Journal of Memory and Language 68 (2013) 26–38

Contents lists available at SciVerse ScienceDirect

Journal of Memory and Language

journal homepage: www.elsevier.com/locate/jml

Heft lemisphere: Exchanges predominate in segmental speech errors

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ARTICLE INFO

Article history:
Received 11 November 2011
revision received 24 August 2012
Available online 30 September 2012

Keywords:
Speech errors
Speech planning
Self-monitoring
Inner speech
Scan-copier

ABSTRACT

In most collections of segmental speech errors, exchanges are less frequent than anticipations and perseverations. However, it has been suggested that in inner speech exchanges might be more frequent than either anticipations or perseverations, because many half-way repaired errors (Yew…uhh..New York) are classified as repaired anticipations, but may equally well be half-way repaired exchanges. In this paper it is demonstrated for experimentally elicited speech errors that indeed in inner speech exchanges are more frequent than anticipations and perseverations. The predominance of exchanges can be explained by assuming a mechanism of planning and serial ordering segments during the generation of speech that is qualitatively similar to the scan-copier model proposed by Shattuck-Hufnagel (Sublexical units and suprasegmental structure in speech production planning. In P.F. MacNeilage (Ed.), *The production of speech (pp. 109–136)*. New York: Springer).

Introduction

Errors of speech come in many varieties. One major distinction is between syntagmatic errors and paradigmatic errors. In syntagmatic errors there is a source and a target within the utterance, as in *heft..left hemisphere* (most English examples in this paper are taken from Fromkin,1993), where supposedly the source of the error is the *h* of *hemisphere*, the target is the position of the *l* of *left*, and an intruding segment, taken from the source, is misplaced into the target position. In paradigmatic errors the source of the error is to be sought outside the utterance, as in *on your left..uh your right hand*. In this paper the focus will be on syntagmatic speech errors. Another major distinction is between errors where the misplaced units are meaningful lexical units, such as in the last example, or meaningless speech sounds as in *some kunny kind* instead of *some funny kind*. In collections of speech errors syntagmatic segmental errors far outnumber syntagmatic lexical errors, by a factor of 5 or 6 (e.g. Nooteboom, 1973; Nooteboom, 2005a). Here syntagmatic segmental errors take center stage. The misplaced unit in a speech error cannot only replace another unit as in the examples given, but also be omitted or added, as in *acon and begs* for *bacon and eggs*, where the *b* is omitted from *bacon* and added to *eggs*.

Another dimension that is relevant to the study of syntagmatic segmental speech errors, is what may be called the “direction” of the error. A speech sound may come too early, as in *a Tanadian from Toronto* for *a Canadian from Toronto*. Such errors we call “anticipations”. Or a speech sound may come too late, as in *she can she it* instead of *she can see it*. These errors are named “perseverations”. And a speech error may exchange two speech sounds as in *teep a cape* for *keep a tape*. These are sometimes called “transpositions”. Here they will simply be called “exchanges”. In collections of speech errors in spontaneous speech exchanges are most often less frequent than anticipations and perseverations. Typically, Nooteboom (1973) found in a corpus of errors in spontaneous Dutch collected by Cohen (1966), 78% anticipations 15% perseverations, and only 7% exchanges. Nooteboom (1980), counting errors in Meringer’s (1908) corpus, found 61% anticipations, 28% perseverations, and 11% exchanges. Nooteboom (2005a) reporting on the much larger Utrecht corpus of

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http://dx.doi.org/10.1016/j.jml.2012.08.004

speech errors (Schelvis, 1985), mentions 60% anticipations, 22% perseverations and 18% exchanges. Although these numbers seem to suggest that exchanges are less frequently made than anticipations and perseverations, this may not be true for the generation of sound errors in inner speech. The reason is that in all the studies mentioned, errors of the form *heft... left hemisphere* are classified as repaired anticipations. Both Nooteboom (1980, 2005a) and Shattuck-Hufnagel (1979, 1983) pointed out that such incomplete errors, corrected in midstream, may be incipient anticipations, as *heft hemisphere*, but may also be the first parts of exchanges, as *heft lemisphere*. Shattuck-Hufnagel (1979) suggested that there "is evidence that exchange errors are more common than substitutions" (p. 323), referring to an analysis of the MIT-CU corpus that seems to suggest that feature constraints on exchanges and substitutions are quite different, and that incomplete errors are indistinguishable from exchanges but significantly different from substitutions in their feature constraints (p. 325; also see Shattuck-Hufnagel & Klatt, 1979). Nooteboom (2005a) concluded, on the basis of a somewhat speculative argumentation, that in inner speech exchanges are probably more frequent than both anticipations and perseverations.

