

SYMPOSIUM NO. 7: THE RELATION BETWEEN SENTENCE PROSODY AND WORD PROSODY

(see vol. II, p. 375-430)

Moderator: Eva Gårding

Panelists: Arthur S. Abramson, Gösta Bruce, Johan 't Hart,  
Eunice V. Pike, Nina Thorsen, and Kay Williamson

Chairperson: George D. Allen

EVA GÅRDING'S INTRODUCTION

The purpose of the symposium is to discuss the relation between sentence prosody and word prosody in different prosodic systems, with the aim of tracking down universal features and tendencies in this relation. A more general goal is to contribute to a common framework for the description of prosodic phenomena. Since one of the symposia deals with length, such features have not been included here. To secure a broad treatment of the topic, a number of specialists of various prosodic systems were invited to be members of the panel. They represent Thai (Abramson), Amerindian languages (Pike), Nigerian languages (Williamson), Swedish (Bruce), Danish (Thorsen), Dutch ('t Hart), and Czech (Jánota).<sup>1</sup>

In volume II p.375 I proposed a terminology and suggested some points for discussion. I shall first elaborate on these points (1.1 - 1.4). Next follow summaries of the panelists' comments to their written contributions (2) and then an account of the discussion, ordered by subject (3.0 - 3.3). With this order some of the contributions have had to be split up under different headings. Finally I try to give a short evaluation of the symposium (4).

1.1 Basic units<sup>2</sup>

The first basic concept which is fundamental to our discussion is sentence intonation. Everybody on the panel agrees that an observed pitch pattern is equal to sentence intonation plus word intonation. But there are different views about what these two components really are and how they should be extracted from an observed curve. For those who treat tone languages and 2-accent languages, sentence intonation seems to be a broad general fea-

1) Přemysl Jánota was unable to attend the congress.

2) See footnote on page 293.

ture (called global in what follows), possibly combined with a local feature. These features express the illocutionary character of an utterance, for instance, statement or question. They can be manifested as downdrift or absence of downdrift with or without some consistent local glide. The ups and downs determined by the tones and accents are imposed on this pattern.

For 't Hart and Collier in their analysis of Dutch, however, intonation is the total intonation pattern including the rises and falls over the accents. Word prosody is lexical accentuation and it only determines the timing of some salient parts in the pattern. Palmer (1922), Bolinger (1958), and O'Connor and Arnold (1961) have described the intonation of English in a similar way.

It seems clear that the existence of these two radically different interpretations does not facilitate our task.

In connection with the concept sentence intonation we should perhaps ask ourselves the following questions:

Are the prosodic systems really so different that they have to be analysed differently?

Is a compromise possible so that sentence intonation can be given the same meaning in different prosodic systems?

Are there any languages for which the decomposition into word prosody and sentence prosody is meaningless?

Is there perhaps a need for a smaller unit between sentence and word, such as phrase?

The second concept important for our discussion is sentence accent. Even here there is fundamental disagreement. About half of the panel take sentence accent to be an accent feature expressing the focus of a sentence which can signal semantically or emotionally important words. In widely different prosodic systems, sentence accent has been reported to have similar manifestations: increased duration and amplitude in combination with a special pitch pattern. Most often sentence accent occurs on the accented syllable of the word in focus but it can also have a separate manifestation on a later syllable. Such cases have been reported by Eunice Pike for Ayutla Mixtec and Acatlan Mixtec (p.414) and by Gösta Bruce and myself for Swedish dialects (p.388). As a rule the tone languages listed by Eunice Pike have sentence accent. Kay Williamson, on the other hand, does not need the concept for her description of Nigerian tone languages and Nina Thorsen as-

cribes the prominent accents elicited from Copenhagen speakers to emphasis or contrast.

't Hart and Collier do not separate a special sentence accent from other accents. All pitch movements in combination with accented syllables are sentence accents. This is consistent with their view of intonation.

The sentence accent has been very useful in the analysis of Swedish intonation and I am ethnocentric enough to think that it should be useful generally. I therefore suggest that we discuss the relevance and usefulness of sentence accent. Also here we might need an intermediate level between word and sentence. A parallel term to phrase intonation would be phrase accent.

