STUTTERING AS INDICATION OF SPEECH PLANNING

M. Koopmans, I. Slis and A. Rietveld

Dept. of Language and Speech, University of Nijmegen,
the Netherlands.

ABSTRACT

In this paper we will report the results of two experiments on the distribution of stuttering in spontaneous speech. Our observations support the idea that stuttering is related to syntactic planning in addition to the subordinate process of searching a specific word for a concept.

1. INTRODUCTION

Previous research has shown that in spontaneous speech of young stutterers, stuttering more often occurs during the beginning of clauses than in the remaining part [6]. Moreover, it has been found that stuttering is more likely to occur at those locations where the information load is high [4]. Soderberg [3] studied read out speech instead of spontaneous speech of adult stutterers. He considered the predominance of stuttering on the first words of clauses as grammatical uncertainty. In medial clause positions he observed stuttering predominantly on content words of high information. The explanation was that at the beginning of a clause the first foundations of a grammatical structure are laid. After that the main problem for the speaker is the choice of words. Therefore there is more lexical uncertainty at locations further in the clause. Our aim is to elaborate Soderberg's suggestions, especially by relating grammatical uncertainty to decision moments in the planning of speech.

Speech planning can be described as a hierarchical process [1] [2]: it is possible to divide speech into segments and nested subsegments that can be related to the different stages in the speech planning process. In the production of speech the clause is considered a grammatical unit. The determination of the grammatical structure of a clause takes place at a hierarchically higher level than the process of word insertion. In this perspective the articulatory realization is of a still lower level than the word insertion level.

Our expectations were (1) that the hierarchical speech planning model gives an explanation for stuttering during the beginning of clauses, (2) that the model is able to explain the differences between stuttering on function words and lexical words depending on their locations in a sentence. We have tested both expectations in a speech experiment with adults. We used spontaneous speech as this kind of speech just requires conceptual and grammatical planning. As will be shown the quantitative analysis of the first experiment supports the speech planning model. The stutter frequency on the first two words (W1 and W2) is higher than on words in the rest of the clause (WR).

Experiment I does not give us any compelling evidence for the model: it is still possible that stutterers and nonstutterers use different segmenting strategies, so that we can't be sure that the positions of W1, W2 and WR within the clause are the same for stutterers and nonstutterers: e.g. if stutterers do not insert a boundary before W1, the labels W1, W2 and WR would be erronous. Hence a second experiment is set up in which the task was to subdivide a written text into parts. It was assumed that the subdivisions reflect the internal structure of language [5]. We will now discuss the two experiments in more detail.

2. EXPERIMENT I

In this experiment we investigated stuttering on function and lexical words at various locations in a clause. In this study the minimal criterion for a group of words to be called a clause is that it contains one NP and one VP.

2.0 Procedure

2.1 Subjects

25 Stutterers, 7 females and 18 males, aged 17-45, participated in the experiment.

2.2 Speech material

To elicit spontaneous speech, all subjects were interviewed about the same theme i.e. their eating habits. From these interviews 1-minute-samples of spontaneous speech from each subject were selected. In these samples, the clauses were determined and the stuttered words were counted.

2.3 Method

We defined three wordpositions within each clause: the first word (W1), the second word (W2) and the remaining words (WR). Each word was labeled as function word or lexical word. This distinction was made because the role of function words is largely grammatical, whereas lexical words carry the main semantic content. Besides, we may assume that lexical words have a relative high information load compared to function words. As it is questionable whether auxiliary verbs and copulas are function words or lexical words, we classified them in two ways. In one counting we considered them as lexical words (A), in another counting as function words (B) (table 1a).

2.4 Analysis

Table 1a was submitted to hierarchical loglineair analysis in order to examine the distribution of stutters over the words in a clause. According to the two definitions of lexical and function words two analyses were carried out. In both cases we studied the interactions of word type and word position. The three variables are: word type (lexical [L] and function words [F]), word position (W1, W2 and WR), and frequency of stuttering (number of stuttered words versus nonstuttered words).

Table 1a. The absolute numbers of stuttered and nonstuttered words on word-position (W1, W2, WR) and wordtype (L,F).

Counting A.

	W1		W2		WR	
	L	F	L	F	L	F
+st	7	54	31	41	126	44
-st	85	324	167	225	1140	733

Counting B.

