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For

Bertil Malmberg

on the occasion of his sixtieth

birthday

22 April 1973

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TONAL ACCENT RULES FOR COMPOUND STRESSED WORDS IN THE MALMÖ DIALECT

Gösta Bruce

The function of tonal accents in Scandinavian dialects

According to the traditional phonological view there is an opposition of two tonal accents - acute accent (accent 1) and grave accent (accent 2) - in the majority of the Swedish and Norwegian dialects and also in some Danish dialects. The primary phonetic difference between the accents is found in the tonal curve (fundamental frequency curve) of the syllable sequence carrying the accents; hence the term "tonal accent". The tonal curves of the accents show, however, great interdialectal variations. The constant feature is that in every single dialect there is an opposition of two accents, independently of the actual manifestations of the difference (Malmberg 1959). The phonemic status of the accents is based on a number of minimal pairs, mainly disyllabic words stressed on the first syllable, the only distinctive factor being the accent characterizing the syllable sequence, e.g. Sw. <u>á n d e n</u> ("the duck") - <u>à n d e n</u> ("the ghost")*. This <u>distinctive</u> function of the tonal accent could be said to be of limited communicative importance. This depends upon the fact that the two words of a minimal pair (in Swedish as few as 350 pairs, Elert 1971) do not normally appear in the same context, and that one of the words is rather unusual as a rule. That the accentual distinction is dispensable is shown by the fact that in those dialects where it is missing, e.g. some Swedish dialects in Finland, the absence of the distinction will hardly cause any difficulties for intelligibility (Malmberg 1966).

*The symbol ´ over the stressed vowel is used to designate the acute accent and ` is used to designate the grave accent.

Although the tonal accent is not necessary from a communicative viewpoint, it may be of help in a morphological identification of phoneme sequences (Elert 1970). The typical feature of the grave accent is that it presupposes and characterizes at least two syllables. When perceiving the tonal pattern characteristic of the grave accent of a first syllable, this indicates to you - if you are a speaker of the actual dialect - that there will follow at least one further syllable belonging to the same word as the first. This function of the grave accent is called connective (Elert 1970, Malmberg 1966). Thus the grave accent signals connection between syllables within the same word. This connective (or constructive) function of the grave accent may be regarded as the most important, as it possesses communicative relevancy in every utterance (Elert 1970). The acute accent on the other hand does not give any information about further syllables after the stressed syllable. Further syllables may follow, but this is not necessary. Any syllables that follow the acutely accentuated syllable can belong to the same word but may also begin another word. The acute accent is therefore called isolating (Malmberg 1966).

The phonological status of the tonal accents

It is often only grave accent that is regarded as a true tonal accent. Acute accent is identified with stress. Any occurrence of grave accent presupposes stress, and grave accent has been described as stress plus a tonal feature modifying the tonal pattern characteristic of stress (= acute accent) and as a result giving another, usually more complex tonal pattern typical of the grave accent (Haugen and Joos 1952, Haugen 1967). This way of looking at the matter is identical to regarding the acute accent as the unmarked member and the grave accent as the marked member of the accentual opposition. Other reasons have been proposed in describing the acute accent as the unmarked accent as against the grave accent. It has been pointed out that the grave accent has a restricted distribution. It is neutralised in monosyllabic and final stressed words and also in the so-called secondary stress position of compound words (Malmberg 1966, Haugen 1967, Lindau 1970). During the last years, under the influence of generative phonology, the question of the predictability of the tonal accents has come into focus, and their phonemic status has been questioned (Öhman 1966, Haugen 1967, Lindau 1970, Elert 1971, Linell 1972). In many cases acute and grave accent are shown to be predictable by general rules, taking into consideration both phonological and other grammatical information. Hence they are superfluous in an underlying phonological form and may be dispensed with as phonemes. From this point of view the minimal pairs are fictitious, as one hardly finds any single pair, where the members have the same morphemic structure (Elert 1966, Haugen 1967). In a typical pair like Sw. á n d e n - à n d e n the acutely accentuated word form consists of a monosyllabic stem 'and' plus the definite article, while the corresponding gravely accentuated word form is a disyllabic stem 'ande' plus the definite article. If the definite final article in the underlying form is postulated to be only consonantal /n/, we have in the above mentioned type pairs a difference in the number of vowels (= syllables), which Öhman interprets as decisive of the tonal accent: "De grava och akuta tonernas funktion är huvudsakligen den att återspegla huruvida stammen + närmaste flexionsändelse är en mång- resp. envokalisk enhet" (Öhman 1966:77).

The dependence of tonal accent on the post-tonic syllable

Rischel (1963) has emphasized the importance of the post-tonic syllable for the tonal accent in a word form. His observations concerning East Norwegian seem to be applicable to the corresponding cases in other Scandinavian dialects as well. According to Rischel it is of limited value to use the term 'word tones' for the tonal accents. The tonal accent is not necessarily associated with the word as an indivisible unit. A lexical word may have different accents depending upon the inflectional ending, e.g. Sw. s ì t t a ("to sit") with grave accent, s í t t e r ("sits") with acute accent. In compounds the elements often lose their tonal characteristics, e.g. Sw. m á t ("food") + s á l ("room") = m à t s a l ("dining-room"). Rischel shows that in non-compound words it is not always enough to identify the root or the stem of a word form and not necessary to take into account all the morphs of a word form to determine the tonal accent of that word form. The important thing is that the tonal accent is predictable, if the morph occupying the post-tonic syllable is known. A monosyllabic stem, e.g. Sw. b a c k ("football back") can be said to be neutral with respect to the tonal accent, although monosyllabic words have the acute accent: in inflected forms the tonal accent may be shifted depending on whether the post-tonic syllable contains a "tone-bearing" suffix ([2]), i.e. causing accent shift, or not ([1]). For example Sw. b a c k + [1]def art = b á c k e n will have acute accent, while b a c k + [2]plur = b à c k a r will have grave accent. Suffixes added to the post-tonic syllable cannot affect the accent in the word form, e.g. Sw. b a c k + [2]plur + [1]def art = b à c k a r n a. The tonal accent of a disyllabic stem with the stress on the first syllable, e.g. Sw. b a c k e ("slope") (grave accent) is already determined by the fact that the post-tonic syllable is located to the stem. Any inflectional suffixes in this case will not be able to affect the tonal accent e.g. Sw. b a c k e + [1]def art = b à c k e n, b a c k e + [2]plur + [1]def art = b à c k a r n a. The importance of the post-tonic syllable being located to the stem or not is further emphasized by the following example: b ò n a ("to polish", disyllabic stem), b o ("nest")+ ^{1}plur + ^{1}def art = b ó n a. I will return below to the discussion about the role of the post-tonic syllable in connection with an analysis of factors determining the choice of tonal accent in compound stressed words in the Malmö dialect.

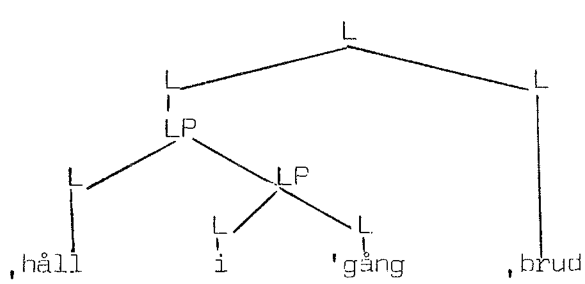
The purpose of the work

The present work will treat the distribution of the tonal accent in the South Swedish dialect of the city of Malmö in compounds and other words having the same stress pattern as compounds. The distribution of the tonal accent in words not having compound stress will only be treated in outline. This type of word seems to be governed - on the whole - by the same tonal accent rules in the Malmö dialect as in Standard Swedish (Elert 1971, Linell 1972) and many other Swedish dialects as well. With regard to words having compound stress we can point at several interesting differences concerning the distribution of the tonal accent. The aim is to investigate the predictability of tonal accent 1 and tonal accent 2 and try to give rules for the occurrence of these accents. Furthermore I will analyse the factors determining the tonal accent in compound stressed words. Is it only a question of phonologically determining factors, or could we find cases using other grammatical information? In this connection it is of interest to point to differences and correspondences between the Malmö and other Scandinavian dialects and on the whole try to contribute towards completing the picture of the function of the Scandinavian tonal accents. Finally I will join the discussion about cyclical or non-cyclical rules in phonology. The necessity and suitability of cyclical application for the prosodic rules of Standard Swedish has been questioned. I will discuss the consequences of cyclicality for the tonal accent rules in the actual South Swedish dialect. Phonetic aspects on the tonal accent question will not be dealt with in this study (for phonetic studies of South Swedish dialects see Malmberg 1953, Malmberg 1955, Malmberg 1959, Hadding-Koch 1961, Hadding-Koch 1962, Gårding 1970, Johansson 1970, Gårding and Lindblad 1973).

Compound stress

In the following discussion I assume that one syllable in every ROOT and in stressable AFFIXES will be assigned stress by rules, the form and predictions of which I will not deal with here (see Linell 1972!) but presuppose in every single case. Compounds and certain derivatives (see below) will hereby receive stress on at least two syllables. The stress patterns of these words will, however, not be finally determined by these stress rules. I also assume the existence of deaccentuation rules, which will bring about that one stressed syllable in - for example - a compound will dominate (Linell 1972). The syllables having been deaccentuated in this way are, however, not regarded on a par with unstressed syllables. The deaccentuated syllables have certain features in common with the stressed syllables not present in the unstressed syllables, e.g. potential opposition of quantity and absence of strong vowel reduction, but they differ from the stressed syllables by the neutralisation of the tonal accent opposition. The stress rules and the deaccentuation rules determine the canonical form of the words (Linell 1971), where we can distinguish three types of syllable with reference to the degree of stress: stressed (') - so-called main stress -, deaccentuated (ˌ) - so-called secondary stress and unstressed. I disregard here the effects of phrase accent and rhythm rules, which can change the prominence patterns of the canonical forms.

In this study I will primarily treat the occurrence of tonal accent in words having what is called compound stress. The characteristic feature of this type of construction is that it will have dominance to the left (Linell 1971) after the application of the deaccentuation rules, i.e. the main stressed syllable will occur in the first element of the compound. The other stressable syllables will have secondary stress. In the canonical form there is no difference between the deaccentuated syllables, so that we can distinguish there between strong secondary stress on the last stressable syllable and weaker degrees of stress, which will result after the application of rhythm rules. Compound stress is by far the most common kind of stress pattern in words having (at least) two stressable syllables, e.g. 'm a t ,s a l ("dining-room"), 'r å d,h u s ,t o r g ("town hall square"). The important thing is to distinguish compound stressed words from words receiving so-called lexical phrase stress (dominance to the right), i.e. the only stressed syllable that is left will be found in the last element of the compound, while the rest of the stressed syllables will be deaccentuated (Linell 1971). To this category belong the above mentioned lexicalised lexical phrases, e.g. ,h å l l i 'g å n g ("non-stop party"). Some compounded place and personal names are accentuated this way too, e.g. ,L a n d s 'k r o n a (city name), ,L a r s - 'G u n n a r (first name) as well as some other kinds, e.g. ,s j u t t i o 'f e m ("seventy-five"), i.e. compounded numerals generally, ,s y d 'v ä s t ("South West") etc. Only in the case where these lexical phrase stressed constructions in their turn make up an element of a compound, will the resulting compound have left dominance, e.g., ,h å l l i 'g å n g ,b r u d ("go-go-girl")*:



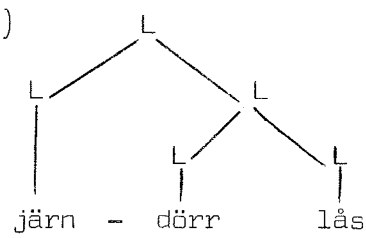
* L = Lexical category; LP = Lexical phrase category.

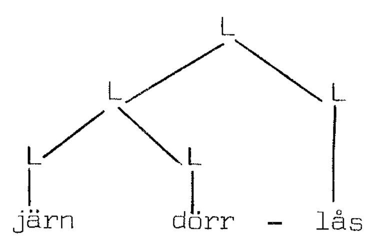
Among derivatives with compound stress we find on the one hand those having stressable prefixes and suffixes and a stressed stem at the same time, e.g. 'å l d e r ,d o m ("old age"), 'h y p e r ,f a r l i g ("hyper-dangerous"), and on the other hand words having non-stressable affixes, but where the stem is compounded containing at least two stressable syllables, e.g. 'i n ,v i g n i n g ("consecration"). Consequently within this group are not included derivatives with stressable suffixes depriving the first element of its stress, e.g. ,b r y g g e 'r i ("brewery"), ,v ä 'n i n n a ("female friend"). These words will receive lexical phrase stress like the lexicalised lexical phrases. Lexical phrase stressed compounds and derivatives and also derivatives having only one stressable syllable are treated together with the simple words as for the assignment of tonal accent. The so-called formal compounds, e.g. 'a r ,b e t e ("work"), 'ä v e n ,t y r ("adventure") have, in spite of the fact that they can be regarded as consisting of only one morpheme, two stressed syllables and will receive compound stress.