The other basic units are of course accents and tones but competing descriptions of tones and accents, although abundant in the literature,<sup>1</sup> are not to be found in the contributions to this symposium. They may come up in the open discussion, however.

#### 1.2 Extraction of the phonetic correlates of basic units

Suppose now that we have some idea of the linguistic nature of the basic prosodic units at sentence and word level. How should we extract their phonetic correlates from observed pitch patterns? To do this extraction it seems necessary to consider utterances in which sentence prosody and word prosody are varied in a systematic fashion. This is the method which has been used by Gösta Bruce. The method may lead to basic forms that are not always directly observable in a given pattern. For Swedish dialects we have in this way extracted four different manifestations of sentence accent which are extremely useful in generating and explaining the different types of intonation in Swedish dialects.

For Abramson it is the citation form which contains the phonetic correlates of the basic tone and this form is then perturbed by sentence prosody and adjacent tones.

There are hardly any competing views about the phonetic correlates of tones but for accents the pendulum has swung between pitch and intensity. For a long time now it has been customary to regard all accents as pitch accents. I found it very refreshing to see the data presented by Fujisaki and his collaborators in a poster session at this congress (Fujisaki et al., 1979a). The data seemed to reestablish some of the importance of intensity for English accents as compared to Japanese ones.

1) See e.g. references in Leben (1978).

For sentence intonation, various auxiliary lines have been proposed. 't Hart and his collaborators have used a baseline joining local minima in a curve, only for them it does not represent sentence intonation.<sup>1</sup> Nina Thorsen joins points (lows) representing stressed syllables. For Swedish we have used a more complex construction of baselines and topline (Bruce and Gårding, 1979). Common to all these constructions is a baseline whose steepness is determined by the length of the phrase. In Fujisaki's intonation model, which he showed during the discussion ensuing the report on perception, the baseline is independent of the length of the utterance (Fujisaki et al., 1979b). I have asked him to give a brief demonstration of the pertinent parts of his intonation model at the end of the time allotted to the panelists.

To sum up my questions under this point (1.2):

I suggest that we discuss various methods for the extraction of the phonetic correlates of the prosodic units.

How should this extraction be done and to what purpose?

Are principally different methods possible?

And what are the phonetic correlates of the basic units, sentence intonation, sentence accent, lexical tone, lexical accent?

### 1.3 Interaction between sentence prosody and word prosody

Let us now assume that we have extracted the phonetic correlates of the basic units of sentence prosody and word prosody. To generate perceptually correct pitch patterns we must know how these units interact. And here finally we come to the main theme.

Generally speaking, sentence prosody precedes and sets the scale for word prosody. This must be a true universal. For instance, downdrift influences everything on its way, and in Swedish, sentence accent influences all preceding and following word accents.

Apart from the interaction between sentence prosody and word prosody there is also interaction between adjacent units in the utterance, usually called tonal coarticulation and described by tone rules (Hyman and Schuh, 1974; Schuh, 1978).

I suggest the following points of discussion under 3:

Is the order sentence prosody, word prosody a true hierarchy?

And at the sentence level, is sentence intonation primary to sentence accent?

Are there any general principles governing tonal and accentual coarticulation?

1) 't Hart modifies this statement: The baseline is not the only manifestation of sentence intonation.

### 1.4 Additional questions

Here I collect questions which are marginal to the main theme. How does one determine if the basic prosodic unit for a word is a tone or an accent? According to Eunice Pike it is possible to determine if a given High represents an accent or a tone by studying its effect on vowel quality. Accented syllables have full vowels and unaccented vowels are reduced. Also accented consonants are affected. High tone, on the other hand, has no influence on vowel quality.

Accent also affects duration in a drastic way. In Swedish an accented syllable is more than twice as long as an unaccented one, whereas tone only has a marginal effect on duration.

According to many linguists, e.g. Larry Hyman (1975, p. 207 ff.) the difference between tone and accent is a linguistic one, not a phonetic one. I think that this point should be debated further. Tone and accent seem to have quite different contextual effects, difficult to explain without some difference of physiology.

