HOW FAR DO WE LOOK AHEAD WHILE SPEAKING?

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ABSTRACT

How many words are speakers generally planning ahead? Empirical evidence from two sources, viz. the material spans between rises and falls in a frequently occurring Dutch intonation pattern, and material spans between "origins" and "targets" in anticipatory speech errors, suggests that speakers often plan the coherent production of three or four words in a row.

INTRODUCTION

It has been suggested, notably by Levelt (1989), that, in the production of fluent speech, the minimally necessary lookahead at the level of the "phonetic plan", is only one word. Levelt's minimalist position, although possibly correct, does not tell us what people actually do in spontaneously producing fluent utterances that contain more than two words. In this paper an attempt will be made to answer this question, drawing on empirical evidence from two sources. One source consists of material spans between rises and falls in the production of a particular frequently occurring intonation pattern in spontaneous Dutch. The other is the distribution of material spans between "origins" and "targets" in anticipatory speech errors.

RISE-FALL PATTERNS IN DUTCH INTONATION

In Dutch one of the possible pitch configurations consists of an accent lending rise followed by an accent lending fall. In normal emotionally and attitudinally neutral utterances, an accent lending rise has to be followed by an accent lending fall: what goes up has to come down. So the very moment a speaker makes an accent lending rise, he must, in order to produce a correct intonation pattern, have sufficient lookahead to know that there will be an accented word within the same intonational phrase to be marked with an accent lending fall. The number of syllables between such rises and falls in spontaneous speech may therefore be indicative of lookahead in the speech programme. Some relevant data can be found in Collier (1972) who among other things counted the numbers of syllables between accent lending rises and falls in hat patterns in a corpus of 750 spontaneous Dutch utterances. Unfortunately for the present purpose, distances were calculated in syllables, not in words. Below distances are recalculated in words on the basis of the average word length of 1.8 syllables in Dutch spontaneous speech. Sixty-five percent of Collier's utterances contained a hat pattern. In 39 % of all hat patterns rise and fall fell compulsorily on the same syllable and thus on the same word because there were no following accented words in the utterance that could attract a fall. The data of the remaining cases, where speakers had an option to produce the hat pattern over more than one word, are given in Table 1.

In 22 % of these cases, corresponding to 8.5 % of the utterances in the entire corpus of 750 utterances, lookahead had to be at least more than one word. Assuming that Collier's corpus is representative of Dutch spontaneous speech in general, we may conclude that in at least one out of every twelve Dutch spontaneous utterances lookahead is more than one word. For eleven out of twelve utterances there is no such evidence, one way or the other.

Table 1. Distances in words between rises and falls in Dutch rise-fall patterns, limited to the cases where the speaker had an option to produce such a pattern. The word containing the rise is, and the word containing the fall is not counted (N = 297).

0 words lookahead:	c. 46 %
1 word lookahead:	c. 32 %
2 words lookahead:	c. 12 %
> 2 words lookahead:	c. 10 %

ANTICIPATORY ERRORS OF SPEECH

When someone says: "sil.. filter cigarette", we assume that the [s] of "cigarette" is anticipated inappropriately in the pronunciation of the word "filter", replacing the [f] of "filter". This can only be explained by assuming a lookahead of at least one word. By the same token a slip like "knife with the salami" instead of "salami with the knife" seems to suggest a lookahead of at least three words. It has been argued in these or similar terms that anticipatory errors show "that speakers must have access to a representation that spans more than the next word of the utterance" (Shattuck-Hufnagel, 1979).

In order to discuss errors of speech in terms of lookahead, we have to distinguish between 'origin' and 'target'. 'Origin' is the position where a particular entity belongs in the error free version of the utterance. 'Target' is the position where this entity ends up in the speech error. Many years ago I made some counts of distances between targets and origins in a collection of Dutch and German errors of speech (Cf. Nooteboom and Cohen, 1975).

For phonological errors distances were expressed in syllables. I have, for the present purposes, recalculated these distances on the basis of an average word length of 1.8 syllables in the same corpus of speech errors. In order to check whether these estimates are at all realistic, I also counted lookahead spans expressed in words in the selection of English errors published in Fromkin (1973). This gave the numbers in Table 2:

Table 2. Distances in words in phonological anticipatory errors of speech in Dutch and German, and in English. The word containing the origin is, and the word containing the target is not counted.

	Dutch/ German N = 1057	English N = 231
0 words lookahead:	15 %	4 %
1 word lookahead:	50 %	56 %
2 words lookahead:	23 %	27 %
> 2 words lookah.:	12 %	9 %

The data in Table 2 show that in some 35 % of anticipatory phonological speech errors lookahead is more than a single word. This is a considerable proportion, suggesting that lookahead of more than one word may not be all that exceptional.

