What Makes Speakers Omit Pitch Accents? : An Experiment

Citation for published version (APA):

Document status and date:
Published: 01/01/1982

Document Version:
Publisher’s PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

• A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher’s website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the “Taverne” license above, please follow below link for the End User Agreement:
www.tue.nl/taverne

Take down policy
If you believe that this document breaches copyright please contact us at:
openaccess@tue.nl
providing details and we will investigate your claim.
What Makes Speakers Omit Pitch Accents?
An Experiment

S.G. NOOTEBOOM, J.M.B. TERKEN

Institute for Perception Research (IPO), Eindhoven, The Netherlands

Abstract. The present paper reports on an experiment which was set up to examine whether we can make a speaker either accent or de-accent particular words by systematically varying the objective probability that a particular referent will be mentioned (and therewith the referent's predictability for speaker and listener). In the experiment each of 24 speakers was asked to watch a visual display, showing a very simple configuration of letter symbols, and to describe orally each change in the current configuration to a listener. By manipulating the letter configurations shown on the display, the objective probability that the speaker would mention a particular letter could be controlled. Letters could either move around on the screen (moving letters) or remain fixed and serve as spatial reference points (fixed letters). Objective probabilities were 0.5 and 1 for both moving letters and fixed letters. The main findings were the following:

1. When a referent is fully predictable to speaker and listener there is a high proportion of ellipsis, particularly for the moving letter, which was always referred to from subject position.

2. The probability that a word referring to a letter will be accented appears not to be immediately controlled by the predictability of the referent. The controlling factor is rather the preceding linguistic context. More specifically, the probability of accenting, being close to 1 the first time a specific referent is mentioned, sharply decreases when the same referent is mentioned for the second time in a row, and decreases again when this same referent is mentioned three or more times in a row. However, as soon as the competing referent is mentioned once, in the same role (moving or fixed letter), the probability of accenting jumps up again.

3. The probability of accenting is systematically lower for the moving letters in subject position (average 0.32) than for the fixed letters in predicate position (average 0.52).

In view of these findings, de-accenting, defined as conspicuously omitting an accent on a word that, for grammatical reasons, otherwise would have been accented, is interpreted as a device which can be used by a cooperative speaker for helping the listener to find the intended referent as easily and quickly as possible. It is supposed that speakers not using this device systematically give their listeners a harder time.

Introduction

General Description of the Research Problem
In normal speech some words are conspicuously marked by the
speaker with, among other things, a pitch movement on the lexically stressed syllable, other words are not. This raises two questions related to potential communicative functions of such pitch movements or pitch accents:

(1) What motivates a speaker’s choice of the words to be marked with a pitch accent?

(2) How does the presence or absence of a pitch accent affect a listener’s perception and/or comprehension of an utterance?

The experiment to be reported in this paper is only concerned with the speaker, but obviously, in so far as pitch accents have a communicative function, the factors that determine the assignment of pitch accents are intimately related to how listeners can profit from the presence or absence of pitch accents. Below we will elaborate on some possible communicative factors involved, put forward a hypothesis for at least one possible role of pitch accents in speech communication, and present a specific question we have tried to answer experimentally. Before we do all this we will first explain where our interest in what speakers and listeners do with pitch accents comes from, and what, within our descriptive framework, pitch accents are.

In the recent past, Dutch intonation has been extensively studied [Cohen and ’t Hart, 1967; ’t Hart and Cohen, 1973; ’t Hart and Collier, 1975]. These investigations have focussed on the perceptually relevant aspects of pitch contours, seen as carriers of intonational patterning. This has resulted in a formal description of Dutch intonation in terms of a limited inventory of perceptually relevant pitch movements plus some rules for concatenating these pitch movements to form stylized pitch contours. This ‘grammar of Dutch intonation’ generates perceptual (melodic) equivalents of virtually all naturally occurring Dutch pitch contours. These rules could easily be implemented in a system for speech synthesis by rule, and then supply the synthetic speech with acceptably sounding pitch contours. However, in order to choose a suitable pitch contour for a particular sentence, the rule system must be told where in the sentence prosodic boundaries have to be made, and which words are to be marked with a pitch accent. Once these decisions have been made, the rules provide us for each such sentence with a possible stylized pitch contour. Figure 1 presents, by way of example, two possible pitch contours for a particular sentence, differing in the number of assigned accents.
Accenting a word is making that word perceptually prominent by means of a pitch accent on its lexically stressed syllable. A pitch accent is one of a class of well-defined pitch movements. The most frequent of these are a single rise, early in the syllable, a single fall, late in the syllable, or a combination of these giving a rise-fall pattern within one syllable. These types of pitch movements are exemplified in figure 1.