The common denominator of the constructions that are the object of our present study is consequently that they are words having two stressable syllables within their domain and receiving compound stress, whether they are compounds, derivatives or formal compounds. When it is necessary to talk about these constructions as a unit, they are called compound stressed words. Relevant information for the grave accent rule for compound stressed words, which will be discussed below, is, among other things, that there must be two stressed syllables within its domain. The deaccentuation rule giving left dominance to a construction and thereby destressing all stressed syllables except that of the first element may therefore be assumed to be ordered after the grave accent rule (see below). By ordering the lexical phrase stress rule before the grave accent rule we will avoid applying the grave accent rule to the lexicalised lexical phrases and other words with lexical phrase stress. Thus at the point where the grave accent rule will be applied, compound stressed words have the following structural condition: $(_{L}..[+\text{ stress}]..[+\text{ stress}].._{L})$.

The dependence of tonal accent on constituent structure

Before penetrating the rules governing the accentuation in compound stressed words in the investigated South Swedish dialect, it might be appropriate to show how the constituent structure of the words may in certain cases determine the choice of tonal accent. Considering a word like j ä r n d ö r r l å s it may receive different accents, depending upon how it is interpreted to be compounded. One interpretation is j ä r n - d ö r r- l å s ("door-lock of iron") and the other is j ä r n d ö r r - l å s, ("lock for iron doors"). The structural difference may be illustrated by the following tree-diagram showing the constituent structure of the words:

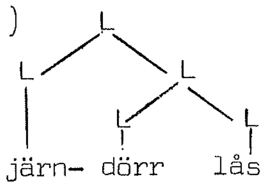
(1)


(2)


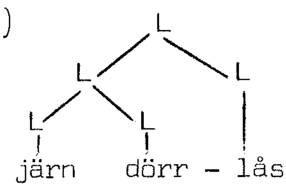
The first compound will be assigned acute accent, while the second will have grave accent. In case (1) j ä r n has acute accent before being compounded with d ö r r l å s, while j ä r n d ö r r in case (2) has grave accent before being compounded with l å s. Having these examples as a starting-point one might guess that the tonal accent of the left hand element before being compounded with the right hand element is not irrelevant to the resulting tonal accent of the compound stressed word. It is evidently a general fact that words having the same constituent structure as (1) will receive acute accent, and words having the same structure as (2) will have grave accent provided they meet further conditions that will be specified below.

If we consider the compound *järn-dörr* ("iron door") separately, we will find that it has grave accent, although the left hand element has acute accent. Now, what gives *järn-dörr* its grave accent, whereas *järn-dörrlås* (whose left hand element has acute accent) has acute accent? Considering the tree-diagrams of (1) *järn-dörrlås*, (2) *järndörr-lås* och (3) *järn-dörr*, we find that (2) and (3) are more closely related with regard to the constituent structure:

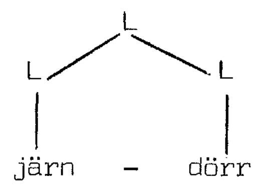
(1)



(2)

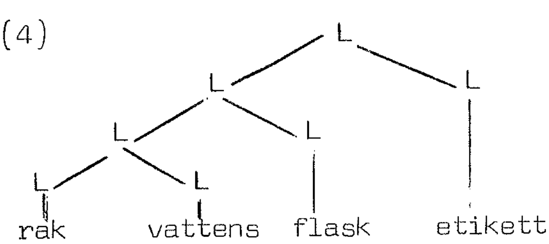


(3)

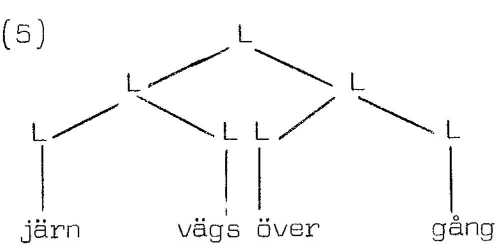


Järndörr-lås is simply an expansion of *järn-dörr*. The structural similarity may be expressed in terms of dominance. In case (2) and (3) the first terminal L (*järn*) is dominated directly by an L that also directly dominates the second terminal L (*dörr*). In case (1) we do not have this close connection between the first and the second constituent. Instead the second terminal L (*dörr*) is dominated directly by an L that only in its turn is directly dominated by the same L that directly dominates the first L (*järn*). Only in the case where the first and the second constituent are directly dominated by the same L will grave accent result. This also applies to words with more complex structures which do have this beginning of the constituent structure, e.g. *råkvattens-flasketikett* ("label on a bottle of after-shave lotion"), *järnvägsövergång* ("railway level crossing"):

(4)



(5)



Tonal accent in words not having compound stress

The fundamental condition for determining the tonal accent in a compound stressed word in the Malmö dialect is – according to my observations – knowledge of the accent of the first element when it is not an element of a compound but constitutes an independent word. This is, however, not always a sufficient condition, which will become evident below. On the other hand the tonal accent of later elements of a compound, when they stand isolated, seems to be irrelevant to the resulting accent of a compound stressed word. This discovery is by no means unique for the investigated dialect but is generally true of Scandinavian dialects, as far as I know. The accent 1 and accent 2 rules in compound stressed words in the Malmö dialect are consequently based upon knowledge of the accent conditions in simple words and other words not having compound stress that may occur as a first element of a compound. The rules governing the accentuation in words not having compound stress in the actual dialect correspond by and large to those applying both to Standard Swedish and many other Swedish dialects. Here I will briefly sketch the most important regularities. The main grave accent rule in words lacking compound stress in Swedish may be formulated as follows: GRAVE ACCENT OCCURS IN WORDS CONTAINING AT LEAST TWO VOWELS (= SYLLABLES) AND WHERE THE STRESS, WHICH IS IN THE ROOT, IS FOUND ON THE FIRST SYLLABLE (what Linell 1972 calls the "standard solution"; see Öhman 1966, Teleman 1969). Consequently there must always be a syllable after the stressed syllable for grave accent to result. According to this version it is irrelevant, whether the word in question consists of only one root morpheme, e.g. s k ò l a ("school") or consists of ROOT + vocalic derivational or inflectional suffix, e.g. l à g + l i g (legal), ù n g + a (pl. of "young"). Acute accent is simply the accent occurring in other cases, i.e. when a stressed syllable does not meet the grave accent conditions, e.g. always when the stress is on the last syllable, which includes monosyllabic words. Among the words having both first and last syllables unstressed we will find both accent types. Acute accent is found in e.g. b e f á l l a ("to order"), e g é n t l i g ("proper"), f u n d é r a ("to ponder"), while e.g., v ä n ì n n a ("female friend"), p r o f e t ì a ("prophecy"), p r i n s è s s a ("princess") will have grave accent. Some exceptions to the grave accent rule above are a number of disyllabic or polysyllabic words of foreign origin, but by no means all of them. The tendency to use acute accent for this kind of words seems to be even stronger in the Malmö dialect than in Standard Swedish. A fair-sized number of words having a disyllabic stem ending in -er, -el or -en with the stress on the first syllable will also have acute accent. The words of this category have sometimes been regarded as monosyllabic in an underlying phonological form, since the e-vowel of the second syllable is omitted in certain alternation forms. This way, they do not meet the structural condition for grave accent given above, but will regularly be assigned the acute accent. A vowel insertion rule, ordered after the grave accent rule, then gives them their disyllabic surface form. The definite final article and the present tense ending are interpreted as non-vocalic in the underlying form, and cannot therefore influence the tonal accent.

Elert (1971) presents a "modified standard solution" (Linell 1972) of the main grave accent rule for Swedish. According to this rule grave accent will result in words, where the stressed syllable (which is in the root) is followed by an unstressed syllabic inflectional or derivational suffix. The difference between the standard version and Elert's version lies in the morphological interpretation of disyllabic word stems. While according to the standard version a word like s k ò l a is analysed as one morpheme, Elert makes a division into root and stem formative s k o l + a. Consequently, disyllabic words that cannot be divided into root and stem formative, especially words of foreign origin like p á j a s ("clown") do not meet the structural condition for grave accent and will regularly receive acute accent. Thus Elert's version does not need to regard disyllabic monomorphemic words as exceptions. Elert therefore interprets grave accent as a juncture, i.e. it signals morpheme boundary (in words not having compound stress), as it is - above all - words with a monosyllabic root followed by a vocalic inflectional, derivational or stem-forming suffix, that are characterized by grave accent. According to this interpretation a monomorphemic word may have grave accent only exceptionally. Grave accent presupposes two syllables and two morphemes. As a consequence of Elert's interpretation certain disyllabic and polysyllabic morphemes must, however, be lexically marked for grave accent, where the standard version would regularly have assigned them grave accent. It is evident that both versions of the grave accent rule have to count a certain number of exceptions.

Tonal accent in compound stressed words in the Malmö dialect

It has been known for a long time (Kock 1885) that certain South Swedish, especially Scanian dialects tend to use accent 1 in compounds to a considerable extent. In this respect they differ from most of the Swedish dialects (including Standard Swedish), where almost exclusively accent 2 is used in compound stressed words. Comparing the accent rules for compounds in Scanian dialects proposed by Kock with those concerning the Malmö dialect presented in the present study we will find many points of agreement. The tonal accent rules for compound stressed words in the Malmö dialect below are categorically formulated throughout, although they should preferably be regarded as strong tendencies rather than hard and fast rules. Variation in the choice of tonal accent may occur both inter- and intraidiolectally for certain types of compound words (cf. Malmberg 1972).

Rule (i): WORDS WITH GRAVE ACCENT IN THE FIRST ELEMENT WILL RETAIN THIS ACCENT INDEPENDENTLY OF THE CHARACTERISTICS OF FOLLOWING ELEMENTS.

We can observe that, if the first element has grave accent before the compounding takes place, this accent will not be shifted in a compound, independently of the prosodic structure of following elements: the tonal accent of following elements and the position of stress are unimportant. The only thing that is required is presence of a second element. Thus we need not have a special rule for these cases of compound stressed words. The correct accent is given already by the rule assigning tonal accent - in this case grave accent - to simple words and other words not having compound stress. E.g. s ò m m a r s t u g a ("summer cottage"), l ì n g o n s k o g ("cowberry forest"), k à f f e s e r v i s ("coffee-set"), t ì d n i n g s b u d ("newspaper-boy"), v ä r d ì n n e r o l l ("hostess role").

Rule (ii): WORDS WITH A MONOSYLLABIC FIRST ELEMENT DIRECTLY FOLLOWED BY A STRESSED SYLLABLE IN THE SECOND ELEMENT HAVE GRAVE ACCENT.

If the first element is monosyllabic and consequently lacks grave accent, a compound in which it occurs may have grave or acute accent depending upon the position of stress in later elements. Grave accent will result, if the second element is monosyllabic and stressed. If the second element is disyllabic or polysyllabic with stress on the first syllable, the whole compound will also receive grave accent, independently of the tonal accent of the second element. Further elements that may be added to this first compound do not change these predictions. E.g. s k ò l s a l ("schoolroom"), v å̀ r b l o m m a ("spring flower"), b à d h u s v å g ("bath-house scales"), r à k v a t t e n s f l a s k e t i k e t t ("label on a bottle of after-shave lotion").

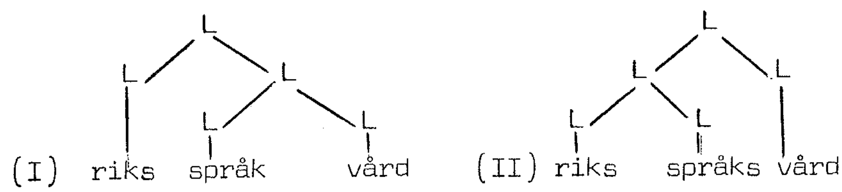
Rule (iii): WORDS WITH A MONOSYLLABIC FIRST ELEMENT DIRECTLY FOLLOWED BY AN UNSTRESSED SYLLABLE IN THE SECOND ELEMENT WILL RECEIVE ACUTE ACCENT.

If we consider a word having a monosyllabic first element and the second element of the word consists of more than one syllable and at least the first syllable of the second element is unstressed, the condition for grave accent disappears, and the acute accent of the first element is retained. This is true not only of second elements consisting of simple words having these characteristics but also of second elements consisting of derivatives with an unstressed prefix or a stressable suffix depriving the root of the stress or also lexical phrase stressed compounds. It is immaterial how many unstressed syllables will precede the stressed syllable in the second element. E.g. g á s p e d a l ("accelerator pedal"), g r ú p p t e r a p i ("group therapy"), h j ä́ r n k a p a c i t e t ("brain-capacity"), l á g f ö r s l a g ("law proposal"), f l ý g v ä r d i n n a ("air stewardess").

Rule (iv): WORDS WITH A MONOSYLLABIC FIRST ELEMENT FOLLOWED BY A SO-CALLED "JOINING"-S WILL HAVE ACUTE ACCENT.

A monosyllabic first element having a genitive-s in the junction before the second element (a so-called "joining"-s) will block the grave accent, independently of the position of the stress and the tonal accent of the second element. E.g. r ú m s r e n ("house-trained"), d á g s t i d n i n g ("daily newspaper"), t í d s k o n t r o l l ("time control").