## 2. COMMENTS FROM THE PANELISTS

Arthur Abramson emphasizes that the five tones of Thai are essentially preserved in connected speech.<sup>1</sup> He goes on to give an example which shows that the declination over an utterance is 30% of a woman's voice range, with the topline responsible for a larger amount of the declination than the baseline. Sentence accent is perhaps not as adequate a notion for the description of Thai as syntactic groupings in which phrase breaks are signalled by prosodic variation.

Eunice Pike summarizes ways in which pitch is used in the languages she has studied. It signals contrasts between lexical items, segments a stream of speech into words and clauses, marks sentence stress and conveys attitudinal meaning. Eunice Pike exemplifies these functions in various languages. In Marinahua of Peru a high tone will be still higher and a low tone lower under sentence stress. In Mikasuki of Florida tones are modified downward to mark boundaries between words and upward to mark bound-

1) According to Gsell (1979) the distinctiveness of tone in Thai is very much reduced in connected speech. There are only certain positions, comparable to accented syllables, in which the tones retain their distinctive power. - This publication contains a lot of other information relevant to the theme of this symposium.

aries between phrases. In Eastern Popoloc of Mexico a final upglide marks politeness as opposed to the unmarked neutral ending with a glottal stop. (For references see Vol. II p. 416). In Fasu high tone and low tone contrast lexical items only in stressed syllables, the unstressed syllables carry attitude or sentence intonation. A special voice quality is used in talk with spirits.

Kay Williamson calls attention to tonal modifications due to grammatical constructions which in her present view were underemphasized in her earlier contribution (p. 424). With fewer minimal pairs there is more freedom for extensive variation without causing ambiguity. One of the languages has some dialects which could be called pitch accent systems. Such a system may have developed as follows. Series of high tones have gone low and the surviving highs have become - phrase accents! Kay Williamson exemplifies global and local effects in connection with sentence type. Global manifestations are downdrift, a cancelling of downdrift or a raising of highs so as to increase intervals. One example of a local effect is that in Igbo the normal pronominal repetition of a subject at the beginning of a phrase has a high tone in the statement and a low tone in the question. In all other cases the local effect occurs at the end of the sentence with an opposition between statement and question. There is a final high for statement as opposed to low for question in some of the languages, which goes to show that the connection of high with question and low with statement is not a universal one.

Gösta Bruce shows a Stockholm Swedish pitch contour with six word accents surrounding a sentence accent in the middle of the utterance (Fig. 1). This figure shows that there are two contextual variants of one and the same accent, depending on their position relative to the sentence accent, rise-falls before the sentence accent and mere falls after it. Statement intonation is represented by the downdrift. The extent of this downdrift for a given speaker

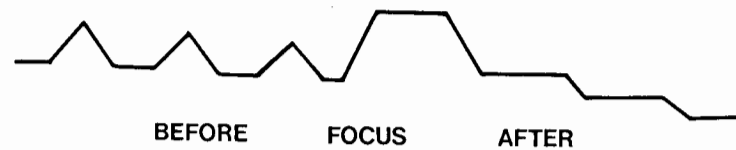


Fig. 1. Downdrift in Swedish. Stylized pitch contour of a Swedish utterance. From Gösta Bruce. Work in progress.

seems to be independent of the length of the utterance. However, the figure, assumed to be typical in this respect, shows that the actual course of the downdrift pattern has a very gentle slope before the sentence accent and a steeper, terrace-shaped downdrift afterwards. The figure sums up some important aspects of the interaction between sentence prosody and word prosody. Sentence intonation sets the scale for accentuation and accentuation determines the time course, in this case of the downdrift.

Nina Thorsen needs two prosodic units between word and sentence, the stress group, defined as the stressed syllable and the succession of unstressed ones, and a prosodic phrase group consisting of several stress groups. In her prosodic system there are two components which do not interact. Stress-group patterns are simply superimposed on the intonation contour which in her model is described as a line joining the stressed syllables. Nina Thorsen further discusses problems of definition when she applies this view to utterances with emphasis for contrast. She prefers to think that with emphasis the utterance is reduced tonally to a one-stress utterance. With this interpretation the difference between statement and question lies mainly in the stressed syllable and the post-tonic syllables.