What we are concerned with in this paper is the reasons a speaker has for either making or not making a pitch accent on particular words. We will assume that the various types of pitch accent are equivalent, and thus only consider the presence or absence of pitch accents. What we are striving for is to increase our insight into what speakers and listeners do with pitch accents in speech communication. In the long run this may help us in setting up adequate rules determining the locations of pitch accents in speech synthesis. The experiment reported here was done in the context of a research project on the communicative functions of pitch accents. Some earlier results, obtained in the exploratory stage of our efforts, were published elsewhere [Nootenboom et al., 1981]. This project is part of a more comprehensive research project on the production and comprehension of descriptive language by adults and children.

**Grammatical and Extragrammatical Factors**

According to a number of linguists, the locations of pitch accents in utterances are determined by the grammatical structure of these utterances. Syntax-based rules for deriving the locations of accents are proposed within the framework of transformational grammar by Chomsky and Halle [1968], Bresnan [1971], Liberman [1978], Selkirk [1981] and others. Within this approach, the possible relations between syntactic structure and the distribution of accents are supposed to be mediated by abstract metrical patterns, of which not all details necessarily have observable consequences. For our purposes, this analysis is not fully adequate, because the notion of 'accent' remains ill-defined. Furthermore the analysis is restricted to isolated sentences, and therefore necessarily overlooks what seem to be important determinants of pitch accent assignment, i.e. the relationships of different parts of the utterance to its preceding linguistic and non-linguistic context.

The importance of such contextual relationships is emphasized by many other linguists such as those within the Prague school tradition.
[Firbas, 1964; Sgall et al., 1973], by Halliday [1967], by Bolinger [1972], and by Chafe [1973, 1974]. According to the Prague linguists, intonational prominence is related to the communicative value of parts of speech: The thematic part (corresponding to the psychological subject or topic) contributes less to the progress of the communication and is intonationally less prominent than the rhematic part (corresponding to the psychological predicate or comment). The topic corresponds to what the utterance is about, and there is a strong tendency to make topical the information on which the attention of the speaker is already focused and to express topical information relatively early in the utterance. It is supposed that the comment is marked with intonational prominence.

Halliday [1967] separates the thematic relationships within an utterance, which are thought to be responsible for the ordering of information, from the determinants of ‘intonational focus’: new information is thought to attract intonational focus, given information does not. Information is supposed to be given when it is recoverable from the preceding context or situation.

For Chafe [1973, 1974], who also uses the labels new and given (or old) information, given indicates that the information is supposed by the speaker to be present in the consciousness of the addressee. Clark and Haviland [1977] refer to given information as information the speaker believes the listener already knows and accepts as true. This would relate a potential communicative function of accenting and de-accenting to truth claims about the content of sentences. Obviously, different authors have different ideas about what their common labels new and given stand for, and these ideas seem still rather vague. A more precise hypothesis is called for. We will return to this below. Here we observe that the notions new and given in all approaches are supposed to refer to something which is outside grammar. They refer to properties of the extralinguistic information which is transmitted by linguistic means. In as far as this view is correct, the locations of accents in utterances may, at least partly, be controlled by extragrammatical factors. Of course, grammatical and extragrammatical factors do not necessarily exclude each other. Possible interactions between both types of factors are, in different terms, discussed by Halliday [1967], Chomsky [1971], and more recently by Ladd [1980]. What comes forward from these discussions is that extragrammatical factors may operate against the background of grammatically determined accent patterns.
This ties in with some results of our own, obtained in a first exploratory investigation [Nootenboom et al., 1981]. There we examined accent patterns in oral descriptions of configurations of letter symbols. De-accenting of words and expressions which, in the absence of contextual and situational constraints, would have been accented, could occur when the referent of a particular word or expression had been mentioned earlier in the same utterance or in the immediately preceding utterance. One possible way to account for the structure of these data is to assume that de-accenting due to extragrammatical factors modifies accent patterns that are determined by grammatical factors.