A possible argumentation for the latter claim runs as follows. Imagine that an anticipatory error, like *heft hemisphere* is made in inner speech. In that case the monitor watching out for speech errors in inner speech has only one single chance to detect the error, by detecting the erroneous form heft. However, when an exchange error, such as *heft lemisphere*, is being made in inner speech, there are two erroneous forms that can trigger error detection, *heft* and *lemishere*. One may note, of course, that this presupposes that an error can be detected in inner speech, before this error is spoken. As it happens, this appears not only to be true for hidden errors such as *lemisphere* in *heft..left hemisphere*, but also for most, if not all, of the overt incomplete errors. One reason is that these incomplete errors in a great many cases are fragments of speech consisting of only a single word-initial consonant, or a word-initial CV-combination, as in *d..barn door* or *ga..bad goof*. Such fragments of speech generally are shorter than a humanly possible reaction time (Nooteboom, 2005b). Therefore error detection leading to the command to stop speech, must have taken place before the error was made overt. A second reason is that the interval between offset of the interrupted, incomplete error and onset of the repair very often is in the order of 0 ms, suggesting that not only error detection but also error repair was planned before the spoken realization of the error (Blackmer & Mitton, 1991; Nooteboom, 2005b). It has also been shown experimentally that monitoring inner speech for speech errors by the speaker is faster and more efficient than monitoring overt speech (Hartsuiker, Kolk, & Martensen, 2005).

Assuming, then, that indeed exchanges have two chances to be detected against anticipations only one, it is reasonable to conclude that most incomplete, interrupted, errors stem from exchanges, and only a minority from anticipatory errors. This has been argued by Nooteboom (2005a) for errors in spontaneous speech. The weakness of Nooteboom's claim was that in his collection of segmental speech errors in spontaneous Dutch most exchanges supposedly having occurred in inner speech remained hidden in the large set of early interrupted errors of the type *Yew...uhh..New York*. They could not be distinguished from early repaired anticipations, and could therefore not actually be counted. In this paper we will describe an experiment set up with the explicit purpose of severely reducing the number of early interrupted speech errors, and of explicitly eliciting not only exchanges but also anticipations and perseverations. If our idea that in inner speech exchanges are considerably more frequent than anticipations and perseverations is correct, than we will find that exchanges predominate not only when these are explicitly elicited but also when anticipations and perseverations are explicitly elicited. This is strongly suggested by results obtained by Karen Humphreys and described in her unpublished dissertation (2002). She did an experiment explicitly eliciting anticipations and perseverations instead of exchanges and found that, when anticipations were explicitly elicited, nevertheless unrepaired exchanges were more frequently made than unrepaired anticipations. Results were less clear when perseverations were explicitly elicited, probably because of the scarcity of segmental speech errors in that experiment. However, the most frequent type of segmental speech error was what she called "aborted onset exchange", and what we call "early interruptions", that derive either from exchanges or from anticipations in inner speech. This means that in her data there remains some uncertainty whether indeed exchanges had been the most frequent type of segmental errors in inner speech. In another experiment Humphreys compared numbers of segmental errors when exchanges were explicitly primed with those obtained when anticipations were explicitly primed. In this experiment priming exchanges was far more effective than priming anticipations in eliciting segmental speech errors, suggesting that, at least in experiments explicitly priming segmental speech errors, exchanges are not caused solely by an initial anticipation automatically followed by an anticipation (as suggested by Shattuck-Hufnagel, 1979, 1983). Here again unrepaired exchanges were more frequent than unrepaired anticipations. But again, as in collections of segmental speech errors in spontaneous speech, early interruptions were more frequent than any other type of segmental speech error. This made the ratio between exchanges and anticipations in inner speech invisible.

As it happens, the predominance of exchanges in inner speech is not, at least not quantitatively correctly, predicted from existing models of serial ordering of segments in speech production. Dell's computational spreading activation model (1986) has a feature promoting exchanges, viz. post-selection inhibition of activation, but the resulting effect is too weak to predict a strong predominance of exchanges. Parallel Distributed Models of speech production, as exemplified by the model proposed by Dell, Juliano, and Govindjee (1993), do not generate segmental exchanges at all. The computational spreading activation model WEAVER++, as described by Levelt, Roelofs, and Meyer (1999), does not have a mechanism that would more or less automatically generate a following perseveration after an anticipation has occurred, and would thus not