Other first elements with acute accent will also retain their acute accent in compounds with a joining-s between the first and the second element. These cases would still receive acute accent by other applicable rules; hence we do not need to treat them separately. Even if a word with a joining-s added to the first element consists of more than two elements, the accent will not be altered. In a minimal pair like r i k s s p r å k-v å r d ("language standards in a national scale") and r i k s s p r å k s-v å r d ("language standards of the approved dialect") the contrasting words will both have acute accent, in spite of the difference in constituent structure illustrated below:



Thus the presence of a joining-s after the first element will neutralize the accent contrast in these cases, where otherwise only (I) would have received acute accent (cf. rule (v) below).

Rule (v): WORDS WHERE THE SECOND ELEMENT IS MORE INTIMATELY RELATED TO SUBSEQUENT ELEMENTS THAN TO THE FIRST, AND WHERE THE FIRST ELEMENT IS MONOSYLLABIC WILL RECEIVE ACUTE ACCENT.

A third and last case of monosyllabic first element receiving acute accent is the following which is somewhat similar to case (iii). If the second element is stressed on the first syllable and is more intimately connected to subsequent elements than to the first, the acute accent of the first element is retained (see section 'The dependence of tonal accent on constituent structure' above). In most cases the stress on the first syllable of the second element will be reduced and therefore words of this type will often have a superficial stress pattern that is similar to case (iii). E.g. b á r n d a g h e m ("children's day home"), f l ý g o l y c k a ("airplane accident"), s p r ǻ k v e t e n s k a p ("linguistics").

Rule (vi): A POLYSYLLABIC FIRST ELEMENT WITH ACUTE ACCENT ON THE FINAL SYLLABLE WILL GIVE ACUTE ACCENT TO THE WHOLE WORD.

First elements consisting of more than one syllable and having acute accent before the compounding takes place will as a rule give acute accent to the whole compound. Within this group we may discern:

I) Final stressed first elements of a compound where, even if the second element begins with a stressed syllable, grave accent is blocked. Belonging to this category may also be considered compounds, the first element of which is a lexical phrase stressed compound. E.g. b a n á n s k a l ("banana-skin"), s i g n á l o f f i c e r ("signalling officer"), h å l l i g ǻ n g b r u d ("go-go-girl"). Final stressed first element in compound stressed words is the only case, where presence of stress in the post-tonic syllable - i.e. in this case the first syllable of the second element - is not an obstacle to acute accent.

Rule (vii): WORDS WITH AN ACUTE POLYSYLLABIC FIRST ELEMENT AND NO STRESS ON THE LAST SYLLABLE WILL RETAIN THIS ACCENT IN COMPOUND STRESSED WORDS.

II) Acute disyllabic or polysyllabic first elements, stressed no later than on the penultimate syllable (including the initial stressed ones) will in most cases give acute accent to compound stressed words. E.g. l ǻ k r i t s s t å n g ("liquorice bar") b á n d y b o l l ("hockey ball"), c á n n a b i s b r u k ("use of cannabis"), n a r k ó t i k a- m i s s b r u k ("drug addiction"), k a d á v e r l u k t ("cadaverous smell").

I have chosen to classify the acute polysyllabic first elements into the two categories described above instead of forming one category of words with an unstressed beginning, including the final stressed ones, and another category consisting of only the initial stressed first elements. In the investigated dialect we do not find, however, any difference between final stressed first elements and other first elements having an unstressed beginning with regard to the tonal accent of the compound. But there seem to be dialects where a final stressed first element of a compound will determine grave accent, while other acute first elements with an unstressed beginning will not. Disyllabic words ending in -el, -er or -en form a sub-category within category II. Words with a first element from this category must be divided into those receiving acute and those receiving grave accent. It is hard to decide in every single case exactly what determines the resulting accent. I will return to this problem below. There is acute accent in c ý k e l b a n a ("cycle-track"), n é g e r-g h e t t o ("negro ghetto"), and grave accent in h à g e l s k u r ("hail-shower"), f å̀ g e l s k r ä m m a ("scarecrow").

Exceptions to the grave accent rule for compound stressed words

Negative exceptions. A number of compounds can be found that meet the conditions for grave accent according to the grave accent rule for compound stressed words and yet receive acute accent. These are exceptions to case (ii). Within this group we may find some regular sub-categories such as compound color adjectives like b l ǻ g r å ("blue-grey"), v í t r ö d ("white-red"), words with a monosyllabic numeral as the first element like t r é r u m-m a r e ("three room flat"), f é m t i d e n ("about five o'clock"), words with a verbal stem as first element, like s í t t p l a t s ("seat"), r í d h u s ("riding-house"); the past participle of particle-prefix verbs like ó m b y g g d ("rebuilt"), á v b r u t e n ("interrupted"). The list of negative exceptions to the grave accent rule is not exhausted by this brief sketch, but I consider it beyond the scope of the present study to go further into the remaining more or less regular exceptions.

Positive exceptions. As indicated above, the disyllabic words ending in -er, -el, -en with a fugitive e-vowel and having stress and acute accent on the first syllable will cause certain difficulties in predicting the resulting tonal accent of compound stressed words, where such words occur as a first element. On the one hand we find those receiving acute accent like other words belonging to case (vii), e.g. cýkelbana ("cycle-track"), tígerskinn ("tiger-skin"), i.e. retaining the same tonal accent as the simple words cýkel and tíger. On the other hand there exist words with grave accent, when they occur as a first element of a compound, e.g. fìngertopp ("finger-tip"), få̀gelsång ("bird song"), although they have acute accent in isolation: fínger, fǻgel. It is interesting to note that the plural forms of these simple words have the same tonal accent in the Malmö dialect as the compound words where they appear as a first element, i.e. grave accent in fìngrar, få̀glar and acute accent in cýklar, tígrar. The predictability of tonal accent in these disyllabic words ending in -er, -el, -en as a first element of a compound is, however, far from total. A separate study will be needed to give an account of the tonal accents of this group.

Analysis of factors governing the choice of tonal accent

A survey of the seven type cases is given in the following scheme indicating whether the tonal accent of the first element is retained or altered in the compounded word:

	Accent of first element	Accent of compound	Accent shift?
(i)	sòmmar ("summer")	sòmmarstuga ("summer cottage")	no
(ii)	mát ("food")	màtsal ("dining-room")	yes
(iii)	gás ("gas")	gáspedal ("accelerator pedal")	no
(iv)	rúm ("room")	rúmsren ("house-trained")	no
(v)	bárn ("child")	bárndaghem ("children's day home")	no
(vi)	banán ("banana")	banánskal ("banana-skin")	no
(vii)	bándy ("hockey")	bándyboll ("hockey ball")	no

Is it possible to find a common denominator for the different cases, where the tonal accent of the first element is retained in the types of compound and derivative discussed? It seems to be the case that if the syllable following the stressed syllable lacks stress, there will be no shift of tonal accent. This is independent of whether this unstressed syllable is a part of the first element as in s ò m m a r + s t u g a, b á n d y + b o l l, or of the second element as in g á s + p e d a l. The fact that properties of the post-tonic syllable would govern the choice of tonal accent is in agreement with the observations of Rischel (1963) and Haugen (1967) concerning East Norwegian. If the post-tonic syllable is in the first element, we need not take into account properties of the second element in order to predict the accent of the compounded word. This is found in case (i), where the first element has grave accent and in case (vii), where it has acute accent. In the remaining cases the post-tonic syllable is part of the second element, which must be taken into account in some cases. Presence of stress in the post-tonic syllable of a compound in the actual dialect will determine accent shift (to grave accent) for the compound (case (ii)) with the following exceptions. In the type case, where the first element is stressed on the final syllable and consequently acute, the stressed syllable may be followed by a stressed syllable without this affecting the resulting accent (case vi). Thus the tonal accent of a polysyllabic first element (cases i, vi, vii) will not be altered in a compound. Obviously an unstressed beginning is more powerful than stress in the post-tonic syllable. As is well known an unstressed beginning will have the same effect in the non-compounded words too, as in t à l a ("to speak"), b e t á l a ("to pay"), although in this case it is not a question of two stressed syllables coming together. Besides the phonological factors discussed - positions of unstressed and stressed syllables and the tonal accent of the first element - we also find a morphological factor governing the choice of tonal accent, the above mentioned joining-s blocking grave accent under the conditions stated above. Thus also in this case the properties of the second element are of no importance. To these factors must be added also the type of constituent structure (case (v)) which evidently blocks the accent change. This case, as mentioned above, will lose the stress in the post-tonic syllable and is thereby often superficially similar to case (iii), where this syllable, however, does not have any stress from the beginning. The question is, whether it is the stress factor that determines the tonal accent and not the constituent structure typical of case (v), as has been postulated. It is doubtful, however, whether the degree of stress in the post-tonic syllable is lower in case (v), j a̋ r n - d ö r r l å s, with its acute accent than in the expanded case (ii), j ä̀ r n d ö r r - l å s, with its grave accent. For the assumption to be true, that it is the reduced degree of stress in the post-tonic syllable that causes the accent to remain unchanged in e.g. j a̋ r n - d ö r r l å s, it is necessary to show that the stress reduction is performed according to another rule or other principles than those responsible for the stress reduction in j ä̀ r n d ö r r - l å s.

In order to be able to formulate rules for assigning tonal accent in compound stressed words, it is - as has been pointed out above - a prerequisite that we know the tonal accent of the first element. Then we need only formulate rules for the cases, when acute accent in the first compound element is altered to grave accent. First elements already possessing grave accent (case (i)), will always retain this accent in the compounds and derivatives discussed. Even in the above mentioned cases (iii) - (vii), where we have acute accent in the first element, the same accent is retained in the compounded word. The rule for changing the acute to the grave accent in compound stressed words in the actual dialect may then be formulated:

Rule I: ACUTE ACCENT IS ALTERED TO GRAVE ACCENT, WHEN IT OCCURS WORD-INITIALLY IN A MONOSYLLABIC FIRST ELEMENT AND THE SECOND ELEMENT BEGINS WITH A STRESSED SYLLABLE AND IS DIRECTLY CONNECTED TO THE FIRST ELEMENT.

As a first approximation the rule may be formalized as follows:

Rule I': [– tonal] ⟶ [+ tonal] / $[_{L}$ # [+ $\overline{\text{stress}}$] # [+ stress]

Type words not meeting the structural condition of the rule and therefore passing through it with an unaltered accent are the following: (i) s ò m m a r s t u g a, (iii) g á s p e d a l, (vi) b a n á n s k a l, (vii) b á n d y b o l l. Case (ii) s k ò l s a l is subject to the rule and will receive grave accent. Case (iv) r ú m s r e n and case (v) b á r n d a g h e m incorrectly have their accent changed, as the rule is formulated. In order to exclude even these cases the rule must be further constrained. Here the possibility of a cyclical rule application presents itself.

Cyclical or non-cyclical rules?

The cyclical rule application was introduced into phonology by Chomsky-Halle-Lukoff (1956) to generate stress degrees in compounds and phrases in English, and has since then been used within generative phonology by several authors above all in order to handle prosodic phenomena in different languages. The need for cyclical rules in prosody has been questioned in recent years, as far as Swedish is concerned by Elert (1970: 115): "... en cyklisk tillämpning av de prosodiska reglerna skulle utgöra en oekonomisk procedur. Den viktigaste anledningen till detta är, enkelt uttryckt, att blott en mycket ringa del av den information som ligger i den syntaktiska strukturen signaleras prosodiskt." Also Lindau (1970) and Teleman (1970) have used non-cyclical rules in describing prosodic phenomena of Swedish.

For the Malmö dialect we find a more complicated situation. The possibility of having different accents in the above mentioned example j ä r n d ö r r-l å s depending upon whether it is meant to be 'door-lock of iron' or 'lock for iron doors', might be regarded as an argument for the necessity of having a cyclical rule application in order to generate the correct accents in the Malmö dialect. In Standard Swedish both interpretations of the word have grave accent. The one interpretation j ä̀ r n d ö r r - l å s has the same structure as m å̀ t s a l s - b o r d (expanded case ii), while the other interpretation j ä́ r n - d ö r r l å s corresponds to case (v) b á r n - d a g h e m. Besides the grave accent rule in compound stressed words we would have to assume the existence of a deaccentuation rule saying that a stressed syllable between two other stressed syllables will be deaccentuated (see Teleman 1970!):

Rule II: [+ stress] → [- stress] / [+ stress] —— [+ stress]

After the application of the rule in all cycles only the stress of the first and the last element will remain in a compound; the other elements will be deaccentuated. If we assume furthermore that this deaccentuation rule is ordered before the grave accent rule in the cycle, we will have the following derivations:

$[_N[_N$'j ä r n$_N]$ $[_N[_N$'d ö r r$_N]$ $[_N$'l å s$_N]_N]_N]$

$[_N[_N$'j ä r n$_N]$ $[_N$'d ö r r 'l å s$_N]_N]$

1st cycle
deaccentuation not applicable
grave accent applicable

$[_N$'j ä r n d ȍ r r 'l å s$_N]$

2nd cycle
deaccentuation applicable
grave accent not applicable

= 'j ä r n ˌd ö r r 'l å s

The result for j ä r n - d ö r r l å s will be the acute accent (= stress), i.e. a retention of the accent of the first element, as the deaccentuation will remove the condition for the grave accent rule in the 2nd cycle. As a result of the deaccentuation of the mid element d ö r r, its grave accent will be neutralized too, as this accent can only occur in a stressed syllable. Thus we can account for case (v) too without modifying the grave accent rule for compound stressed words by letting the rule apply cyclically. The correctness of giving the deaccentuation such a form that the last element will retain its stress may be questioned. It is, however, a necessary condition for a cyclical rule application having the effect intended and giving the correct tonal accent. If the rule is formulated:

Rule III: [+ stress] ⟶ [− stress] / [+ stress] ... ___

which should imply that only the stress of the first element would be retained, we would get an incorrect result in one of the two cases, even if the order between the deaccentuation rule and the grave accent rule be changed.