**A Hypothesis and a Question**

Many words (or more complex verbal expressions) in speech utterances refer to things, concepts, or persons outside the domain of language. A listener, in order to interpret an utterance, has to select for each such word or verbal expression the appropriate referent. Not all referents are equally accessible or available to the listener. One particular referent may be much more available than other possible referents due to the situation and/or preceding linguistic context, knowledge of which is shared by speaker and listener. We now hypothesize that a speaker, by conspicuously not accenting a word (or expression) that otherwise (for grammatical reasons) would have been accented, signals to the listener that the intended referent is the single most accessible one. So in the following pair of utterances (where words printed in capitals are accented)

**Michael is writing a Novel.**
**The Title of this book is Unknown.**

the conspicuous de-accenting of ‘book’ would signal that of all potential referents that might be mentioned at this point in the discourse, the most accessible or available one should be selected. This would aid the listener in identifying the referent of ‘the book’ with the just mentioned referent of ‘a novel’.

It should be noticed that this hypothesis in some important respects differs from earlier formulations. First of all the hypothesis is limited to de-accenting, that is to say conspicuously omitting a pitch accent where for other reasons one would have expected a pitch accent. No claims are made about accenting or not accenting words that are generally left unaccented by grammatical factors, most function words for example. Secondly, the notion of *given or old*, as the supposed deter-
ominant of de-accenting, is given a rather specific interpretation: De-accenting will (or can?) occur when the speaker has reason to believe that, for the particular word or word group he is uttering, there is one possible referent which is, for the listener, at that point in the utterance, much more accessible than other possible referents, and the intended referent is indeed this most accessible one. Thus, de-accenting is seen as cooperative behaviour on the speaker's part, serving to minimize the listener's mental effort in finding the intended referent.

This hypothesis, as it stands, is not immediately testable. This is so, because no claims are made about what it is that makes a speaker consider a particular referent much more accessible for the listener than other referents. We will sustain the proposal as a working hypothesis serving as a background for asking more specific questions concerning the factors that may single out the intended referent as the most accessible one for the listener, and thus may lead to de-accenting in speech production. There are probably many different ways in which a referent can be made easily accessible for the listener. We do not intend in this paper to explore the full range of communicative factors that might do so. We will examine only one such factor to begin with, for which we have chosen the objective probability that a particular referent will have to be mentioned by the speaker, due to the structure of the communicative situation, which is known to both speaker and listener. The question we are asking, then, is whether we can make a speaker either accent or de-accent particular words or word groups, by systematically varying the objective probability that a particular referent will be mentioned. This probability can be varied by manipulating the information to be transmitted from speaker to listener. We may expect that if the probability of mentioning a particular referent is close to 1, and both speaker and listener know this, the corresponding word or word group will most probably be de-accented. If on the other hand, two or more possible referents have equal probabilities of being mentioned, the word or word group mentioning one of those will not be de-accented.

**Method**

*Experimental Set-Up*

The basic idea of the experiment was this: A speaker is asked to watch a visual display, showing a very simple configuration of letter symbols, and to describe orally each change in the current configuration to a listener, who watches a similar display for verification of the
Omitting Pitch

Accents

323

speaker's descriptions. By manipulating the letter configurations shown on the visual display, the objective probability that the speaker will mention a particular letter can be controlled.

The experimental set-up consisted of two visual display units (Hewlett Packard 1310 A), one for the speaker to watch, and one for the listener. Both display units were controlled from a Hewlett Packard Graphics Translator (1350), a device whose main function it is to translate digitally coded x and y coordinates for describing graphic information (pictures or text) into analogue signals that can be fed to the display units. The Graphics Translator also has its own character generator, giving out modified ASCII characters in four different sizes. In the present experiment only these characters were used, never more than four at the same time. The characters to be used in a particular session of the experiment were stored in separate memory files of the Graphics Translator, and during the experimental session the coordinates controlling the location of each character on the screen were under computer control. Thus the entire order of events, consisting of a sequence of letter configurations, was controlled by a simple computer programme, running on a P857 minicomputer. On each of the two display units the letter configurations were displayed within a fixed line frame of $16 \times 21$ cm, helping to focus the subject's attention on the centre part of the $30 \times 40$ cm screen. The letter configurations on the two screens could be either the same or different. If they were different, the listener could, by pushing a 'no' button, make the speaker's configuration appear on his screen. The listener also had another button, which, when pressed, signalled the computer to make the next configuration appear on both screens. Via an intercom system, speaker and listener could hear but not see each other. Each speaker was seated in a sound-insulated booth and watched the screen through the double glass window of this booth. The distance between the subject's eyes and the screen was approximately 60 cm, the characters had a height of 9 mm. The speaker's voice was recorded on tape for later analysis, via a Philips electret microphone (N8301) and a Revox tape recorder (A77).

