PHONETIC AND LINGUISTIC ASPECTS OF PITCH MOVEMENTS IN FAST SPEECH IN DUTCH[1]

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ABSTRACT

Assuming that speakers tend to preserve the communicatively important aspects of speech, time pressure seems to be a promising experimental tool for isolating the important aspects of intonation. Linguistic hypotheses concerning the optionality of accent and boundary marking pitch movements were tested by having subjects read aloud stimuli in a normal and fast rate. Speakers did not economize on accent lending pitch movements, but 40% of the boundary marking pitch movements disappeared under time pressure, reflecting the linguistic hierarchy in obligatory and optional intonation phrases.

1. INTRODUCTION

We assume that speakers under time pressure will keep unimpaired those parts of the speech signal that are the most important. By comparing normal and fast (read aloud) speech we hope to isolate the more important aspects of intonation. In the present experiment we concentrate on the question if less important accent or boundary marking pitch movements disappear sooner under time pressure than important pitch movements.

2. LINGUISTIC BACKGROUND

2.1. Optionality of Pitch Accent Movements

The notion of integrative accent [1,2] offers an opportunity to distinguish between more or less important accent positions. For example, in the sentence:

(1) There is a tear in your trousers

presenting new information, the most important accent lies on tear (the 'exponent' [2], the constituent on which the integrative accent is placed). The complete utterance can be put into focus, i.e. made important, by just this one accent. However, speakers can choose to highlight other parts of the sentence separately, by placing additional pitch accents on embedded exponents (here on trousers). We formulated the hypothesis that speakers under time pressure can omit pitch accents that correspond to focus domains that can be incorporated into a higher-order focus domain (hypothesis 1).

It is known that a strong correspondence exists between the distribution of new and given information and accent placement: pitch accents generally highlight parts of the sentence containing new information. However, under certain circumstances it is acceptable to put given information into focus by a pitch accent [5]. Assuming that pitch accents highlighting new information are more important than pitch accents focussing given information, we expect speakers to economize on the latter (hypothesis 2).

2.2. Optionality of Boundary Marking Pitch Movements

Speakers use boundary marking pitch movements to highlight communicatively important breaks

in the speech stream. We adopted the phonological theory of prosodic domains [4] to get a grip on differences in importance of prosodic boundaries. The theory presents a range of hierarchical prosodic domains (from "Syllable" to "Phonological Utterance"), of which the "Intonational Phrase" (henceforth 'I'), the domain of intonation contours, is likely to be marked off with a phonetic boundary. The I is a relatively free domain; "root sentences" and "obligatory I's" (cf. [4], p 188ff.) obligatorily form I's, but the I can be restructured, i.e. split up in a number of smaller domains, as a consequence of - for instance - lowering of the speaking rate. This restructuring process is optional, but not completely free; it is limited to positions with a certain syntactic structure. Generally, the optional I-boundaries can occur after a noun phrase (but one cannot separate an obligatory argument from its head) or before an embedded sentence (but an NP may not be broken up). The higher the speaking rate, the smaller the opportunity to restructure an I. From this theory of I-domains we derived the hypothesis that boundary marking pitch movements can dissappear under time pressure when located at an optional I-boundary (hypothesis 3).

3. METHOD

To test hypothesis 1, eight stimuli were constructed of the form:

(2) (Weet je wat die gekke broer van mij heeft gedaan? Hij heeft) een ou[5] de Citroën[4] met voor[1]-wielaandrijving voor z'n vriendin[2] gekocht[3]. (Know you what that crazy brother of mine has done? He has an old Citroen with front-wheel drive for his girlfriend bought.)

The superscript numbers indicate the degree of 'embeddedness' ('DEMB') of the possible pitch accents[2]. A pitch accent on 1 (the exponent) can not be omitted, 2 to 5 are regarded as optional (hierarchically, 5 is considered the easiest to omit). The context sentence has the function of presenting part of the stimulus sentence (not parenthetical) as new information.

To test hypothesis 2, another four sentence pairs were made:

(3) (Salman Rushdie is na lange tijd weer in de openbaarheid verschenen.) De schrijver bood in een televisie-interview zijn excuses aan./ In een televisie-interview bood de schrijver zijn excuses aan. (Salman Rushdie has after a long time again a public appearance made. The writer offered in a television interview his apologies).

The underlined parts of the stimulus have the same referent as the subject of the context sentence (in parentheses). Because we did not know what the influence of the sentence initial place of the given information in the test sentence would be, the stimulus was repeated with the given information in sentence medial position[3].

To test hypothesis 3, six small texts were constructed, consisting of one to four rather long sentences. Configurations for obligatory[4] and optional I-boundaries ('IB') were systematically varied. As obligatory I's, appositions and nonrestrictive relative clauses were used (indicated with '[O' for the left boundary and ']O' for the right boundary), next to root sentences (']R'). The end of a noun phrase (']NP') and the beginning of an embedded sentence ('[S'') were regarded as optional I-boundary positions. Two additional syntactic configurations were systematically varied in the stimulus material. In a pilot experiment we found pauses at places which could not be described in terms of optional I-boundary positions, but only as: an S' within a long noun phrase ('([S'])') and the beginning of a prepositional phrase ('[PP'). Both configurations were regarded as optional I-boundary positions.