Johan 't Hart underlines that in his and his collaborators' analysis of Dutch, declination is part of the intonation but not the only manifestation of it. Word prosody is lexical accentuation and sentence accentuation is represented by the pitch accents in the sentence. Sentence intonation has a higher place in the hierarchy. Reference to the communicative function has been avoided. Intonation patterns are not connected with linguistic categories such as statements, questions, wishes or commands, but represent classes of melodic shapes distinguished by the listener.

Hiroya Fujisaki in an extra contribution invited by the moderator, describes a model for Japanese intonation. It is, he says, principally similar to an intonation model proposed by Öhman (1967). In logarithmic scale all  $F_0$  patterns are sums of two components, a baseline component (called voicing component) corresponding to sentence prosody and an accent component. Fujisaki showed a figure (Fig. 2) that strengthens his view that the time constant of the baseline is not affected by sentence length. In longer sentences the speaker resets his baseline at one of the major syntactic boundaries. A general observation is that with an

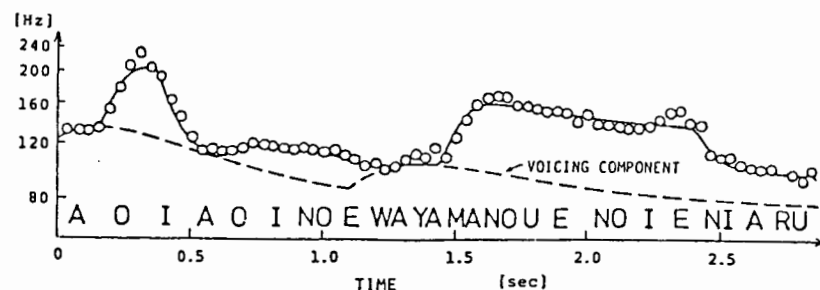


Fig. 2. Analysis by synthesis of a Japanese  $F_0$ -contour with two voicing (baseline) commands. From Fujisaki et al. (1979b).

absolute scale the height of accentual  $F_0$  peaks over the baseline decreases towards the end of a declarative intonation contour. In logarithmic scale, however, the peaks have approximately the same height over the baseline. This analysis can lead to a simpler and more illuminating interpretation of prosody.

### 3. DISCUSSION

In this section I have chosen to organize the discussion by subject. Consequently one intervention may occur in several places. I have followed the terminology of each discussant, inserting my earlier suggested term within parentheses. Terminological remarks, in particular those with a bearing on typology, have been collected under point 3.0. Since all the additional questions (1.4) concern the basic units and their correlates, they have been referred to 3.1 and 3.2. Otherwise the points for discussion follow the suggested outline. The discussion typically begins with the panel, proceeds with the respondents from the audience and ends with the panelists' responses.

#### 3.0 Terminology

Irmgard Mahnken wants the terminology to show the non-isomorphic character between grammatical and prosodic units.

William Moulton offers a list of terms useful for the description of different prosodic systems. Three uses of pitch and stress, lexical, morphological and syntactical, can be combined in different ways. William Moulton also underlines the need to distinguish between gradient versus discrete pitch and stress signals.

#### 3.1 Basic units

All the panelists agree on the usefulness of an intermediate unit between sentence and word level.

For the description of a Subject Object Verb language, Kay Williamson uses the concept tone group. This tone group is syntactically determined. Within such a group the first word sets the pattern for the whole group. For the group Object Verb the verb loses its own pattern and follows that of the object. In the dialects mentioned earlier, where only one High per group survives, normally the last one, group accent might be an appropriate term.

Also Johan 't Hart advocates the idea of introducing groups into the descriptive framework.