Design and Material

In order to elicit more or less 'complete' utterances, having a subject plus predicate structure, the changes in the position of a particular letter on the screen were always relative to another letter, so that we could expect utterances of the form: 'The t comes top right of the k.' So each change involved one moving letter and at least one fixed letter, and thus there were always at least two letters in each configuration. We manipulated the probability of reference to moving and fixed letters in the following way. The two classes of letters were made perceptually distinct by only underlining the fixed letters. We made four different sequences of 20 configuration changes, each sequence to be used in a separate experimental session. One sequence had one fixed and one moving letter, another had two fixed and one moving letters, a third had one fixed and two moving letters, a fourth had two fixed and two moving letters.

Initial configurations for the four sequences are shown in figure 1. Each moving letter could obtain any of eight different positions respective to each fixed letter, i.e. left, top left, top middle, right, top right, bottom right, bottom middle, bottom left. In both sequences (1 and 3 in fig. 2) with one fixed letter the probability of being mentioned in any description of a configuration change was 1 for that letter (if we include anaphoric reference and ellipsis), and in both sequences (2 and 4 in fig. 2) with two fixed letters the probability of being mentioned was 0.5 for both letters. Similarly, the probability of being mentioned was 1 for the moving letter in sequences 1 and 2, and 0.5 for both moving letters in sequences 3 and 4. No information was given to speaker or listener concerning these probabilities, except what could be deduced from the initial configurations plus their knowledge that no other letters would be involved than the ones on the screen.
Fig. 1. Some examples of stylized pitch contours as generated by the grammar for Dutch intonation. The pitch contours as drawn here continue through voiceless portions, as it were 'virtually'. Accented words are capitalized in the text.

Fig. 2. Initial letter configurations of the four sequences of such configurations used in the experiment. Fixed letters are underlined. Moving letters, not underlined, could occupy each of eight positions evenly spaced around each of the fixed letters. In each configuration change one moving letter changed position.
Subjects

24 subjects acted as speakers in this experiment, most of them students who were paid for their participation. A few were employees of the institute. None of the speakers had prior knowledge of the purpose of the experiment, and all of them were native speakers of Dutch. The part of the listener was played by one of the experimenters or someone else aware of the purpose of the experiment.

Procedure

Each speaker was tested individually. The instruction was read to speaker and listener together, to let the speaker know what the listener knew about the communicative situation. They were told that there were four sequences of letter configurations, preceded by a brief sequence for adapting to the situation, and that, during each sequence of 21 configurations, no letters would be added or deleted. They were also informed about the distinction between moving and fixed letters. No further information was given about the a priori probability of a letter to be involved in an event. The speaker was asked to describe each configuration change in one short utterance. Some examples of possible descriptive utterances were given. The listener was asked to verify whether the description given by the speaker matched the configuration change on his own screen. Both speaker and listener were told that some configurations on the listener screen would actually differ from the corresponding one being described by the speaker. If that happened, the listener should press a 'no' button, and in addition say 'wrong'. The listener was asked to limit his interaction with the speaker to these 'wrong' responses. The speaker was told not to interpret these 'wrong' responses as signs of having given a wrong description. He should in no way repeat or try to improve on his descriptions.

The pacing of events was under control of the listener, who was in most cases one of the experimenters, and who was not a subject in the experiment. He made a decision about the truth of the description, and – in case of a non-matching description – pressed the 'no' button, and gave his 'wrong' response to the speaker. He then pressed another button, giving a signal to the computer to display the next configuration. When a sequence was completed, both screens were cleared, and the initial configuration of the next sequence was shown. All speakers were presented with four different sequences in the same order 1–4 (cf. fig. 2).

Transcription of Pitch Accents

All utterances produced by the speakers in our experiment were, after having been recorded on tape, re-recorded per speaker, in scrambled order. There should have been 80 utterances for each of 24 speakers, equalling 1,920 utterances. Due to technical errors 6 utterances were not produced or not recorded, so our tape contained 1,914 utterances. Of these, a type-written version was made of all utterances in the same scrambled order. The scrambling was done to prevent our trained listeners, transcribing the utterances, from using information about the context condition in which each utterance had been produced.