The expansion of case (ii) j ä r n d ö r r - l å s can be handled without a cyclical rule application, but the correct tonal accent will result also with it on the assumptions given:

$[_N[_N[_N$'j ä r n$_N]$ $[_N$'d ö r r$_N]_N]$ $[_N$'l å s$_N]_N]$

$[_N[_N$'j ä r n 'd ö r r$_N]$ $[_N$'l å s$_N]_N]$

1st cycle
deaccentuation not applicable
grave accent applicable

$[_N$'j ä̀ r n ˌd ö r r 'l å s$_N]$

2nd cycle
deaccentuation applicable
grave accent not applicable

= 'j ä̀ r n ˌd ö r r 'l å s

The element j ä r n d ö r r will receive grave accent with the cyclical rule application before the stress reduction of d ö r r has taken place.

It remains to account for case (iv) r u m s r e n. Also with a cyclical rule application the accent will be shifted, which is an incorrect result. Obviously we must modify the grave accent rule so that a monosyllabic first element with a joining-s will not be subject to the rule. One possibility is simply to put a condition on the rule: Y = joining-s cannot occur between the first and second element for accent shift to take place:

Rule IV: $[-\text{ tonal}] \rightarrow [+\text{ tonal}]\ /\ [_L \#\#[+\ \overline{\text{stress}}]\ Y\ \#\ \ [+\text{ stress}]$

Another possibility presents itself. If we assume that the constituent structure of r u m s r e n is the following: $[_A[_N[_N\text{rum}_N]\text{s}_N]\ [_A\ \text{ren}_A]_A]$, we may use this information to block accent shift. The constituent structure will determine the positioning of the word boundary symbols in a construction. According to the convention given by Chomsky-Halle (1968:366) word boundaries will be placed as follows: "The boundary ## is automatically inserted at the beginning and end of every string dominated by a major category, i.e. by one of the lexical categories "noun", "verb", "adjective", or by a category such as "sentence", "noun phrase", "verb phrase", which dominates a lexical category." This would imply that r u m s r e n appears as follows, when word boundaries have been inserted (but with parentheses and labels suppressed): ## ## ## 'r u m ## s ## ## 'r e n ## ##. Between the first and the second stressed syllable there are three word boundary symbols, i.e. one more than in case (ii) m a t-s a l, which has the following appearance:

$[_N[_N\text{m a t}_N]\ [_N\text{s a l}_N]_N]$ or ## ## 'm a t ## ## 's a l ## ##

This difference may be used in the rule to prevent case (iv) r u m s r e n from getting grave accent. But now it appears that case (v) after an analysis into word boundaries will also get three word boundary symbols between the first and the second stress:

$[_N[_N \text{b a r n}\,_N] \; [_N[_N \text{d a g}\,_N] \; [_N \text{h e m}\,_N]_N]_N]$ or

'b a r n ## ## ## 'd a g ## ## 'h e m ## ##

The number of word boundaries between the elements, being a direct reflex of the constituent structure, may be said to express the degree of separation between them. Both cases (iv) and (v) thus have a higher degree of separation between the first and the second element than case (ii). If we now set a limit - maximally two word boundaries may separate the elements - quite correctly only case (ii) will change accent:

Rule V: $[-\text{tonal}] \longrightarrow [+\text{tonal}] \;/\; [_L \#\# [+\overline{\text{stress}}]\; \#\#^2\; [+\text{stress}]$

What we expressed as a direct connection between the first and the second element above, we may now formalize as maximally two word boundaries between the elements. It is not necessary to go via word boundary symbols in order to express the degree of separation between the compound elements. It may equally well be read off directly from the constituent diagrams, e.g. with the aid of the number of parentheses separating the elements, although this may not be an established method in phonology. The important thing is that there is independent grammatical motivation for postulating a difference in constituent structure in the cases discussed. The direct connection, which we found in case (ii) will be signalled by a grave accent (connective function), while in cases (iv) and (v) the absence of grave accent may be regarded as expressing the absence of such a direct connection. But now the necessity of having a cyclical rule application of the tonal accent also in case (v) will disappear, the only case that motivated a cyclical application. It is perfectly possible to let the rule operate directly from left to right. Having the grave accent rule run through every cycle will entail especially for long compounds complicated derivations, as we are first forced to assign tonal accent to every element meeting the conditions, and later deaccentuate every element except the first one. The cyclical rule application obscures the fact that only properties of the first element and in certain cases of the second element determine the tonal accent of the compounded word, which will be clearly expressed in a non-cyclical application of the grave accent rule.

Somehow we must indicate in the rule that a monosyllabic first element with a joining-s (case (iv)) does not change the accent. Now when we are using for case (iv) the condition "maximally two word boundaries" ($\#\#^2$), this will automatically be applicable to case (v) too. Hereby we will get a simpler description with a non-cyclical than with a cyclical rule application. This may be illustrated by comparing the earlier described cyclical derivation of j ä r n - d ö r r l å s and j ä r n d ö r r - l å s with a non-cyclical one. We assume in a non-cyclical rule application that the grave accent rule precedes the deaccentuation rule. This later rule may be given the form:

Rule VI: [+ stress] → [- stress] / [+ stress] ... ___

This rule deaccentuates all other elements than the first:

I. ## ## 'j ä r n ## ## ## 'd ö r r ## ## 'l å s ## ## ##

grave accent not applicable
deaccentuation applicable

= 'j ä r n ,d ö r r ,l å s ('dörrlås av järn')

II. ## ## ## 'j ä r n ## ## 'd ö r r ## ## ## 'l å s ## ##

grave accent applicable
deaccentuation applicable

= 'j ä̀ r n ,d ö r r ,l å s ('lås för järndörr')

It is hard to see anything speaking in favour of the standpoint that a cyclical rule application is more reasonable than a non-cyclical. We will, however, reach the same result with a cyclical application - if we add a rule deaccentuating the last element too - but the psychological reality of this procedure may be questioned: Is it conceivable that you have to account for the tonal accent of every element, when only the tonal accent of the first element has any importance to the choice of accent in the compound? A non-cyclical derivation will give this information directly.

Tonal accents in compound stressed words in Standard Swedish

It is a well known fact that in Standard Swedish the majority of the compound stressed words will receive grave accent, which will happen independently of whether the elements building up the compound have acute or grave accent in isolation. Alternatively one might express the above mentioned fact by saying that those initial elements of a compound having grave accent in isolation, will retain this accent in compounds, while acute accent in corresponding cases will be shifted to grave accent (cf. Elert 1971). Thus grave accent will be found in a compound like t à x i-c h a u f f ö r ("taxi-driver"), where the simple words t á x i and c h a u f f ö́ r each has acute accent. It is the stressed syllable of the first compound element that will begin the domain of the grave accent extending to the stressed syllable of the last element. Exceptions to the otherwise highly productive grave accent rule in Standard Swedish are above all lexical phrase stressed compounds and certain lexicalized compounds, i.e. the names of the days of the week, certain place and personal names and yet other words like r í k s d a g ("parliament"), v é r k-s t a d ("workshop"), t r ä́ d g å r d ("garden") etc. Certain lexical phrase stressed compounds may receive grave accent, but the determining factor is not the same in these words as in compound stressed words. The presence of another stressed syllable independently of its position in relation to the first stressed syllable can be regarded as the determining factor for the grave accent in compound stressed words. All of the seven type cases would in Standard Swedish receive grave accent, while in the Malmö dialect only two cases will have grave accent, as has been pointed out above. Factors other than two stressed syllables are irrelevant to the tonal accent of compound stressed words in Standard Swedish.

Tonal accents in compound stressed words in Norwegian

According to Haugen (1967) the difficulties of formulating absolute rules for the tonal accents in compounds in Norwegian are great. There is considerable vaccillation both regionally, socially and individually. Haugen notes, however, the following tendencies for the distribution of tonal accent in compound stressed words in Norwegian:

1) A compound word with a polysyllabic first element will have the tonal accent of this element. Exceptions to this first rule are disyllabic first elements with a facultative -e- in front of -l, -n, -r and also some first elements consisting of prepositions and adverbs. Thus these exceptional cases have acute accent as independent words, but their accent will be changed, when they occur as the first element of a compound.

2) For compounds with a monosyllabic first element, the first syllable of the second element - i.e. the second syllable of the word - will determine the tonal accent of the whole compound. The second element is normally tone-bearing, i.e. it causes the accent to be changed in the compound, unless a) it has a weaker degree of stress, b) it is a noun or adjective preceded by an inflected noun (in -s) or adjective-adverb (in -t), c) it is a verb preceded by a stressed particle, or d) it is a noun preceded by a verb. The last three subrules have the common feature that the first element is relatively loosely attached to the second element. The lack of grave accent stresses this fact. An example of case 2c) is ú t t a l e ("to pronounce") with the acute accent as against ù t t a l e ("pronun-

ciation"), which is accentuated as a regular compound.

3) Finally a number of compounds of foreign origin or connection are non-tonal, i.e. they have acute accent.

The interesting thing is that the Malmö dialect exhibits a considerably better agreement with Norwegian (East Norwegian) than with Standard Swedish in regard to the distribution of tonal accent in compound stressed words. Five out of the seven type cases have the same tonal accent in Norwegian as in the Malmö dialect. Only case (iii) and (v) will not be found among the regularities described by Haugen. The similarity is not confined to five cases but is also true of certain words belonging to the subcategories of 2) above.

Summary

The distribution of tonal accent in compound stressed words (i.e. compounds and other words having the same stress pattern as compounds) in the Malmö dialect has been investigated. In most cases the tonal accent of the first element of a compound is directly decisive of the tonal accent of the whole compound. Therefore it is important to know the distribution of tonal accent in simple words and in other words that can appear as the first element of a compound in order to determine the tonal accent of the compound. The distribution of tonal accent in simple words in the Malmö dialect is in agreement with that of Standard Swedish, as it is described by Öhman 1966, Teleman 1969 or Elert 1971. The main rule for grave accent in simple words could in one version be formulated: Accent 2 will result, if there is at least one vowel (syllable) following the stressed syllable of the word; in other cases accent 1 will appear. This rule must count a not negligible number of exceptions, but it could be said to be a relatively good approximation.

The distribution of tonal accent in compound stressed words in the Malmö dialect can be described with reference to phonological and morphological factors. The following scheme of seven type cases accounting for the tonal accent in the majority of the compound stressed words and being regarded as productive rules, is based upon information about the tonal accent of the first compound element, the positions of the stressed syllables, presence and position of "joining"-s and the constituent structure:

Case (i): WORDS WITH GRAVE ACCENT IN THE FIRST ELEMENT RETAIN THIS ACCENT.

" (ii): WORDS WITH A MONOSYLLABIC FIRST ELEMENT DIRECTLY FOLLOWED BY A STRESSED SYLLABLE IN THE SECOND ELEMENT HAVE GRAVE ACCENT.

" (iii): WORDS WITH MONOSYLLABIC FIRST ELEMENT DIRECTLY FOLLOWED BY AN UNSTRESSED SYLLABLE IN THE SECOND ELEMENT RECEIVE ACUTE ACCENT.

" (iv): WORDS WITH A MONOSYLLABIC FIRST ELEMENT DIRECTLY FOLLOWED BY THE SO-CALLED "JOINING"-S RECEIVE ACUTE ACCENT.

" (v): WORDS WHERE THE SECOND ELEMENT IS MORE INTIMATELY RELATED TO SUBSEQUENT ELEMENTS THAN TO THE FIRST, AND WHERE THE FIRST ELEMENT IS MONOSYLLABIC, HAVE ACUTE ACCENT.

" (vi): WORDS WITH FINAL STRESSED FIRST ELEMENT RECEIVE ACUTE ACCENT.

" (vii): WORDS WITH POLYSYLLABIC FIRST ELEMENT HAVING PENULTIMATE (OR EARLIER) STRESS AND ACUTE ACCENT RECEIVE ACUTE ACCENT.