Eva Gårding argues that in the data presented by Arthur Abramson for Thai (p.383) one can find phrase accents manifested as increased amplitude and length and in the same utterance also something that looks like a sentence accent with an even more prominent increase of length and amplitude. In her own dialect of Swedish there are similar phenomena. Lexical restrictions on the pitch pattern in an accent language like Swedish make it perhaps more convenient to signal a syntactic unit by a phrase accent, expressed by increased amplitude and length rather than by a particular pitch configuration, as for instance in the Dutch hat pattern.

Arthur Abramson agrees with this interpretation of phrase accent in his material but he is not happy with the notion of sentence accent, which is determined by the whole discourse.

René Gsell gives a linguistic functional definition of tone, accent and sentence which he missed in the panelists' discussion. (This critique was repeated by other discussants, e.g. Mahnken, Moulton and Carton.) Tone is a paradigmatic mark of morphemes and words. Accent is a syntagmatic mark and the function of accent is the grouping of morphemes into words and at a higher level, of words into tagmemes and larger phrase constituents. In the symposium sentence accent has been used for emphasis and focus, which are two different things. From a linguistic point of view sentence accent is mainly phrase accent, the culminative mark of a higher constituent. Intonation is a still higher level of integration by which tagmemes or constituents are grouped into sentences.

Vichin Panupong demonstrates how in Thai sentence intonation can be signalled by final tone-bearing particles. One such particle is ka which modifies the total meaning of a sentence from e.g. statement to question by means of one of four possible tones. Sentence intonation can be carried by a final word as well. Final particles are also used to mark boundaries.

Sieb Nooteboom comments on the confusion between pitch accent in the Dutch analysis as compared to sentence accent in the Swedish one. The Swedish picture of one accent determined by focus surrounded by a number of smaller ripples caused by other accents (Fig.1) may correspond to just one pitch accent in Dutch determined by focus without any pitch manifestation of the other accents. Gösta Bruce has analysed sentences with only one semantically determined pitch accent whereas 't Hart (p.398) shows sentences with a number of semantically determined pitch accents. The question is what would happen in Swedish in a comparable situation, i.e. in a sentence with several semantically determined pitch accents.

Fernand Carton points out that even within one language there are problems of description. He needs the notion of accent (as do other analysts) for his study of dialects in the north of France where accent is still contrastive. Other analysts, as e.g. Mario Rossi, claim that there is no accent in modern French since it has only demarcative (syntactic) function. A common theoretical framework is needed, which takes functional aspects as well as the existence of different factors into account. A constant check on the interplay between form and substance is needed at all stages of the analysis and perceptual tests are crucial.

Alan Cruttenden is disturbed by the continued use of such simple categories as statements and questions for sentence intonation.

Barbara Frohovich thinks that an intermediate unit like prosodic phrase might have a bearing on the definition of the word and the sentence.

Lisa Selkirk with experience from comparative work in French and English wants to posit an intermediate level which has a syntactic definition.

Philippe Martin wonders how phoneticians can say that there are well formed sequences of pitch accents, as for instance in Dutch, if they reject any relation between syntax and sentence intonation.

#### Responses to 3.0 and 3.1

Gösta Bruce answers Sieb Nooteboom that there may be two or three sentence accents in the same Swedish utterance.

Eva Gårding is of the opinion that all panelists agree with René Gsell on the importance of function in a linguistic analysis.<sup>1</sup>

Kay Williamson in response to William Moulton's typological suggestions says that at least nine combinations of pitch and stress are needed. We speak of tone languages, stress languages and pitch accent languages, but we need more categories for the languages described in Eunice Pike's contribution, where both stress and pitch are contrastive. There are in addition at least two types of tone languages, the syllable-tone type and the word-tone type. To sum up, we need a rather more complex typology than the ones suggested earlier.

Eva Gårding reassures Alan Cruttenden that the members of the panel are well aware of the existence of a variety of sentence intonation types. The reason there is so much talk of statement and question intonation in the contributions is that the purpose of the symposium is to study the relation between word and sentence prosody and that this can be done safely in the statement and question types since they are well established in prosodic systems and easily elicited from speakers.