The 'trained listeners' were the present authors and one colleague, all three having been trained to some extent in finding the best fitting rule-generated pitch contour, as derived from the grammar of Dutch intonation, for each natural pitch contour. This was indeed the basic strategy used in transcribing the utterances for pitch accents. The locations of pitch accents in each utterance were thus determined by the locations of pitch accents in the best fitting grammatical pitch contour. In this way we kept as close as possible, in determining accent locations, to the requirements of the rule system for Dutch intonation. In principle this strategy also allowed us to check the correctness of each transcription by resynthesizing the utterance, and comparing the original pitch contour with the rule-generated one. This procedure was too time-consuming, however, to be regularly applied. The 3 listeners worked together, strove for agreement, but were allowed to differ in their judgements.
In following this procedure, we encountered two problems. One was that, in a number of cases, the listeners did not agree on the presence or absence of a pitch accent, the other was that in a number of cases the need was felt to distinguish degrees of certainty of the presence or absence of accent, whereas the grammar of Dutch intonation only allows for the presence or absence of pitch accents. We solved these two problems together in a practical manner, by allowing each listener to assign to each word three degrees of accent, i.e. 0 for no accent, \(\frac{1}{2}\) for 'uncertain', 1 for plus accent. These values were summed per word. 80% of the scores obtained for words referring to letters (the only ones we are interested in in this experiment) were 0 or 3, showing full agreement. Each score was divided by 3 (for the 3 listeners), and the resulting value was called the 'plus accent score' for that word.

The utterances obtained were generally of the form: De k komt links van de p (the k comes left of the p).

Perhaps it should be observed here that, whereas both the moving letter and the fixed letter could be either predictable or unpredictable in this experiment, the position of the moving letter was always unpredictable. This was reflected in the data, as expected, by the fact that expressions for positions practically always had at least one pitch accent. This will not be further discussed.

**Results**

**Preliminary Classification**

Of the 1,914 utterances transcribed for pitch accents, 129 did not describe the change in letter configuration, as was asked, but rather described the resulting configuration in a self-contained expression, often containing an internal contrast, of the type

The K is LEFT and the T is RIGHT of the p
(capitals indicating pitch accents).

These 129 utterances were excluded from further analysis. So 1,785 utterances remained, referring 1,785 times to a moving letter and 1,785 times to a fixed letter. Due to speech errors made by our subjects, in 61 cases the references to moving letters had to be excluded, and in 28 cases the references to fixed letters, leaving us with 1,724 cases of reference to a moving letter, and 1,757 cases of reference to a fixed letter. Letters were referred to by letter names in 2,591 cases, by anaphora (unaccented but for one exception) in 95 cases, and, implicitly, by ellipsis in 795 cases. Practically all these cases of ellipsis occurred, as we will show later, in the condition where the probability of that letter being mentioned was 1. In 100% of the utterances the moving letter was referred to from sentence subject position, and the fixed letter from sentence predicate position.

For each time a letter was referred to, cases of ellipsis excluded, we had, as described in the previous section, a value ranging between 0 and 1 indicating the 'plus accent score', based on three judgements. These values served as the raw data for all further calculations.
The Effect of Objective Probability on De-Accenting

The main question we are trying to answer in this experiment is whether we can make a speaker either accent or de-accent particular words by systematically varying the objective probability that a particular referent will be mentioned. In this experiment the objective probability that a letter would be mentioned was either 1 or 0.5. If it was 0.5, two letters were equally probable. We can now examine the effect of this objective probability to the proportions plus accent obtained in this experiment. These proportions were found by adding the 'plus accent scores' assigned to each word in the transcription, ranging from 0 (judged unaccented by all 3 judges) to 1 (judged accented by all 3 judges). The total 'plus accent' score was then divided by the total number of cases a letter was referred to, including cases of ellipsis. The outcome of this division was called the proportion plus accent. This calculation was done separately for the two objective probabilities, and for moving and fixed letters. Because moving letters were always mentioned in subject position, and fixed letters always
as part of the predicate, we will from now on refer to the moving letter condition as *subject*, and to the fixed letter condition as *predicate*. The resulting proportions *plus accent* are given in figure 3.

From our hypothesis that de-accenting is used to signal to the listener that the intended referent is the most accessible one, we expect (assuming that objective probability known to speaker and listener can determine the relative accessibility of referents) that the proportion of *plus accent* will be practically 1 when the objective probability is 0.5 (i.e. there are two equally likely potential referents) and practically 0 when the objective probability is 1. We see in figure 3 that there is indeed a big, and highly significant, difference between the objective probabilities in the proportions *plus accent* and *minus accent*, for both *subject* and *predicate*. There is also a consistent difference between *subject* and *predicate* in the proportions *plus accent*, showing no interaction with the two objective probabilities. Apparently, the *subject* attracts fewer accents than the *predicate*, in otherwise identical conditions.