The seven type cases are examplified in the following scheme also indicating whether the compound has got the same tonal accent as its first element:

	Accent of first element	Accent of compound	Accent shift?
(i)	s ò m m a r ("summer")	s ò m m a r s t u g a ("summer cottage")	no
(ii)	m á t ("food")	m à t s a l ("dining-room")	yes
(iii)	g á s ("gas")	g á s p e d a l ("accelerator pedal")	no
(iv)	r ú m ("room")	r ú m s r e n ("house-trained")	no
(v)	b á r n ("child")	b á r n d a g h e m ("children's day home")	no

Accent of first element		Accent of compound	Accent shift?
(vi)	b a n á n ("banana")	b a n á n s k a l ("banana-skin")	no
(vii)	b á n d y ("hockey")	b á n d y b o l l ("hockey ball")	no

With the sole exception of case (ii) the compound has the same tonal accent as the first element. The factor determining the accent change in case (ii) is the position of the stress in the second element. If the stressed syllables of the second element and the monosyllabic first element are closely connected, i.e. are not separated by an unstressed syllable (case (iii)) or by a morphological factor such as the "joining"-s (case (iv)) or by the closer connection of the second element to the third than to the first element (case (v)), there will be an accent change (cf. the connective function of the grave accent!). If the first element is polysyllabic its tonal accent will be preserved (case (i), (vi) and (vii)). Consequently we need to formulate a special compound rule only for case (ii), i.e. when acute accent is altered to grave. The tonal accent of other compound stressed words is given already by the rules applying to simple words and other words appearing as the first element of a compound. The rule shifting acute to grave accent in compound stressed words may be formulated:

$$[-\text{ tonal}] \longrightarrow [+\text{ tonal}] \;/\; [_{L}\ \#\#\ [+\ \overline{\text{stress}}]\ \#\#^{2}\ [+\text{ stress}]$$

The constraint 'maximally two word boundaries between the first and the second element' ($\#\#^2$) will prevent case (iv) and (v) from accent shift. According to the conventions inserting ## given by Chomsky-Halle (1968) the result for these type cases would be more than 2 ## between the first and the second element:

(iv) ## ## ## 'r u m ## s ## ## 'r e n ## ##

= 3 ##

(v) ## ## 'b a r n ## ## ## 'd a g ## ## 'h e m ## ## ##

= 3 ##

Case (ii) would however meet the condition ($\#\#^2$):

(ii) ## ## 'm a t ## ## 's a l ## ##

= 2 ##

For the grave accent rule in compound stressed words a cyclical rule application would have been a less direct way of arriving at the correct result than a non-cyclical application; therefore it could be dispensed with in this connection.

Comparing the compound tonal accent rules for the Malmö dialect with those applying to other Scandinavian dialects we find a considerably better agreement (five out of seven cases) with Norwegian than with Standard Swedish (only two cases), where we find grave accent in almost all compound stressed words.

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CONSTANCY AND VARIATION IN SWEDISH WORD ACCENT PATTERNS

Eva Gårding and Per Lindblad

INTRODUCTION

0.1. Goals

The Scandinavian languages are famous for their word accents. In these languages a stressed syllable is connected with one of two accents usually called acute (Accent 1) and grave (Accent 2). Both accents occur in polysyllabic words but monosyllables can only have the acute accent. The great majority of the polysyllabic words have predictable accent. The rules that assign the correct accent to a word are morphologically and phonologically determined and apply rather uniformly to all Scandinavian languages. The phonetic manifestations of the accents, however, occur in a bewildering variety. In Norwegian and Swedish, every major dialect or group of dialects uses characteristic pitch patterns for the two accents and in Danish they are distinguished by the presence or absence of stød (a kind of glottal stop). This variation has intrigued generations of scholars and made the word accents one of the favourite themes of Scandinavian phonetics. Going through the literature of the past decades we do indeed find a large number of papers and dissertations that deal with the subject from various angles, for instance for Swedish:

Data collection and description, acoustic analysis: Fant (1954, 59), Malmberg (1959), Witting (1961, 68).

Perceptual aspects: Malmberg (1955, 67), Hadding (1961), Jassem (1963), Segerbäck (1966), Johansson (1970).

Aspects of speech recognition: Svensson (1971), Lindblom and Svensson (1973).

Physiological aspects: Öhman et al. (1967), Gårding et al. (1970), Lindqvist (1972).

Timing and coordination of speech signals: Öhman (1965), Eriksson and Alstermark (1972).

Models: Öhman (1967), Gårding (1970).

Programs for synthesis: Liljencrants (1971).

Linguistic analysis: Malmberg (1962), Elert (1964, 70, 71), Öhman (1966), Teleman (1969, 70), Lindau (1970), Linell (1972).

But in spite of all this activity it is not exaggerated to say that we lack a representative post-spectrograph collection of data that shows us how the tone accents behave in different kinds of speech in different parts of the country.

The primary goal of our project (from which this is the first report) is to supply a set of registrations of accents produced in systematically varied contexts by systematically chosen speakers.

There are a large number of questions that we want to ask this material. For instance:

1. Is it possible to set up reasonable rules by which we can generate all the observed contours for a given speaker?

2. Can we make these rules general enough to fit all the speakers of a given dialect?

And the most ambitious question:

3. Given a set of rules for different dialects, can we write the rules in such a way that they fit the whole language area and bring out similarities and dissimilarities satisfactorily?

The last question is treated in the third chapter, entitled Form by Substance. This elliptic phrase also recalls what we regard as an essential theme in the works and teaching of Bertil Malmberg. We dedicate our paper to him on the occasion of his sixtieth birthday.

0.2. Outline

Chapter 1 contains the preliminaries to our work. For the benefit of the reader who is not familiar with the Scandinavian languages we have collected some of the most important facts about the word accents in Section 1.1.

The manifestation rules that the presentation of our new accent data is leading up to will be given in terms of an analysis of Swedish accents which developed from a critical study of Öhman's work on intonation (Öhman 1967, Gårding 1970). Öhman's original model and the revised model will be summarized in 1.2. The choice of dialects and speakers was motivated by a study of Meyer's Intonation im Schwedischen with its collection of word accent data from the whole Scandinavian language area (1.3.). Our selection of speech material will be presented in 1.4. Measurements and their acoustic and physiological background will be treated in 1.5.

Chapter 2, Accent manifestations, contains our new data, their description and interpretation in the following order:

2.1 Stockholm

2.2 Skåne

2.3 Gotland

2.4 Västergötland

Chapter 3, Form by substance, will summarize similarities and dissimilarities in the word accent data presented in Chapter 2. Tentative general rules will be set up.

0.3. Prosodic analysis and terminology

Our prosodic transcription of Swedish words uses length for vowels, three degrees of stress (primary, secondary and no stress) and the grave accent. The grave accent can only occur in connection with primary stress. In accordance with common usage, primary stress, which has not the grave accent, will be called the acute accent. The following symbols are used: /ˊ/ for the acute accent (primary stress), /ˋ/ for the grave accent. Secondary stress is marked by a vertical accent mark on the line /ˌ/. The position of the accent symbols shows the onset of the stressed syllable.

To obtain simple rules that generate fundamental frequency contours for utterances of varying segmental composition, we need the syllable as a reference unit. Hence the location of the syllable boundaries becomes important. The syllabification used in the sequences of our material agrees with earlier analyses (e.g. Gårding 1967, Ch.1 and 1971). A stressed syllable in non-final position has the structure ...V:- or ...VC-.

In certain cases, e.g. for Skåne acute, the morpheme may be a more adequate reference unit than the syllable (see 2.2).

Another reference unit which has been found useful in the rules for a certain dialect (Västergötland) is the mora. According to our analysis a stressed vowel counts two morae and an unstressed syllable one mora in non-final position. For examples of our morphological analysis, transcription, and syllabification, see Table 1.1.

We should like to emphasize that we regard our analysis as preliminary.

Chapter 1

PRELIMINARIES

1.1. Some facts about the accents

The accents will be described in relation to other prosodic features, morphological structure and juncture. Some examples are presented in Table 1.1.

A simple word has one stressed syllable. Length can only occur with stress. Compounds and derivatives may have two stressed syllables, here analysed as primary and secondary. The grave accent is always combined with primary stress. Other primary stresses are called acute accents. The great majority of Swedish words are stressed on the first syllable. A considerable number of polysyllabic words have stress on the second syllable and there are many tetrasyllabics with stress on the third. French loans (of recent date) are stressed finally.

The acute accent can occur in any syllable irrespective of the word boundary, but the grave accent never occurs in the last and has a strong predilection for the first. All monosyllabics carry the acute accent. An overwhelming majority of initially stressed bisyllabics have the grave accent.

Monosyllabic roots have the acute accent in accordance with the phonological rule stated above. Bisyllabic roots with stress on the first syllable may have either of the two accents. A great number of unstressed inflectional suffixes (e.g. plural suffixes for nouns, the past tense suffix etc.) require the grave accent in the preceding root. Hence a root morpheme with the acute accent as a free stressed form will have the grave accent when combined with these suffixes. Examples are found under (4), Table 1.1.

A small number of unstressed inflexional suffixes do not change the accent of the root morpheme. A statistically very important group here is the definite suffix for nouns (Examples under [3]). Compounds and derivatives usually have the grave accent (Example [6]).

A knowledge of the morphological structure of the words makes it possible to predict the distribution of the accents for a large part of the vocabulary. (For a discussion of various solutions to these problems in the framework of generative grammar, see Linell 1972.) There are about 350 so called minimal pairs but the morphological structure of the members of a pair differs in most cases (Elert 1971).

A great deal of discussion has been devoted to the surface manifestations of the accents and their alleged dynamic or tonal character has been a moot question in the phonetic discussion and literature (e.g. Gjerdman 1952, 54, Malmberg 1953, 55, 59).

The notation of the Dictionary of the Swedish Academy (acute: $\overset{4}{\text{a}}$nd$\overset{0}{\text{e}}$n, grave: $\overset{3}{\text{a}}$nd$\overset{2}{\text{e}}$n) implies an interpretation of the different manifestations of the accents as a difference in stress distribution.

The accents are not marked by the orthography. Native speakers normally do not make any accent mistakes. As a rule interdialectal understanding is not hampered by a lack of the accent distinction in one of the interlocutors (as may be the case when a Swede talks to a Swedish speaking person from Finland). A dialectal difference in pitch pattern is of course noticed but does not impede communication (see discussion in Malmberg 1955 and 1962). Differences in pitch patterns are in fact less striking to a native speaker than differences in distribution rules. There are some categories of words that are assigned different accents depending on the dialect.

Foreigners have great difficulty in mastering the accents. This holds for pronunciation as well as rules. The grave accent is often mistaken for a word stressed on a later syllable. The rendering of French oxytones

Table 1.1. Categories of words carrying the acute or grave accent

	Acute (Accent 1)					Grave (Accent 2)			
	conventional spelling	phonetic transcription with syllabification	morphological structure	translation		conventional spelling	phonetic transcription with syllabification	morphological structure	translation
(1)	and	[ˊand]	(and)	duck	(2)	ande	[ˋan-dɛ]	(and)(e)	spirit
	Polen	[ˊpo:-lɛn]	(po:lɛn)	Poland		påle	[ˋpo:-lɛ]	(po:l)(e)	pole
	café	[kaˊfe:]	(kafe:)	coffee-shop		ända	[ˋɛn-da]	(ɛnd)(a)	end
						russin	[ˋrʉs-sin]	(rʉsin)	raisin
(3)	anden	[ˊan-dɛn]	(and)(n)	the duck	(4)	andar	[ˋan-dar]	(and)(e)(ar)	spirits
						pålar	[ˋpo:-lar]	(po:l)(e)(ar)	poles
	änder	[ˊɛn-dər]	(änd)(r)	ducks		ändor	[ˋɛn-dɔr]	(ɛnd)(a)(or)	ends
	änderna	[ˊɛn-də(r)-na]	(änd)(r)(n)(a)	the ducks		ändorna	[ˋɛn-dɔ(r)-na]	(ɛnd)(a)(or)(n)(a)	the ends
(5)	tisdag	[ˊti:s,da(g)]	(ti:s)(da:g)	Tuesday	(6)	badrum	[ˋba:d,rʉm]	(ba:d)(rʉm)	bathroom

(early loans) in Swedish as grave accents shows that there is more similarity between these categories than between oxytones and the acute accent. Example under (2).

1.2. Models

Öhman (1967) used a very suggestive and inspiring intonation model to analyse and generate the pitch curves of various dialects in statement intonation. The components of his model are stepfunctions, which represent the on- and offset of nerve signals. Generally speaking, the model transforms these stepfunctions to pitch curves by a physically and physiologically motivated smoothing procedure. There are two linguistic elements in his treatment of Swedish, tone accents and sentence intonation. Tone accents (acute and grave) are generated as negative pulses, superimposed on a positive step which represents sentence intonation. By timing the pulse in various ways in relation to the step, Öhman obtained the configurations that he needed to approximate tone accents in different dialects. According to Öhman's model then, dialectal variation is the result of a difference in timing between the pulse and the step. The acute accent of one dialect (e.g. Stockholm) may have the same time order between the pulse and the step as the grave accent in some other dialect (e.g. Skåne). Öhman tried to correlate the negative pulse to some activity pattern in the vocalis and cricothyroid muscles with pitch inhibiting effect. An EMG investigation with probes into these muscles failed to support his hypothesis, however (Öhman et al. 1967).