Not only phonemes move around in speech errors. Morphemes and whole words also get misplaced. The numbers in Table 3 were obtained in counting words between targets and origins for anticipatory speech errors involving lexical items (morphemes and words) as entities changing position (N = 147).

Table 3. Distances in words between origin and target, in anticipatory lexical errors of speech in Dutch and German. The origin is, the target is not counted. N = 147.

0 words lookahead:	7 %
1 word lookahead:	34 %
3 words lookahead:	22 %

4 words lookahead: 10 %
> 4 words lookahead: 3 %

Fifty-nine percent of these errors involve a necessary lookahead of more than one word! That is much more than the 35 % we estimated for phonological speech errors. Obviously speakers look farther ahead when selecting and ordering lexical items than when spelling out the selected lexical items as strings of ordered phonemes. This seems to provide an answer to a question raised by Shattuck-Hufnagel (1979, p. 329): "Does the size of the span change during the planning process; e.g. is it longer when syntactic structure is being computed, shorter when phonological details are being worked out?" But whether the span changes or not depends on how we count the entities in the span.

One way of interpreting the difference between the two classes of speech errors is to assume that they reflect two different stages of mental programming. One stage, generating the surface structure, is concerned with selecting and ordering lexical items, and another deals with spelling out phonological forms and setting up phonetic plans for speaking these items in coherent stretches of speech. This interpretation is in line with Levelt (1989), who discusses speech errors involving exchanges of words and morphemes in his chapter on the generation of surface structure, and discusses phonological errors in his chapter on phonetic plans for words. Levelt also points out that misplaced lexical items attract the pitch accent, case marking and inflectional forms that go with their new position:
(a) "the knife with the SALAMI" instead of "the salami with the KNIFE"
(b) "Bis er es bei Dir abholt" instead of "Bis Du es bei ihm abholt"

(c) "Dat is nieuwer dan een dure" instead of "Dat is duurder dan een nieuwe"
In (a) "salami" gets the pitch accent that "knife" should have had in the intended utterance. In (b) the German pronouns for second and first person swap positions, and after they have been swapped receive the grammatically correct case markings going with their new positions. In (c) the Dutch content morphemes "nieuw" and "duur" exchange positions, and after that the comparative suffix changes correctly from "-der" to "-er", adapting itself to the incorrectly placed content morpheme. Apparently errors of this type take place during grammatical encoding rather than during phonological encoding. Function words and inflectional morphemes are not yet spelled out phonologically at the moment the speech error is generated. Presumably they are present as abstract syntactic and/or semantic functions or labels, that are about to be attached to appropriately or inappropriately selected content morphemes, and only thereafter receive their phonological form. For the present purpose this means that it is hard to know how to interpret the quantitative data given earlier in terms of lookahead.

Summarizing: Phonological speech errors may be used as a source of information about the amount of lookahead at the stage of phonological encoding, generating a phonetic plan. As in an estimated 35 % of such errors lookahead is at least two words, we may conclude that lookahead of more than a single word is not exceptional. Lexical speech errors on the other hand reflect planning at the stage of grammatical encoding. In terms of the utterance to be produced, speakers look farther ahead at this stage than at the stage of phonological encoding, three or four words lookahead not being exceptional. It is difficult, however, to decide on the nature and number of ordered entities

actually involved at this stage of programming.

DISCUSSION
We have no direct access to the size of the phonetic plan underlying speech production. Quite literally, we do not know what we do when we speak. Estimates of the extent of preprogramming during speech production can only come from indirect evidence, such as acoustic/phonetic aspects of speech depending on what is yet to come, and recorded slips of the tongue.

The brief review of some available empirical evidence given above suggests that, although one word lookahead may be sufficient for the production of fluent speech, a lookahead of more than a single word is far from exceptional in spontaneous speech production. Often lookahead is two words and occasionally lookahead may be three or four words. This is suggested both by material spans covering rise-fall patterns in Dutch intonation and by anticipatory speech errors. The strongest evidence to this effect stems from phonological speech errors. Lexical errors follow a pattern suggesting that function words and inflectional morphemes are inserted only after a speech error at this level has been made.

There is no way to know, of course, whether the above estimates are biased: It may be that the probability of speech errors increases with the amount of lookahead. If so, the frequencies of occurrence of particular material spans over which errors occur would not reflect frequencies of occurrence of amounts of lookahead in error-free speech production. On the other hand, the material spans counted contain what is minimally necessary to explain the errors concerned. There is no way of knowing whether actual lookahead is generally

more than this. Because of such uncertainties it is worthwhile to look at empirical evidence from different sources.

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