



# Self-monitoring and feedback: A new attempt to find the main cause of lexical bias in phonological speech errors <sup>☆</sup>

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## Abstract

This paper reports two experiments designed to investigate whether lexical bias in phonological speech errors is caused by immediate feedback of activation, by self-monitoring of inner speech, or by both. The experiments test a number of predictions derived from a model of self-monitoring of inner speech. This model assumes that, after an error in inner speech, (1) an early interruption of speech may be made when speech was initiated too hastily, (2) the error may be covertly repaired, leading to the correct target, (3) the error may be covertly replaced by another speech error, or (4) an error may go undetected, leading to a completed spoonerism. This model of self-monitoring was supported by the speech errors observed in two SLIP experiments. The pattern of results supports the idea that lexical bias has two sources, immediate feedback of activation and self-monitoring of inner speech.

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## Introduction

### *Explanations of the lexical bias effect*

Lexical bias is the effect that phonological speech errors, for example BARN DOOR inadvertently spoken as DARN BORE, result in real words more often than in nonwords, other things being equal. This was demon-

strated in the laboratory over 30 years ago by Baars, Motley, and MacKay (1975). Lexical bias has also been convincingly demonstrated in spontaneous speech errors (Dell & Reich, 1981; Nooteboom, 2005a; but see Del Viso, Igoa, & Garcia-Albea, 1991; Garrett, 1976). Recently, it was found that in bilinguals, lexical bias does not discriminate between languages (Costa, Roelstraete, & Hartsuiker, 2006).

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Basically, two competing explanations have been proposed for lexical bias, reflecting different models of the architecture of the mental production of speech. The original explanation by Baars et al. (1975) was in terms of pre-articulatory editing of inner speech. Baars et al. assumed that nonwords are more often detected, rejected and repaired in inner speech than real words. This would explain why overt phonological speech errors are more often real words than nonwords. This explanation is strongly supported by Levelt (1989) and Levelt et al., 1999. Levelt introduced his “perceptual loop” theory of self-monitoring, which claims that the “monitor” employs the same speech comprehension system that is also used in listening to other-produced speech. In self-monitoring, the speech comprehension system receives two different forms of input, inner speech allowing the speaker to detect, reject and repair speech errors before they are articulated, and overt speech, allowing the speaker to detect, reject, and repair speech errors after they have been articulated. Following Baars et al. (1975), Levelt assumes that self-monitoring of inner speech uses a criterion of lexicality (“Is this a word?”). Nonlexical speech errors are more easily covertly detected, rejected and repaired than lexical errors. This explains lexical bias. Self-monitoring is supposed to be a semi-conscious process, sensitive to context. This self-monitoring explanation of lexical bias would be supported by evidence that lexical bias is affected by context. Such evidence has been provided by Baars et al. (1975), who found that in an experiment eliciting spoonerisms nonword–nonword errors are suppressed in a “mixed” context with both word–word and nonword–nonword stimuli, and that word–word errors are suppressed in a nonword–nonword context. Motley and Baars (1976) demonstrated in a similar experiment that the probability of spoonerisms to be elicited increases dramatically when the target word pairs are preceded by word pairs that are semantically related to the spoonerisms. Motley, Camden, and Baars (1982) found that taboo words in elicited spoonerisms are more often suppressed than nontaboo words. The suppressed taboo words were also accompanied by increased Galvanic Skin Response, showing that the taboo words were actually present in inner speech before being edited out. Further support for the role of centrally controlled pre-articulatory editing comes from Hamm, Junglas, and Bredenkamp (2004) who showed that in an experiment eliciting spoonerisms a secondary cognitive task taxing the central control system increases the number of spoonerisms, and also that in girls suffering from anorexia nervosa, a secondary cognitive task leads to a sharp increase in the number of spoonerisms semantically related to their illness.

A second explanation of lexical bias has been proposed by Dell and Reich (1980, 1981), Stemberger (1985), Dell (1986), and Dell and Kim (2005). These

authors assume that during the mental production of speech there is immediate feedback of activation between phonemes and word forms. This causes activation to reverberate between phonemes and word forms, giving speech errors that form real words an advantage over speech errors that have no corresponding lexical representations. A computational model implementing immediate feedback of activation neatly accounts for lexical bias and for some other well known properties of phonological speech errors, such as the so-called “mixed error” effect (phonological speech errors are more likely when error and target are not only phonetically but also semantically similar), and the “repeated phoneme” effect (two consonants are more easily substituted for each other when they are followed by the same vowel than when they are followed by different vowels). Because feedback between phonemes and words is supposed to be an automatic process internal to mental speech production, the feedback account of lexical bias cannot easily explain the earlier mentioned context effects.

It is important to realize that feedback and self-monitoring of inner speech are thought to be successive processes that do not exclude each other. Those who believe that feedback is responsible for lexical bias, do not deny that there is also self-monitoring of inner speech. They do, however, deny that self-monitoring employs a criterion of lexicality. Feedback leads to more word–word than nonword–nonword spoonerisms in inner speech, before self-monitoring operates, and the probability of such inner-speech errors to be detected, rejected and repaired would be the same for both word–word and nonword–nonword spoonerisms. In principle, though, both feedback and self-monitoring of inner speech could change the ratio between word–word and nonword–nonword spoonerisms. This is precisely what is proposed by Hartsuiker, Corley, and Martensen (2005) who report a well-controlled experiment eliciting word–word and nonword–nonword spoonerisms, in which the kind of context is varied from mixed (word–word and nonword–nonword priming and test word pairs) to nonlexical (nonword–nonword pairs only). The main finding in this study is that it is not the case that nonwords are suppressed in the mixed context, as claimed by Baars et al. (1975), but rather that word–word errors are suppressed in the nonlexical context. Hartsuiker et al. explain this suppression of real words in the nonlexical context by adaptive behaviour of the self-monitoring system. This explanation presupposes that there is an underlying pattern, before operation of the self-monitoring system, that already shows lexical bias. This underlying pattern would be caused by immediate feedback as proposed by Dell (1986). In an experiment eliciting lexical and nonlexical spoonerisms with bilingual subjects, Costa et al. (2006) explain lexicality effects on the nontarget lexicon as resulting from feedback between phonology and lexical items.

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