A revised model was suggested by Gårding (1970). According to this model the fundamental frequency of a Swedish utterance is the combined result of responses to sentence intonation, stress and one tone accent. It has some support in an EMG investigation (Gårding et al. 1970) which showed that similar activities - pulses - were found in two pitch controlling muscles (m. vocalis and m. cricothyroideus) both in connection with falls and with rises. Whether a syllable has rising or falling pitch may depend on how it is timed in relation to these pulses. In the two speakers and the speech material used for the EMG investigation, no need was felt for a special pitch-inhibiting or pitch lowering mechanism in connection with the tone accents. A fall could be explained as a consequence of a relaxation of muscles that had been activated earlier. All the pitch movements, then, could be regarded as the result of differently timed positive pulses. The revised model has also support in the pitch curves collected by Meyer. From what can be seen in his data (cf. Fig. 1.1), a common feature of the grave accented words in the great majority of the dialects was that in the later parts of their contours the grave words repeated the pitch movement of the acute ones. This repeated part was interpreted as a "delayed sentence intonation" (Gårding 1970 p. 42). A similar view had been advanced by Haugen (Haugen and Joos 1954).

The new data to be presented in Chapter 2 makes it possible to develop this model a bit further.

1.3. Dialects

According to the analysis of the tone accent data made by Meyer (1937 and 1954), the so-called Svea dialects (Central Sweden) axhibit two kinds of intonation, Svea intonation proper and the Mining district intonation (Bergslagen). Meyer uses slightly schematized pitch curves of bisyllabic words with contrastive accents to show the difference between these two dialectal types. In the Svea intonation, the acute accent has a peak towards the end of the first syllable and the grave accent has a peak in the second syllable which is preceded by a fall in the first syllable. The accents of the Mining district have one peak each but

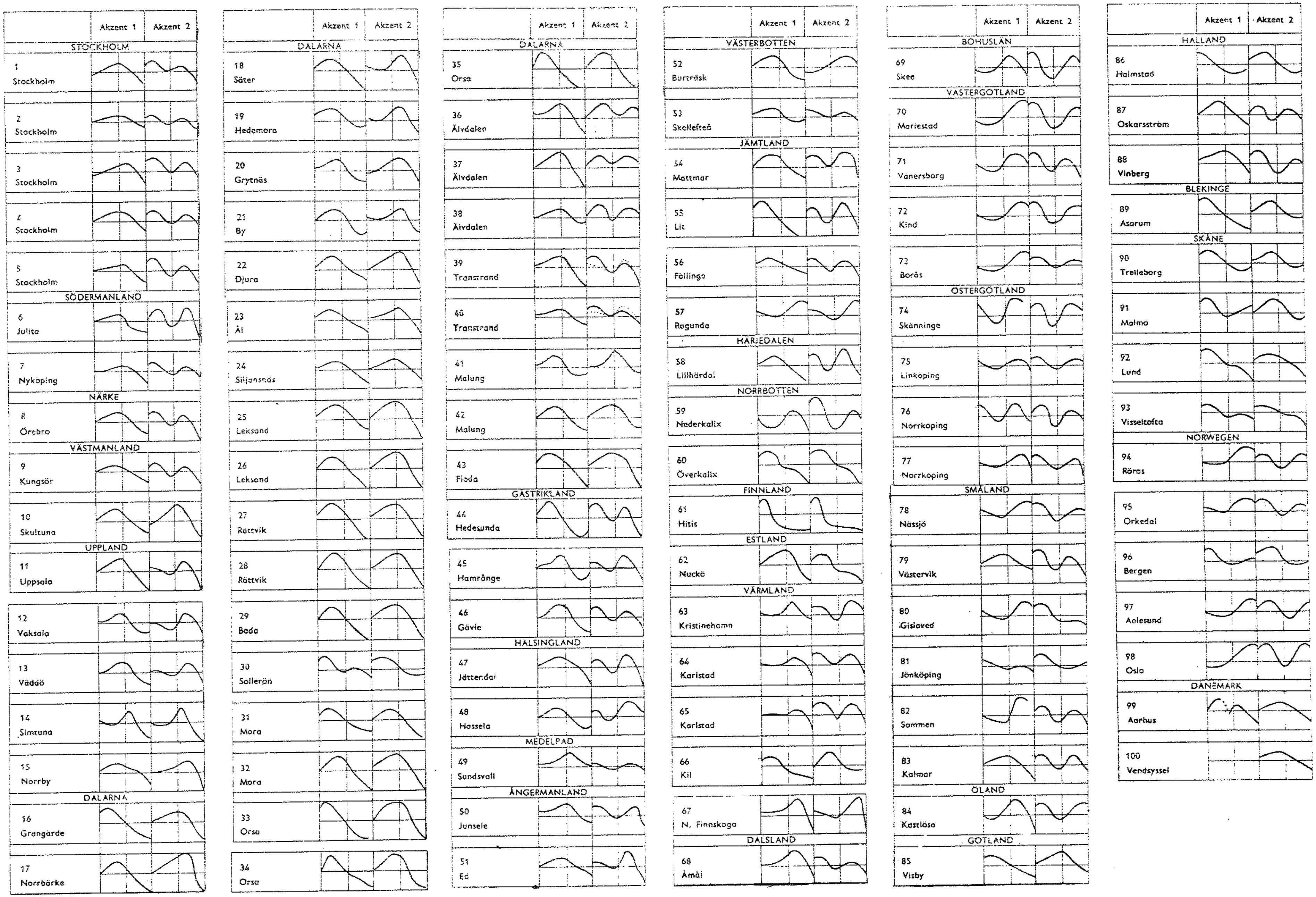


Figure 1.1. Schematic acute and grave pitch patterns of a hundred Scandinavian dialects according to E.A. Meyer: Die Intonation im Schwedischen, part II. From Öhman 1967.

the peak comes later in the grave words. In Part I, which deals with the Svea dialects, Meyer also mentions in passing a third type of intonation common to the Göta dialects (between Southern and Central Sweden). By a systematic treatment of Swedish intonation and tone accent variation Meyer made an essential contribution to Scandinavian dialectology. Part II which deals with the dialects of the north was edited posthumously. It has no summary or analysis of the data, but concludes with a collection of pitch curves representing all the different dialects investigated by Meyer. Figure 1.1 which gives an idea of the pitch variation connected with the Scandinavian accents uses Meyer's data collected in Part II.

The criteria that were used by Meyer for a characterization of the Svea and Mining district dialects can also be used for the rest of his material. The following table shows a tentative tonal typology based on Meyer's material of bisyllabics.

Table 1.2. Tentative tonal typology for accents in Swedish dialects

	Accent 1	Accent 2	Region
Type 0	one peak	one peak	
	In the stressed syllable No distinctive difference	In the stressed syllable	Isolated marginal cases in the far North, Finland
Type 1	one peak	one peak	
Type 1A	Early in the stressed syllable	Late in the stressed syllable	South (former Danish provinces)
Type 1B	Late in the stressed syllable	Early in the posttonic syllable	Gotland (in the Baltic), Dalecarlia
Type 2	one peak	two peaks	
Type 2A	In the stressed syllable	One in each syllable	Central Sweden (Svea dialects)
Type 2B	In the posttonic syllable	One in each syllable	Between Southern and Central Sweden (Göta dialects)

Type 0 is represented by the dialects that do not possess a tone accent contrast: Swedish dialects in Finland, and dialects in the north of Sweden.

Type 1A is represented by dialects in the South of Sweden (numbers 90–92 in Fig. 1.1). Dialects in Dalecarlia (Central Sweden) and Gotland are examples of Type 1B (number 16–29, 85).

Type 2A contains by far the most common patterns. Dialects in Halland (87, 88), in East Småland (79, 83), and Central Swedish dialects (1–9, 44–48) belong to this type. The Göta dialects (Västergötland and Östergötland), Bohuslän, Dalsland, and Värmland are representatives of 2B (63–77, 94, 95, 97, 98).

Figure 1.2 presents a tonal dialect map for Sweden which has been made in collaboration with Benson, following principles developed at the Dialect Archives at Lund University. (For other applications of these principles, see Benson 1958 and 1970). A symbol in the map refers to our interpretation of Meyer's data. The accent typology has later been extended to embrace all Scandinavia (Gårding 1973).

The four tonal types of contrastive accents found in Meyer's material motivated the choice of speakers for our investigation.

1A	Skåne	Speakers EG, PL
1B	Gotland	Speakers ALa, TS
2A	Stockholm	Speakers CS, CÖ
2B	Västergötland	Speakers JA, ALö

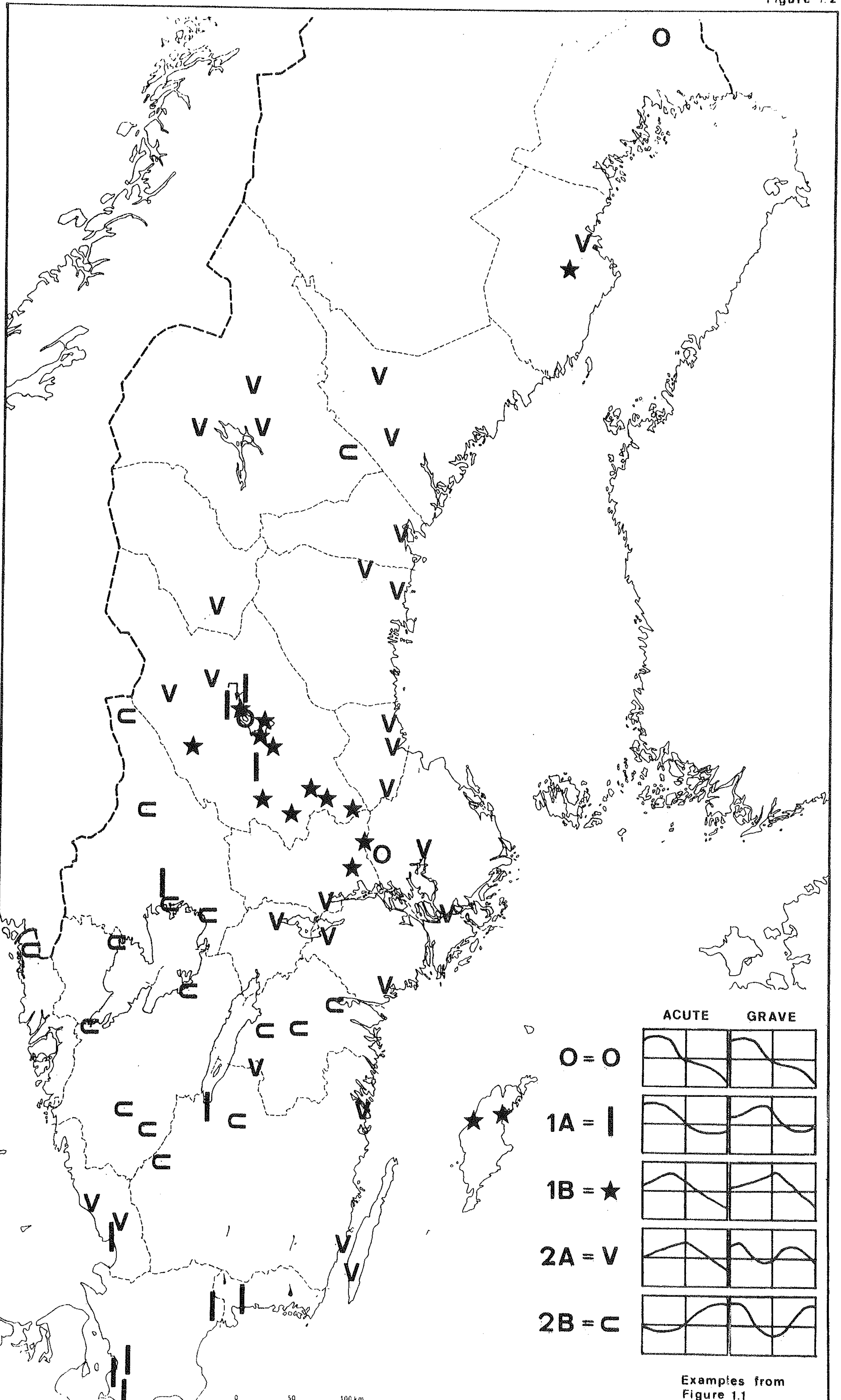
For further information about our speakers see Appendix 1.

1.4. Material

The core of our material consists of Swedish words of one, two, three, and four syllables with stress on the first. About one half of the words carry the acute accent, the other half the grave accent. The words are

Geographical distribution of the accent types of Table 1.2.

Figure 1.2



listed in Appendix 2. In the list there are several minimal pairs of varying phonetic shapes where the two members are contrasted by accent, e.g. Polen [ˊpo:lɛn], pålen [ˋpo:lɛn], änderna [ˊɛndəna], ändorna [ˋɛndəna].* These pairs and the monosyllabic Pål [ˊpo:l] will receive special attention. The fact that the members of the two pairs are spelled differently turned out to be a great asset. Helped by the spelling the speakers gave more consistent responses to these test items than to the other ones. Part of our test words are compounds. They will not be treated in this report. There are a few nonsense words in our list. These words could not be used with non-linguist speakers and even with phoneticians they tended to create confusion. We also tried to make our speakers produce nonsense words of four syllables contrasted by accent but with limited success.