#### 3.2 Extraction of the phonetic correlates of basic units

##### 3.2.1. Citation forms versus other forms

According to Gösta Bruce citation forms would be insufficient for a thorough analysis of an accent language like Swedish. A Swedish citation form is a very complex pattern containing contributions from several linguistic variables, word accent, sentence accent, sentence intonation and terminal juncture. His results have been obtained by comparing words in different prosodic contexts. In this way it has been possible to decompose the classical double-peaked Accent 2 pattern of e.g. Stockholm Swedish into a word accent fall, a sentence accent rise and a terminal juncture fall.

Arthur Abramson defends the use of citation forms, partly for practical reasons - they are easy to elicit and measure - and partly for psychological reasons - children tend to learn one-word

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1) I was too rash here. Gsell and Moulton and others requested a functional definition of the concepts under discussion. It should have been said from the beginning that the basic units were intended to be useful and efficient in the analysis and synthesis of prosody. In this capacity they are not necessarily functional units in the classical sense.

utterances and hence citation forms.

Alan Cruttenden gives an example from one variety of Panjabi which supports the view that the basic form of pitch accent should be derived from connected speech rather than citation forms. In connected speech a two-way pitch accent distinction involves a clear deviation downwards or upwards respectively in a particular intonation pattern, whereas in citation forms the distinction is very complex.

Eunice Pike finds it very important to remember in an aural linguistic analysis that lexical tones may be modified by sentence intonation or sentence stress. One trick in such an analysis is to ask for three items and have the words you want to contrast as number one and two. These two will then have a chance to have the same intonation pattern whereas the last item will have terminal intonation. To separate sentence accent from lexical tone it is advisable to have at least two words in a sequence. One of these words will then have the sentence accent and the other words will carry only tone.

### 3.2.2. Methods for the extraction of basic forms

At least four methods have been mentioned in the contributions, elicitation of citation forms (Abramson), comparison of prosodic variables in different contexts (Bruce, Pike), analysis by perception ('t Hart), and analysis by synthesis (Fujisaki).

Edward Purcell makes a request for more statistically based approaches to modelling tone and intonation, by using e.g. polynomial regression. It might then be possible to solve equivalence problems like the Dutch and Swedish sentence accent.

Yukihiko Nishinuma points out that an intonation model has to take the integration of independent acoustic parameters into account as well as the effect of masking at different levels.

### Responses to 3.2.2

Johan 't Hart argues that the most important need is not statistics but a large inventory of intonational possibilities and perceptual testing. He would like to know if Hiroya Fujisaki is as concerned about the fit between synthetic and perceptual patterns as he is about the fit between synthetic and acoustic ones. As for logarithmic versus linear scale he does not think it matters much in short utterances.

Arthur Abramson is in sympathy with the use of polynomial regression but finds it most often sufficient to form hypotheses

based on the acoustic manifestations and to test these hypotheses perceptually.

### 3.2.3 Phonetic correlates

#### a) Sentence intonation and downdrift

Nina Thorsen points out that in her Danish material downdrift is evenly distributed over the utterance. The downdrift does not occur only in connection with the accented syllables as shown in Bruce's figure (Fig. 1). Also, the range varies with the length of a sentence within certain limits. Contrary to Fujisaki's model for Japanese, the downdrift in her material is a linear function of the length of a short utterance. In long ones there is a resetting of intonation in connection with syntactic boundaries. She referred to the figure (Vol. II p. 417) where it appears that the height of the post-tonic syllables above the "baseline" does decrease toward the end, even with a logarithmic scale.

Gösta Bruce ascribes the difference between the distribution of downdrift in Swedish and Danish to the different use of sentence accent. In standard Swedish a normal neutral utterance will have sentence accent on the last accented word whereas in Danish and perhaps also in Southern Swedish dialects there is no obligatory rule. The range of the downdrift has appeared to be constant in sentences with two, three and four accented syllables.

Osamu Fujimura mentions work on pitch synthesis conducted by Janet Pierrehumbert at Bell Laboratories. It is somewhat similar to the work reported by Hiroya Fujisaki. The algorithm is based on specifications of pitch peaks representing relative prominence with options for low-tone stress. Nuclear tones fall below the baseline and postnuclear tones are neutralized. Pitch declination is a descending time function with resetting at major phrase boundaries (see Pierrehumbert, 1979).

