one of the crucial questions is concerned with the level/s of speech processing at which speech errors occur. In this paper, we are concerned with errors that can arise either during phonological or phonetic encoding. We will address the claim that individuals with non-fluent aphasia producing speech errors suffer from a deficit related to the phonetic processing of speech, whereas the errors of individuals with fluent aphasia arise at the phonological level of processing (Lecours & Lhermitte, 1979).

Methods

In order to proceed, we carried out phonological analyses (for movement, deletion and addition errors) and acoustic analyses for substitutions and distortions. The approach for the instrumental study was as follows: Within each individual with aphasia, we compared substitution errors (e.g. [p] instead of [b] in *bata*), in terms of their acoustic properties, to the correct productions of the substituted sounds (e.g. [b] in *bata*), to the on-target productions of the substituting sound ([p] in *pata*). In phonological impairment, we expect the acoustic characteristics of the error to be similar to the on-target productions of the substituting sound ([p] instead of [b] in *bata* similar to [p] in *pata*). In contrast, if the acoustic analyses reveal systematic differences between the acoustic properties of the errors and on-target productions, we can conclude that the phoneme was correctly selected during the phonological encoding and that the nature of the deficit originates in the subsequent phonetic implementation of the selected phonemes.

The corpus included Spanish fricatives and plosives, in different phonetic contexts and stress positions (345 items in total). The data were elicited from 4 individuals with Broca's aphasia and 4 individuals with conduction aphasia in reading and repetition tasks. Distortions and substitution errors were analysed acoustically for the parameters of VOT, VTT, total duration, number of noise-bursts, and their duration.

Results

Overall, our results were consistent with the assumption that individuals with non-fluent aphasia predominantly display phonetic deficits, while fluent aphasic speech is generally characterised by phonological impairment. Our non-fluent patients displayed timing deficits, which were presumably responsible for the observed devoicing errors, as reported in literature (Blumstein, 2001, for review). In spite of this difficulty, acoustic analysis showed that, in general, these patients made a systematic distinction between their on-target

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voiced and voiceless stops. However, the output from one of our non-fluent subjects yielded evidence of an unexpected treatment of voiced stops: his devoiced stops were “more voiceless” than his correctly produced voiceless stops. In our presentation, we will discuss the acoustic patterns of speech of each patient in detail, and the factors that may have determined the nature of the errors.

References

Blumstein, S. E. (2001). Deficits of speech production and speech perception in aphasia. In R. Berndt (Ed.), *Handbook of neuropsychology*, Vol. 3, 2nd ed. The Netherlands: Elsevier.

Lecours, A.R. & Lhermitte, F. (1979). *L'aphasie*. Paris: Flammarion.

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