These data still pose something of a problem. Our hypothesis was that the single most accessible referent can be referred to by the speaker with an unaccented expression, the conspicuous lack of a pitch accent signalling to the listener that the intended referent is indeed the single most accessible one. Although this hypothesis seems supported by the data, it remains unexplained why there are so many unaccented expressions in the condition with two equally probable referents. It could be the case, of course, that all these unaccented expressions are mistakes by the speaker, who fails to tune in on the needs of the listener. But it could also be that we have mistakenly assumed that the objective probability, as manipulated in this experiment, was the major factor determining the accessibility of a referent for the listener. There may be another factor, and a possible candidate is the preceding linguistic context.

*The Effect of Preceding Linguistic Context on De-Accenting*

In order to examine the effect of the preceding linguistic context on de-accenting, we have plotted in figure 4 the proportions *plus accent*, together with the proportions *ellipsis*, for each individual utterance number in two of our four sequences of configuration changes, as described by 24 speakers. These were the two sequences in which either the letter referred to in the *subject* or the letter referred to in the *predicate* was fully predictable, whereas the other letter was not. The data
Omitting Pitch Accents

Fig. 4. Proportions plus accent and proportions ellipsis for each of 20 successive configuration changes, described by 24 speakers. The data are given separately for unpredictable letters in subject position (top left), predictable letters in predicate position (top right), predictable letters in predicate position (bottom right). The letter changing position in each configuration change is indicated at the top of each graph.

are kept separate for subject and predicate. The letter referred to is indicated above each individual set of two data points.

In the upper two graphs in figure 4, where the letter referred to was not fully predictable, but had a probability of 0.5, we see a strong effect of the preceding linguistic context. Each time a letter is mentioned that was also mentioned in the previous utterance, the propor-
tion plus accent is reduced. When the same letter is mentioned three times in a row, we see that the proportion plus accent is still lower for the third time than it was for the second time: the effect of preceding linguistic context appears to become stronger as the number of times a particular referent is mentioned in successive utterances increases. We also see that ellipsis does occur a few times in subject position, but never in predicate position.

Let us now turn to the lower two graphs, where the letter referred to was fully predictable, so that explicit mention of it was redundant. We observe that indeed ellipsis is far more frequent in this condition than in the other condition, but we also see that ellipsis is far more popular in subject than in predicate position. With respect to the proportions plus accent, we see that, at least in subject position, these proportions are already for the very first two utterances considerably lower in this condition. These first two utterances in the two conditions are comparable with respect to preceding linguistic context, the only difference being the predictability of the referent. Thus, the difference in proportions plus accent might suggest an effect of the predictability of the referent, which cannot be assigned to the preceding linguistic context. It should be observed, though, that this difference can be accounted for by the proportions ellipsis. In fact, the data in figure 4 betray a strong effect of the predictability of the referent on the probability of ellipsis, but do not provide evidence that the proportions of plus accent are affected immediately by the predictability of the referent, apart from the obviously strong effect of the preceding linguistic context, more particularly of the number of successive utterances in which the current referent has been mentioned.

In the top graphs of figure 4 we also see a secondary effect, which is stronger in subject position than in predicate position: The proportions plus accent for those referents that have not been mentioned in the immediately preceding utterance gradually decrease from the beginning towards the end of the sequence of utterances.

In the bottom left graph we see, in the curve for ellipsis, some conspicuous plateaus. These are caused by the fact that once a speaker begins using ellipsis, he tends to continue doing so for all remaining utterances, with only very few lapses. Thus the transition from one plateau to the next simply means that at that point one or two speakers are added to the cohort of speakers that have fallen into the habit of using ellipsis. This reflects the much more general phenomenon that
speakers tended to use fixed strategies, which differed from speaker to speaker, throughout their 20 successive utterances, or part of them. This also implies that the lower limit on the proportions plus accent in the top graphs of figure 4 by and large reflects the proportion of speakers who very rarely, if ever, used de-accenting.