	W1		W2		WR	
	L	F	L	F	L	F
+st	7	54	26	46	119	51
-st	64	345	126	266	1027	846

Table 1b. The percentages of stuttered words as a function of word position (W1, W2, WR) for counting A and B.

W1	W2	WR
13.0	15.6	8.3

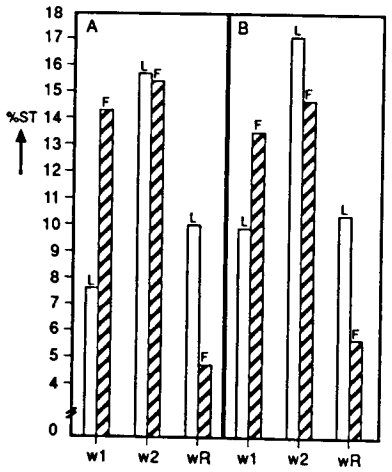

Figure 1. Percentages of stuttered words as a function of word position (W1, W2, WR) for lexical (L) and function words (F) separately. Counting A and B.

2.5 Results and discussion

The first finding is that in spontaneous speech, adults stutter significantly more often at the first and second words of clauses than at the remaining words. For both categorizations A and B defined above, this effect is present (table 1b). This result is in agreement with earlier investigations (see introduction). The second finding is that, using the data of categorization A, there is a significant interaction effect between word position and word type (A: $z=2.20$, $p=0.028$). Note that function words at the beginning of a clause give rise to more stuttering than in the middle or at the end of a clause. Besides there is relatively more stuttering on function words than on lexical words at the beginnings of clauses (table 1a, fig 1). The data of categorization B show the same trend as A but the effect is not significant.

Based on these findings we conclude that word position plays an important role in stuttering. As already mentioned, function words have merely a grammatical function. Therefore we might hypothesize that grammatical decisions are made in the beginning of a clause.

3. EXPERIMENT II

In this experiment we investigated segmenting strategies used by stutterers versus nonstutterers.

3.0 Procedure

3.1 Subjects

The subjects are 20 stutterers and 20 nonstutterers. Both groups were matched on education, age and sex.

3.2 Material

We use a printed text of 81 sentences which have been selected from the speech samples from experiment 1. Each word boundary in the text received a theoretical boundary strenght from 1 to 5. These strenghts were determined with the aid of boundary criteria of Umeda [5], but adapted to Dutch. The values were unknown to the subjects.

3.3 Task of the subjects

The instruction for the participants was to intuitively mark boundaries within the 81 sentences by putting vertical lines between words. The subjects were not given any rules about the number of boundaries per sentence.

Table 2a. Mean number of boundaries placed by stutterers(ST) and nonstutterers(NST).

	X(mean)
ST	0.30
NST	0.33

Table 2b. Mean number of boundaries placed by stutterers(ST) and nonstutterers(NST), for each theoretical boundary strength.

	1	2	3	4	5
ST	0.04	0.09	0.07	0.60	0.76
NST	0.06	0.13	0.09	0.60	0.80

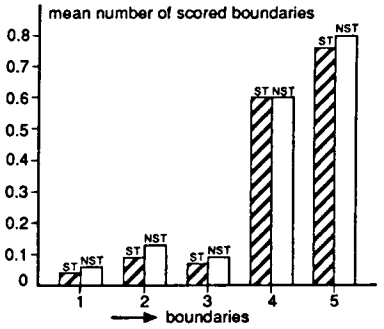

Figure 2. Mean number of boundaries placed by stutterers(ST) and nonstutterers(NST), for each theoretical boundary strength.

3.5 Results and discussion

An analysis of variance is applied on the mean number of boundaries scored by each subject on each theoretical boundary value. No significant difference is observed between stutterers and nonstutterers in the placement of boundaries ($F[1,36]=1,93$ $p=0.174$). We found no interaction effect between group and scoring of the five boundary strengths ($F[4,144]= 0.16$ $p=0.958$). In both groups there are more boundary placements with increasing boundary strength (table 2a-b, fig 2). These findings support that stutterers use the same linguistic criteria as nonstutterers for structuring language.

4. GENERAL CONCLUSION

The data of experiment I suggest a relation between the stuttering pattern and decision moments in the speech planning process. Moreover it looks more plausible to define auxiliary verbs and copulas as lexical words. The outcome of experiment II shows that the findings in experiment I are not due to different parsing strategies of stutterers and nonstutterers.

5. REFERENCES

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