The stimuli were printed on

separate cards, using only full stops and capitals, refraining from other punctuation marks, in order to avoid guiding the subjects in placing boundary markers as much as possible (a rather complicated text without ãny punctuation marks is virtually impossible to read aloud). Six subjects read the stimuli aloud in a normal and fast speaking rate.

4. ANALYSIS AND RESULTS

Two phonetically trained listeners independently marked pitch accent positions and boundaries in the relevant parts of the material. A third judge gave decisive judgements in those cases were the other two markers did not agree (13%). The first author transcribed the pitch configuration at each boundary in terms of the Dutch intonation grammar [3].

TABLE 1. Frequency of plus and minus accent scores in normal (N) and fast (F) speaking rate for the five grades of predicted optionality (DEMB, cf. section 3).

DEMB	no accent N	no accent F	accent N	accent F
1	-	-	48	48
2	6	1	42	47
3	42	39	6	9
4	1	3	47	45
5	4	5	44	43

TABLE 2. Frequency of plus and minus accent scores in normal (N) and fast (F) speaking rate for words containing new information (INFO 1), sentence-initial (INFO 2) and sentence-medial given information (INFO 3).

INFO	no accent N	no accent F	accent N	accent F
1	27	39	165	153
2	-	-	24	24
3	4	3	20	21

A hierarchical loglinear analysis of the data in table 1 shows that the effect of speaking rate on accent placement is totally insignificant ($z=.034$, $p=.488$). The same type of statistic analysis was performed on the data in table 2. Again, the factor speaking rate proved insignificant ($z=-.024$, $p=.492$).

TABLE 3. Total number of potential boundaries (N), percentage of boundaries realised in a normal speaking rate and percentage thereof deleted under time pressure, broken down by seven types of I-boundary (IB, cf. section 3).

IB	realised	deleted	N
1]R	100 %	2 %	42
2 [O	80 %	13 %	30
3]O	96 %	9 %	24
4]NP	58 %	61 %	114
5 [S'	64 %	57 %	36
6 ([S')	67 %	38 %	12
7 [PP	34 %	77 %	90
8 Ø	3 %	77 %	846

The strongest reduction in boundary marking occurs at ordinary word boundaries (Ø) and at the beginning of prepositional phrases. The end of a root sentence is almost always marked, as are the edges of appositions and nonrestrictive relative clauses. In between lies the group of optional I's, extended with the category 'S' in NP'. ANOVA shows that the effect of I-boundary type is significant, $F(7,231=17.6)$, $p<.001$. Newman-Keuls post hoc analysis shows further that there are no internal differences among the obligatory boundaries (types 1,2,3), nor among the optional boundaries (types 4,5,7,8). However, type 6 ('S' in NP') does not differ from either of these two groups ($p<.05$).

In both normal and fast tempo-conditions approximately 95% of the perceived boundaries received a boundary marking pitch movement. Normal/fast boundary pairs were subjected to a further analysis, exploring the possibility that complex boundary marking pitch movements used in normal speech would be replaced by simpler movements in fast speech. Typical-

ly, the type of pitch movement remains the same in both speaking rates, with the following exceptions:
- If a boundary marking rise ('2', cf. [3] p 73) is followed by a declination reset, generally the reset vanishes in fast speech.
- When the boundary is marked by a late rise plus a non prominence lending fall ('2B'), approximately a third of these boundaries gets the simpler configuration of high declination plus fall ('ØB').

5. CONCLUSIONS

We reject hypothesis 1: when reading aloud fast, speakers do not economize on the number of pitch accents placed on embedded exponents. We also reject the second hypothesis: the accent distribution on given information is the same in both speaking conditions. Simply counting the number of pitch accents realised under time pressure is apparently not sensitive enough a method to bear out differences in communicative importance of pitch accents.

The third hypothesis can be accepted. When a speaker is under time pressure, the number of boundaries dropped is approximately 40%. Boundaries disappear mainly at optional I-boundaries, i.e. F0-markers on optional boundaries are more likely to disappear under time pressure than markers of obligatory boundaries. Of the PP-boundaries one third are marked, which indicates that prepositional phrases can play a role in restructuring I's. Two thirds of the positions with the structure '[S' in NP' are marked by a boundary in the normal speaking condition, forcing us to abandon the linguistic restriction that disallowes the formation of I-boundaries at the beginning of an embedded sentence, that interrupt a noun phrase.

Finally, boundary marking pitch configurations tend to be simplified when the boundary remains in fast speech. Changes in shape of accent and boundary marking pitch movements will be the objects of our future research; as a first approximation we shall examine differences in excursion size of pitch accents in relation to our linguistic hypotheses.

6. REFERENCES

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1. This research was partly supported by the Foundation for Linguistic Research, which is funded by the Netherlands Organisation for Research, NWO, under project # 300-173-005.
2. We abstract from the probability of a pitch accent on the indicated positions.
3. In sentence final position it is not possible to accent a constituent containing given information [5, p 1521].
4. We use this term for both root sentences and "obligatory I's".