Discussion

Optionality of De-Acenting

In the introductory section we have introduced the notion of accessibility of a referent for a listener as a possible major factor, moving a speaker to conspicuously omit a pitch accent on a word or word group which otherwise would have been accented. We must emphasize here that this notion is a hypothetical construct for which no direct evidence can be given. It seems to us, however, that this notion provides us with a plausible way of discussing a potential communicative function of de-accenting. The data obtained in the present experiment support the general idea that a speaker may use de-accenting as a device to signal to the listener that the intended referent is highly accessible. Of course, our hypothesis was more precise than that. It suggested that, in de-accenting, a speaker signals to the listener that the intended referent is the single most accessible one. Our data are not in conflict with this hypothesis, but we see that, when we have every reason to believe that a particular referent is indeed the single most accessible one, the speaker still may accent the linguistic expression referring to this referent. This suggests that a speaker has the option of using de-accenting for the purpose mentioned, but is not forced to do so: Some speakers may be more cooperative than others. We also see that, in cases where it is not immediately clear that the intended referent is the most accessible one, the speaker can still omit a pitch accent, particularly in subject position. We will return to this below.

Accenting or De-Acenting?

So far we have stressed the effect of the accessibility of a referent on de-accenting, rather than the effect of, for example, non-accessibility on accenting. This hinges on our belief that actual accent patterns fulfil their communicative function against the background of the accent patterns as they would have been if only grammatical factors operated.
If someone speaks aloud a sentence like:

\[ \text{de P komt Boven de K} \]

(the P comes \textit{above} the K)
in the absence of contextual or situational constraints, the words P, \textit{Boven}, and K, will be accented, under our definition of accenting. So, what we are interested in in the present experiment is not so much why people make accents on these words. We work from the assumption that these words are accented because grammar says they should be. What we are interested in is when and why people omit such accents. Of course, speakers can also deviate from grammatical accent patterns by accenting words that for grammatical reasons would remain unaccented, such as most function words. This does not occur in the simple descriptive utterances we have elicited in our experiment. Perhaps we should make explicit here that we do not claim to know the grammatical rules for accenting in Dutch. We only claim that, if these rules were formulated sometime in the future, they would show that in our descriptive utterances at least all letter names would be accented if only grammatical accent rules operate.

\textit{Factors Contributing to Accessibility}

Retaining, then, the general idea that the accessibility of the intended referent for the listener (as estimated by the speaker) is a major factor in de-accenting, it is appropriate to ask which factor or factors contribute to this estimated accessibility. We had set out to examine the effect of the objective probability for a referent to be mentioned, this probability being known in advance to both speaker and listener. We had expected that this probability would have in and of itself a strong effect on the estimated accessibility, this effect showing up in a decrease in the proportions \textit{plus accent}. What we found instead is that this objective probability, or predictability of the referent for speaker and listener, has a marked effect on the proportions \textit{ellipsis}. When there is only one possible referent in a certain sentence position, mentioning it can be safely omitted, and a considerable number of our speakers do just this. However, those speakers that do not omit explicit reference, only de-accent the referring expression after the referent has been referred to in one or more successive preceding utterances: It is not so much the communicative situation, known to speaker and listener, that makes a speaker believe that conspicuously omitting a pitch accent might help the listener in quickly finding the intended
referred. As far as de-accenting goes, speakers rather place their trust in what has just been said. This ties in with some results obtained by Pechmann [1981], who demonstrated in an experiment on the accenting and de-accenting of words by small children and adults that, if linguistic and extralinguistic context provide conflicting cues, the linguistic context always wins. If there is no linguistic context, as in the first utterances in our experiment, one might expect extralinguistic factors determining de-accenting to take over. We find little evidence for this in the present data, but there are plenty and convincing examples from everyday life showing that de-accenting is not exclusively controlled by linguistic context.

The structure of our data also shows that the tendency for our speakers to de-accent the verbal expression referring to a particular referent increases when this referent is mentioned more often in successive utterances: When a referent is mentioned for the second time in a row proportion plus accent decreases sharply, but when it is mentioned for the third time in a row it decreases still further, and so on, until some asymptote is reached. As soon as another referent than the intended one has been mentioned in the same role (moving letter in subject position or fixed letter in predicate position), the proportion plus accent jumps up again, showing a sharp decrease in the tendency to de-accent. When we assume that the tendency for a speaker to de-accent derives from his estimate that the intended referent is very accessible for the listener, we may conclude that on the average the estimated accessibility of the intended referent increases each time the same referent is mentioned, as long as no competing referent is mentioned in the same role. When the competing referent is mentioned, the estimated accessibility decreases sharply.