The test words appear both isolated as utterances and embedded in a carrier sentence in four different contexts, namely as neutral and emphatic statements and as neutral and emphatic questions. Every word then appears eight times in a regular test situation.

For statements the frame jag såg – där (I saw – there) was used with the test word in stressed position. To make the frame natural for questions, the word order and the pronoun had to be changed: såg du – där (did you see – there). The stress conditions were the same as for statements.

To secure the elicitation of intonation patterns that had about the same attitudinal meaning for various speakers, a situational context was described on the test sheet for each of the four prosodic series.

These descriptions were as follows:

Neutral statements: With frame: "Imagine that you are saying the following sentences as neutral pieces of information". Without frame: "The sentences are meant to be answers to questions like, Who is coming? What did you see?"

---

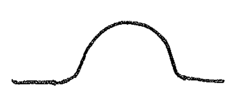
* In the last word the pronunciation of the second vowel varies, [ɔ], [u], [ə].

Emphatic statements. For each sentence a contrasting clause was added in brackets on the test sheet, for instance, Jag såg Pål där (but not Per).

Neutral questions. With frame: "Ask the questions with a moderate degree of interest". Without frame: "You think you have heard the test word but you ask to be on the safe side".

Emphatic questions. A contrasting clause was added as above. "Did you see Pål there?" (not Per).

Up till now we have made recordings with eight subjects, each dialectal area being represented by two speakers (Appendix 1). A recording session was preceded by a short training period. The training lasted until the speakers felt secure and at ease and knew what prosodic pattern they were going to use for a certain situation. It was often difficult to get emphatic responses, particularly from those speakers who were not used to our laboratory. An additional complication is of course that emphasis is a graded expression for a graded feeling. There seem to be two prosodic extremes for emphasis. Judged by the pitch curve, one is just slightly different from the unemphatic contour. The other uses low pitch for the frame and spreads the direction changing movements of the contour over the emphasized word. The two extremes can perhaps be transcribed and their fundamental frequency curves schematized as follows.

Neutral	Low emphasis	High emphasis
1 2 1 jaso:po:ldɛ:r	1 3 1 jaso:po:ldɛ:r	1 1 3 1 1 1 jaso:| po:l| dɛ:r
		
jaso:po:ldɛ:r	jaso:po:ldɛ:r	jaso:po:ldɛ:r

The vertical lines in the transcription of the highly emphatic sentence indicate a slowing down of tempo in connection with the main stress (phrase juncture). Judged according to the given scale our speakers have generally used low emphasis.

The recordings were made in the studio of the Phonetics Institute in Lund. The equipment is a Studer tape recorder (tape speed 7 1/2 inch/sec.).

After a recording session the tape was checked for acceptancy by the speaker and the investigators. The following acoustic records have been used:

Fundamental frequency curves, duplex oscillograms and intensity curves, obtained by a Fonema phonetic analysis assembly and a Mingograph 34 T.

Wide and narrow band spectrograms obtained by a Sonagraph PV-10 (Voiceprint Laboratories).

1.5. Measurements

It is customary to look for the influence of prosodic factors on the speech wave in the behaviour of the fundamental frequency (F_0), and of the intensity, and in the duration and spectral character of the acoustic segments. The acoustic records of our material permit us to study the effect on these parameters of systematic changes in stress, accent, and sentence intonation.

Segmentation and duration of segment. The segmentation was made by means of the spectrograms and duplex oscillograms. In addition to the usual acoustic segments - approximately corresponding to phonemes - the voiced segments were divided into subsegments if they contained local fundamental frequency maxima or minima. The durations of the acoustic segments and subsegments are given in Appendix 3.

Fundamental frequency curves. A fundamental frequency curve (pitch curve for short) is described by the position of its local maxima (peaks) and minima (valleys) in relation to the acoustic segments and to the frequency scale. Minor inflections in the curves that can be referred to articulatory movements - articulatory ripple - will not be regarded as peaks or valleys.

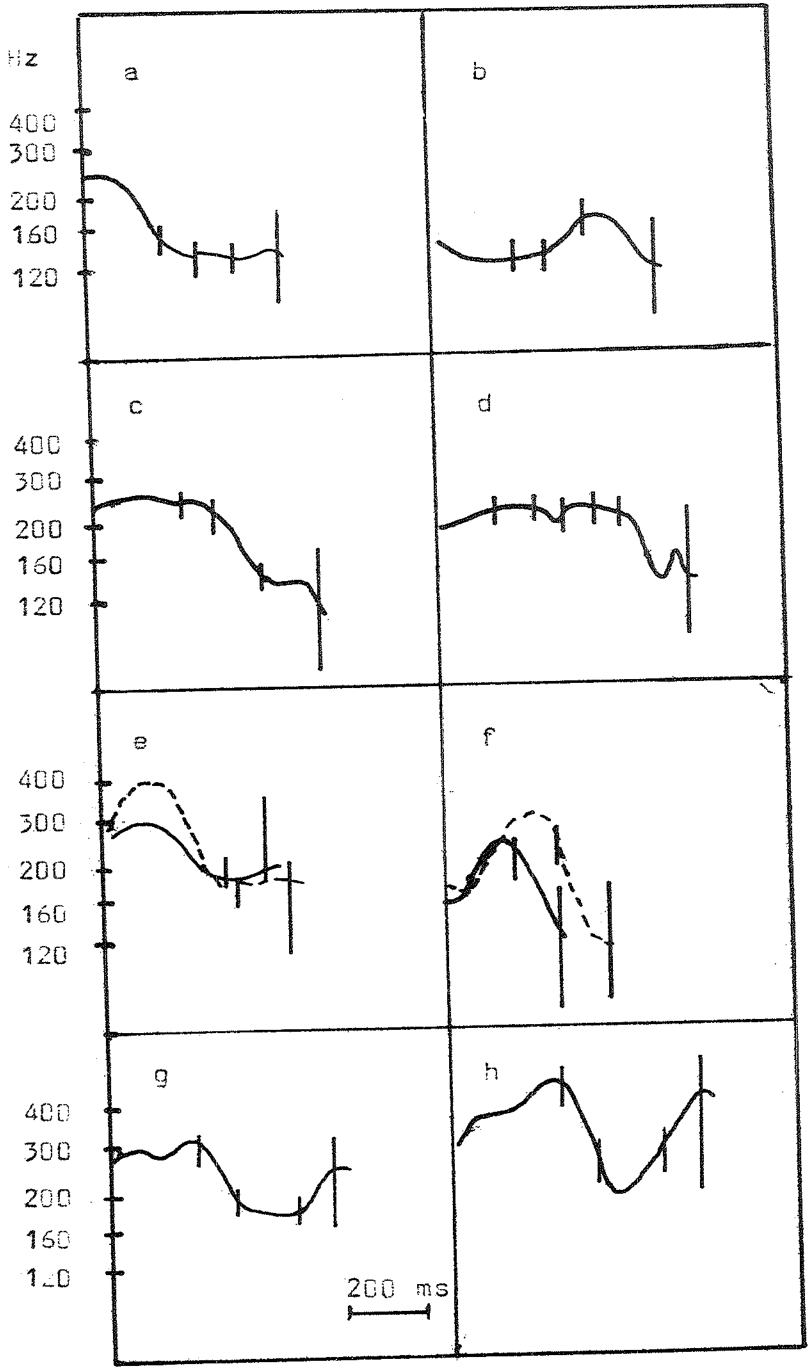
Figure 1.3 shows examples of typical maxima and minima. The mainly falling contours in 1.3.a has a peak in connection with the stressed syllable and the mainly rising contour in 1.3.b has a valley in the corresponding syllable. Since we want our acoustic measurements to be physiologically relevant, we are particularly interested in the timing of the rises and falls that constitute these peaks and valleys.

We shall also consider the shape of the peaks and valleys. Some peaks are more adequately described as plateaus. See for instance Figure 1.3, c and d.

A comparison of the peaks that occur in neutral and emphatic speech shows that for some speakers a higher peak seems to be reached by means of a faster movement, in other cases no change of rate is noticeable in the curve. Instead the peak has been pushed forward to a later time in the acoustic segment in which it occurs. Figure 1.3, e and f, shows two examples of these phenomena, which will be discussed in a later report.

Articulatory ripple. Apart from the well known minor dips in F_0 caused by voiced obstruents, we have also found local deviations in the curves which may be connected with the diphthongisation of the vowel [o:] peculiar to the Gotland dialect (Fig. 1.3, g and h).

Normalisation of the curves. For a comparison of different contours, speakers and dialects, it is necessary that we can also express our data in relative terms. For a given speaker then we need to know his ordinary range of pitch, his high and low etc. To this purpose we used the following method. For one speaker we plotted curves from the five selected testwords under the four selected prosodic situations (20



a) EG, Skåne

<u>Polen</u>, neutral statement

b) ALö, Västergötland

<u>Polen</u>, neutral statement

c) CS, Stockholm

<u>Polen</u>, emphatic statement

d) CS, Stockholm

<u>änderna</u>, neutral statement

e) ALa, Gotland

<u>Pål</u>, neutral (——) and

emphatic (----) statement

f) ALö, Västergötland

<u>Pål</u>, neutral (——) and

emphatic (----) question

g) ALa, Gotland

<u>Polen</u>, neutral statement

h) ALa, Gotland

<u>Polen</u>, emphatic question

Figure 1.3. Examples of measurements. See text 1.5.

curves in all) on top of each other. We did this in two graphs first with the beginning and then with the end of the utterances as a common time reference. Figure 1.4 shows the result of this procedure.

We notice, most clearly in the curves that have been lined up according to the beginning of phonation, that the pitch curves seem to start from a common point or locus on the frequency scale. It is natural to assume that this point represents the laryngeal state prevailing when the vocal folds are in adducted position and the subglottal pressure is built up in expectancy of the phonation to start.

In the curves that have been plotted with the time reference at the end of the utterances, we notice a similar phenomenon. Some of the curves have rising pitch but we shall now only consider the falling ones. We notice that the falling curves are well assembled and converge towards a common point on the pitch scale. This point is interpreted as representing the typical neutral laryngeal state at the end of an utterance. This ending point is somewhat lower than the neutral starting point, which may be explained by the lowered subglottal pressure, caused by the diminished supply of pulmonary air at the end of the utterance.

Combining these hypothetical beginning and ending points of the pitch curves for one speaker by a straight line we get an axis that shows the general downward drift of sentence intonation in a falling contour. The shape of a contour can now be described as peaks (maxima) above and valleys (minima) below this axis. We notice that the peaks seem to favour two high levels on the frequency scale in this kind of speech. (Compare the measurements in Appendix 3.)* These levels will be referred to as <u>mid</u> and <u>high</u>. The level below the neutral axis at which many of the curves turn upwards will be called <u>low</u>.

There is a great deal of discussion of the mechanisms behind these

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* A similar method was used in a comparison of Swedish and English intonation patterns (Gårding 1960).

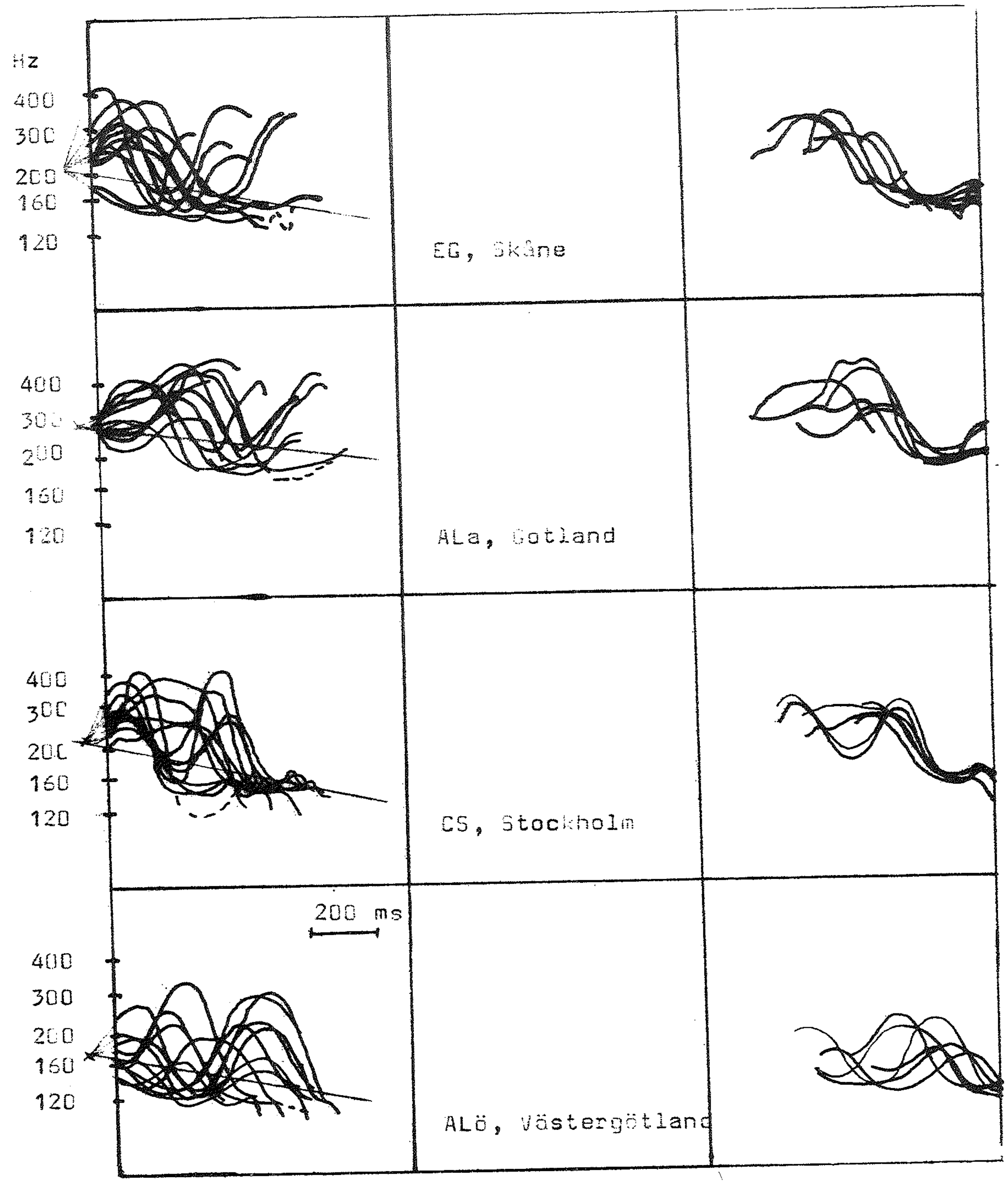


Figure 1.4. Normalisation of the F_o curves. See text 1.5.