Hiroya Fujisaki agrees with Johan 't Hart that the scale is not so important within a small range but for longer sentences the distinction is very clear. In answer to Nina Thorsen he says that there may be many language-specific points in prosody. He strongly agrees with Edward Purcell about the need for analytic and quantitative methods in the analysis of the production and perception of prosodic phenomena.

#### b) Accent versus tone and accent versus stress

In her description of the dialects of İzön Kay Williamson tries to show that there is a gliding scale between tone-dialects

and accent-dialects with a very narrow cross-over zone. In general, [and this is consistent with Eunice Pike's description, EG] the more you have a tone language, the more things are symmetrical, and the more you have an accent language, the less things are symmetrical. The accents have more prominence and other things get reduced in relation to it. Perhaps this is the reason why it is easier to talk about sentence accent in accent languages than in tone languages.

René Gsell says that from a functional point of view the Scandinavian languages, even Danish, are tone languages. The 'stød' acts as an intonation depressor and is a clear example of interaction between word and sentence prosody.

Yukihiro Nishinuma (and also Irmgard Mahnken) find that in the discussion of intonation too much emphasis is put on  $F_0$ , although everybody who has worked on automatic intonation detection knows that  $F_0$  is not sufficient.

Ivan Fónagy presents the acoustic correlates of a Hungarian phrase akar, a kar (with accent on the first and second syllable respectively) as a statement and as a question in normally intoned and whispered speech, by which he wants to show that pitch accent is not an appropriate term for the acoustic correlates of the accent. As a term he prefers stress.

#### Responses to 3.2.3

Eva Gårding agrees with the view that too much emphasis has been put on  $F_0$ . This trend seems to have been weakened lately.

Arthur Abramson points out that apart from fundamental frequency and amplitude variations there are also other cues that may have signal value, creaky voice and various other forms of laryngeal constriction.

### 3.3 Interaction between sentence prosody and word prosody

#### 3.3.1 Hierarchy

Three views are represented at the symposium: Sentence prosody is primary (e.g. Bruce, 't Hart), lexical prosody is primary (Abramson), and sentence prosody and lexical prosody are at the same level. The last view is implied by the model presented by Hiroya Fujisaki. Here the word-prosodic part and the sentence-prosodic part are extracted simultaneously from an observed curve and may therefore be regarded as belonging to the same level of the hierarchy. The final  $F_0$  contour is the sum of these two parts.

Arthur Abramson's feeling is that lexical prosody must be paramount in a tone language. In the mental lexicon the storage form must carry the tone as part of the morpheme. When these tones are strung together in connected speech a particular intonation is superimposed.

According to Johan 't Hart there is a higher hierarchical position for sentence intonation.

René Gsell claims that with the definitions he has given earlier (see 3.2) it is easier to understand interaction. At each level a higher constituent mark modifies lower constituent marks. Intonation dominates sentence accents, sentence accents dominate the word accents and so on. The phonetic characteristics of lower marks are not indifferent to the grouping of higher layers.

Einar Haugen remarks that the Scandinavian word accents are part of the stress pattern of the sentence and always to be seen in relation to the whole utterance. Therefore, to ask whether the word or the utterance is primary is a chicken-and-egg kind of question. You cannot say any Swedish or Norwegian word without having both tone and sentence intonation. They are stored with the word. Every native knows which tone a word has, although it never occurs without sentence intonation. Accent 2 has to be interpreted as a perturbation of the unmarked sentence intonation.

#### Responses to 3.3.1

Eva Gårding refers the conflicting views about the hierarchical relation between sentence prosody and word prosody to different points of departure. To work out a program for pitch synthesis by rule you need a rough idea of the sentence intonation, i.e., where to start on the frequency scale etc. So with this aim in view it is very natural to regard sentence intonation as primary. But with a psycholinguistic approach you are interested in the forms stored in the memory and the citation forms become primary in your hierarchy. These will then be perturbed by sentence prosody at some secondary level, the phrase or the sentence level.<sup>1</sup>

#### 3.3.2 Contextual interaction

Arthur Abramson points out that sandhi phenomena are phonological and have nothing to do with the interaction treated in this section.