However, particularly for the subject, some of the previous accessibility seems to be preserved: The proportions plus accent for each of the two referents immediately after the other referent has intervened, gradually decrease over the sequence of 20 utterances (cf. fig. 3, top left). In the present experiment we have isolated one factor that contributes to the estimated accessibility of the intended referent. Most likely, in other communicative situations there are other factors affecting the strength of this estimated accessibility. A possible candidate would be the explicit introduction by the speaker of some referent as the main theme or topic of discussion, of which the listener may reasonably expect that it will be sustained over a number of utter-
ances yet to come, ans thus would not necessarily lose much of its force when the referent has not been mentioned in one or two utterances (unless, of course, a new theme or topic is introduced). This idea is being pursued in a separate experiment.

*Moving versus Fixed Letters and Subjects versus Predicates*

If we include cases of *ellipsis*, *moving* letters were always referred to in our experiment from *subject* position, *fixed* letters always from *predicate* position. The *subject* was practically always in utterance-initial position. We have also seen that the proportions *plus accent* are systematically lower for *subject* than for *predicate*. Being the *actors* in each configuration change turns the *moving* letters into the most suitable candidates for the *subject* position, and at the same time appears to increase the estimated accessibility relative to the *fixed* letters, thus reducing the proportions *plus accent* for the *subject*. This effect seems to be independent of the much bigger effect of recent mention of the same referent. Of course, many linguists would call the *moving* letter the sentence *topic* and the *fixed* letter part of the *comment*. One should observe, though, that our speakers do not behave according to a simple rule stating that the *topic* remains unaccented and the *comment* receives the sentence accent. When we define the last accent in an utterance as the sentence accent, the *comment* does receive the sentence accent more often than the *topic* does, but this still is only a comparatively small effect.

*Concluding Remarks*

Conspicuously omitting an accent on a word that, for grammatical reasons, otherwise would have been accented, is most likely to occur when the intended referent of that word has just been mentioned, in the same role (in our experiment: *moving* letter or *fixed* letter). In view of this, de-accenting of words can best be interpreted as a device which can be used by a cooperative speaker for helping the listener to find the intended referent as easily and as quickly as possible. Not all speakers make much use of this device, at least in the present experiment.

In fact, some of our speakers hardly ever omitted a pitch accent on a letter name. If we call these speakers the non-cooperative ones, we must conclude that cooperative speakers make fewer accents than non-cooperative speakers. Within the present view, correct de-accenting of words depends on an internal model the speaker builds up of the needs of the listener, in terms of the relative accessibility of possible
referents for each particular referring expression in his utterances. This tuning in on the needs of the listener probably requires some extra mental effort which not all speakers take the pains to go through. An alternative view would be that de-accenting not so much serves the needs of the listener (except where it is clearly needed for disambiguation) but rather follows from a tendency in the speaker to economize in speech production. Under this view speakers would de-accent because they can afford to, not because it aids the listener. [This alternative view was suggested to us by C.J. DARWIN, personal commun.] At this point it is therefore appropriate to ask how important correct de-accenting is for the listener.

How does a listener profit from correct de-accenting, and what damage is done by not de-accenting, or by incorrect de-accenting? At present, we are not in a better position to answer these questions than those who read this. Of course, it seems obvious from the fact that some of our speakers did not bother to use de-accenting systematically at all, that successful communication can go on without it. But it seems reasonable to expect that without proper de-accenting more mental effort will be required from the listener. This may become more and more important as the complexity of the referential information to be transmitted to the listener increases. To pursue this line, experiments have to be done examining the effects of correct de-accenting, not de-accenting, and incorrect de-accenting on the ease and rapidity with which a listener can determine the intended referents. When no such effects can be found it will be time to consider alternative views of accenting and de-accenting.

Acknowledgement

The present research is part of a more comprehensive research project on The Comprehension and Production of Descriptive Language, based on cooperation between the following institutions: Interfacultaire Werkgroep Taal en Spraakgedrag, Nijmegen; Max Planck Institut für Psycholinguistik, Nijmegen; Instituut voor Perceptie Onderzoek (IPO), Eindhoven. The project was funded by the Netherlands Organisation for the Advancement of Pure Research under project No. 07-35. To the experiments described here the technical assistance of G. DOODEMAN and the research assistance of E. TRUIN were of great value. Of the many people who criticized an earlier draft of this paper we particularly wish to thank H. BOUMA, C. J. DARWIN, W. J. M. LEVELT, W. D. MARILEN-WILSON and T. PECHMANN.
References


Received: July 19, 1982

Dr. SEB NOOTEBOOM, Institute for Perception Research, PO Box 513, den Dolech 2, NL-5600 MB Eindhoven (The Netherlands)