1) Gabrielle Konopczynski suggests in a written contribution submitted after the symposium that one should look for a hierarchy by studying in detail how children acquire tone languages.



Gösta Bruce's figure (Fig. 1) gives a good example of interaction between sentence accent and word accents on the one hand and sentence accent and sentence intonation on the other.

George Allen is interested in the deletion of postnuclear accented syllables in an English phrase. This pattern seems to be acquired quite early by children, at the age of 30 to 36 months.

Osamu Fujimura remarks that problems of accentual patterns, such as interaction between sentence accent and lexical accents have been discussed extensively in the traditional linguistic literature in Japanese. He wants to call attention to McCawley's (1968) monograph.

Perceptual tests have shown that the pitch declination effect is compensated for by listeners when they judge the height of accent peaks (Pierrehumbert, 1979).

Ana Tataru exemplifies different relations between word accent and sentence accent in Romanian on the one hand and English and German on the other. Such differences are of great pedagogical interest.<sup>1</sup>

### 3.3.3 Word prosody restricting sentence prosody

Gösta Bruce comments on the often heard assumption that a speaker of an accent language like Swedish is less free in his or her use of pitch as an expression of sentence type and attitude than a speaker of another language, like Dutch for instance. There are restrictions in the possible use of pitch movements locally but globally you are free to express other aspects of intonation.

Johan 't Hart points out that in Dutch there are also restrictions. After a rise, pitch has to come down again to be ready for the next rise. He refers to the examples given in his contribution (p.398) to show that there are also restrictions in the placement of the pitch movement which may to some extent be determined by the syntactic boundaries.

Einar Haugen reminds the audience of Otto Jespersen, who claimed that Norwegians and Swedes were unable to express nuances of feeling as well as Danes, because of the tones. It was to disprove this point that Einar Haugen went into the study of tone!

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1) Paul Schäfersküpper in a written contribution points out that in German, sentence accent operates over larger domains than the syllable.

#### 4. MODERATOR'S AFTERTHOUGHTS

The aim of the symposium was to discuss word prosody and sentence prosody and the relation between them. Although precise results or general agreement were not to be expected, the symposium has contributed new material and well-taken points, and it has put some important questions into focus. I shall list some of them here.

It seems that even a large number of prosodic systems, as varied as those represented at the symposium, are sufficiently similar to be treated in a common framework, and that the dichotomy between word prosody, which I would now prefer to call lexical prosody, and sentence prosody, including phrase prosody, is useful even in languages whose lexical prosody is predictable from simple rules.

To find the basic units of the dichotomy we need data from all levels of analysis on which models can be based. I especially want to stress the need for simple but strict generative models. These models should aim at simulating observed patterns of pitch ( $F_0$ ), intensity and duration. Without such models the interaction between word prosody and sentence prosody cannot be stated with a sufficient degree of precision.

The symposium has given strong evidence for some general tendencies in the interaction between sentence prosody and word prosody. Declination or downdrift has been observed for many languages representing a variety of prosodic systems. We have seen in the Swedish material how this gradual downdrift may be checked by an intervening sentence accent (Fig.1). It is quite possible that there are phonological systems where downdrift is masked by a late obligatory sentence or phrase accent.

Accent reduction brings out an interesting tendency. After the sentence accent (nuclear stress) all following accents tend to be reduced. There is evidence for this from Danish, Dutch, Swedish and Japanese (see Fujimura's intervention). This may be one of the asymmetries that Kay Williamson and Eunice Pike found typical of an accent language as compared to a tone language. A worthwhile project would be to explore the physiological background of this effect.

It has often been observed that the heights of equally strong accents decrease over a declining baseline. As pointed out by

Hiroya Fujisaki, however, their absolute heights are proportional to that of the baseline. This may be a universal.

Are there any general principles behind tonal and accentual coarticulation? This question was left unanswered. One of the reasons may be that these relations can only be studied together with durational aspects which were not included in the topics of the symposium.

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