lows at the present time (Lindqvist 1972, Harris 1970, and Sawashima 1970). Pitch lowering is much less well understood than pitch rising. It has not been possible to correlate pitch lowering to the activity of any particular intrinsic muscle. Disregarding ripple, pitch falls may of course have several causes: A relaxation of tensor muscles that have been activated earlier, a fall in the subglottal pressure, a downward movement of the larynx by means of the extrinsic muscles. (See e.g. Sonninen 1968.) With the neutral axis drawn according to the method presented in Figure 1.4, the fall hardly seems impressive enough to call for a pitch lowering muscle. Anyway, we shall be particularly interested in the effect on lows or valleys in the pitch curves of different degrees of stress and different accents.

Chapter 2

ACCENT MANIFESTATIONS

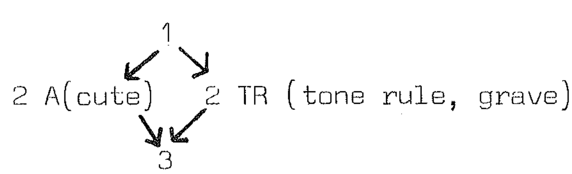
Figures 2.1.1, 2.2.1, 2.3.1, 2.4.1 show the pitch curves that have been traced from the mingograms of five words uttered by eight subjects in four different prosodic situations (prosodies), namely as neutral and emphatic statements and as neutral and emphatic questions. Going from top to bottom of a figure, the effect of a change in one of the prosodic variables can be studied in the fundamental frequency curve. Horizontally the utterances vary in phonological structure. The utterances are Pål [´po:l], Polen [´po:lɛn], pålen [`po:lɛn], änderna [ɛndəna], ändorna [`ɛndəna]. (For morphological structure syllabification and translation see Table 1.1.)

The data will be treated in the following order:

2.1	Stockholm	Speakers CS, CÖ
2.2	Skåne	Speakers EG, PL
2.3	Gotland	Speakers ALa, TS
2.4	Västergötland	Speakers ALö, JA

Data from all our speakers have been analysed in the same way but we have chosen one speaker from each dialect as the prototype (the first mentioned in the list above). The intradialectal differences will be analysed more systematically later.

For each speaker we shall give a general description of the pitch curves that represent the four selected prosodies. After each prosody we shall summarize our observations by giving them the form of a set of rules to a fictitious vocoder which is supposed to generate the pitch curves under observation. The rules are flow diagrams of the following type:



The input to our rules is: Phrases consisting of one to four syllables. Needed information: Acoustic segments, syllable boundaries, location of terminal juncture, location of stressed syllable, accent (grave or not), type of stress (emphasis or not), sentence intonation (question or not).

Rule 1 assigns the correct pitch curve to the last syllable. It gives the terminal pitch characteristics to the contour which at the same time show the general direction of the sentence intonation. Rules 2 A and 2 TR give pitch to the stressed syllable and represent the fundamental frequency response wanted for the two accents. Rule 3 is an automatic join rule that completes the utterance. It fills in the pitch of the part of the utterance that is between the stressed syllable and the final one. Rule 3 makes it possible to handle tri- and tetrasyllabic utterances.

It should be noted that a later rule cannot change the F_0 curve assigned by an earlier.

*

Our analysis is still on the descriptive side and our generative rules are descriptive and "output oriented" rather than analytical. What we do here and in the next chapter is preliminary work preparing for a stricter analysis in terms of the revised Öhman model where pitch is generated by smoothing stepfunctions.

2.1 Speaker CS, Stockholm

Neutral statements

Figure 2.1.1 shows that all the five utterances with statement intonation end in a fall from mid to neutral pitch level. The fall starts at the beginning of the vocalic segment of the last syllable and reaches neutral at the end of the same segment.

All utterances except one end with hook-like local maxima of short duration. When the last consonant is l or n, it levels of a preceding fall. These effects will be disregarded in the rules.

The timing of the fall is clearly determined by the end of the utterance. In the bisyllabic words there is some evidence of a slight delay (~40 msec) in the fall of the grave accented words as compared to the acute ones. The fall rate is related to the duration of the vowel segment in which it occurs. The shorter the vowel the faster the fall. The shape of the pitch curve before the final fall is determined by accent and number of syllables. Common to all the neutral statements is that mid level is reached during the stressed syllable.

For the acute accent there is no change of level until the final fall begins. The location of the peak in the stressed syllable of the acute words depends on the number of syllables in the word. In the monosyllabic words the peak occurs earlier than in the polysyllabic ones. This difference can be interpreted in the following way.

Let us suppose that the location of the acute peak is determined by the command "late in the stressed syllable" and that the neutral statement requires a final fall of a certain duration. In polysyllabics these two requirements do not interfere with each other. Both can be fulfilled. In a monosyllabic, however, the final fall requires an early peak and there is a conflict. Speaker CS resolves this conflict by giving the upper hand to the early peak command (i.e. the sentence intonation).

The acute statement contours can be generated by the following rules:

1. Give the vocalic segment of the last syllable falling fundamental frequency from mid to neutral.
2. Reach mid level late in the stressed syllable (in V in ...V: - syllables and in C in ...VC - syllables).
3. Reach the mid level of the last syllable by the shortest way possible.

If the rules are applied in this order, the monosyllabic utterances

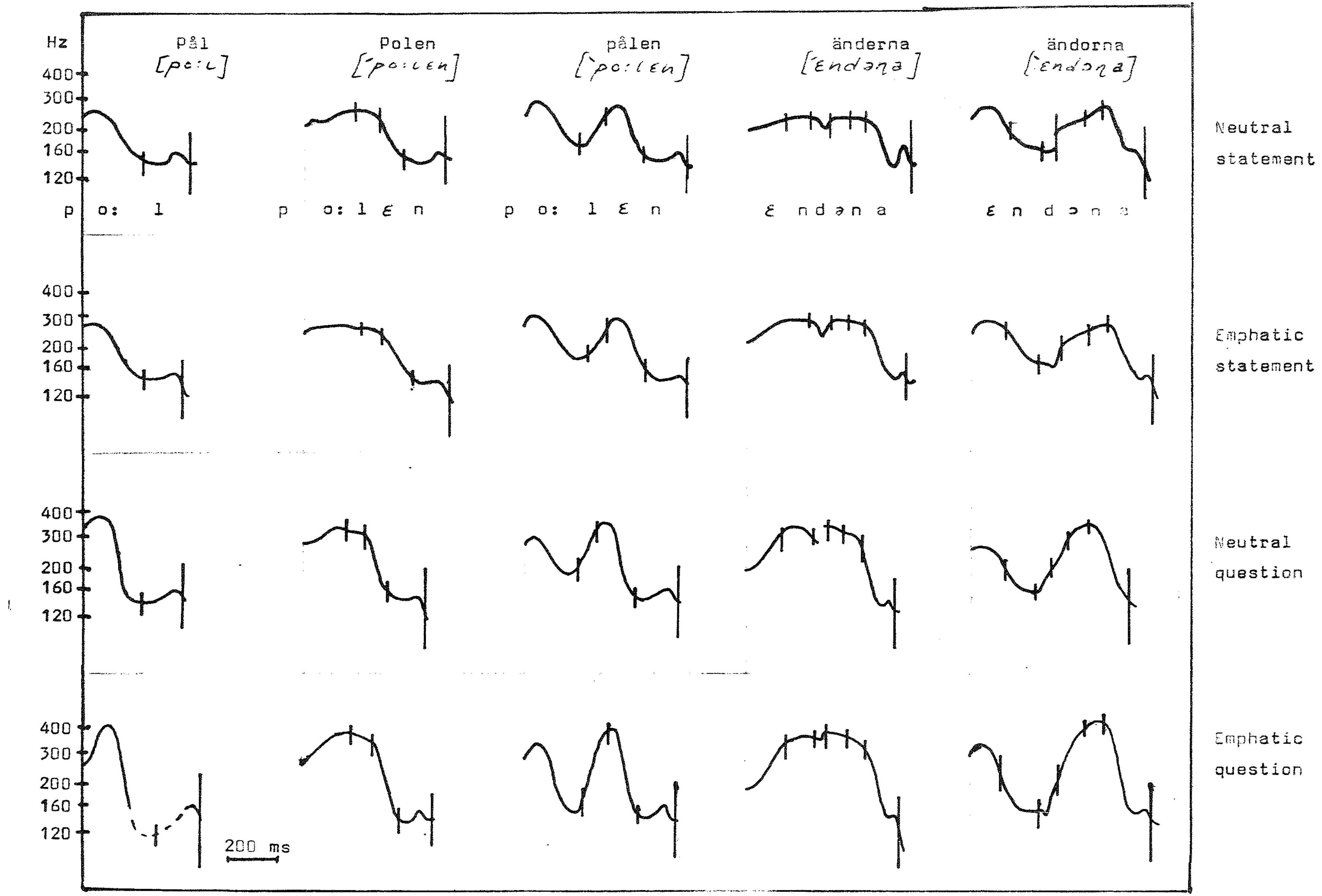


Figure 2.1.1. Acute and grave accents under various prosodies.
Speaker: CS, Stockholm. F_o curves traced from mingograms.

will get a final fall and the peak will get its right position compared to the polysyllabic utterances.

For the grave accented words mid level is reached early in the stressed vocalic segment. The curve falls immediately and reaches neutral level at the end of the syllable (that is in V in ...V:- and in C in ...VC-). From there it rises at once until it reaches the last vocalic segment where the final fall begins. The rate of the rise depends on the number of intervening syllables.

The grave statement contours can be generated by the following rules:

1. Give the vocalic segment of the last syllable falling fundamental frequency from mid to neutral. (The rule is identical with Rule 1 for acute words, but we have to remember a slight difference in the timing of the peak that precedes the fall in the last syllable.)
2. Reach mid level in the stressed syllable as early as possible and fall to neutral.
3. Reach the mid level of the last syllable by the shortest way possible.

A comparison of the rules that generate Speaker CS's neutral statements shows that Rules 1 and 3 are identical.

The rules that generate acute and grave neutral statements can of course also be written in such a way that the common characteristics of the contours are brought out more clearly.

The flow diagram that generates neutral statements for acute and grave words can for instance look as follows:

1. Give the vocalic segment of the last syllable falling fundamental frequency from mid to neutral.

2 A(cute). Reach mid level late in the stressed syllable.	2 TR (tone rule). Reach mid level early in the stressed syllable and fall to reach neutral at the end of the syllable.

3. Join

As usual the join rule means completing the pitch contour by interpolation going the shortest way.

The rules, as they now stand, reflect a linguistic analysis according to which the intonation of an acute accented word as an isolated utterance represents the combined fundamental frequency response to stress and sentence intonation. The effect of rule 2 TR (tone rule) can be regarded as a modification of the basic, acute contour.

Emphatic statements

The emphatic statements of CS have practically the same pitch characteristics as the neutral ones. Figure 2.1.2 shows the emphatic utterances superimposed on the neutral ones. The only difference is that the level reached in the peaks of plateaus is a little higher. It is possible that the difference between the neutral and emphatic statements produced by this speaker is not great enough to be functionally valid.

Neutral questions

Figure 2.1.2 shows the neutral questions of Speaker CS superimposed on the statements. We notice that the last peak or the plateau in each utterance carries the mark of the question, that is a rise to high level and a subsequent fall from there. This means that in the double-peaked curves, it is the second peak that is elevated. The rising rate is higher for the higher peaks but the rate of fall is unchanged in all the utterances except the monosyllabic one. There are practically no changes of duration and no timing differences.

Obviously the question rules are very similar to the statement rules: The tone rule remains unchanged.

In the rest of the rules mid (from the neutral statements) is exchanged for high:

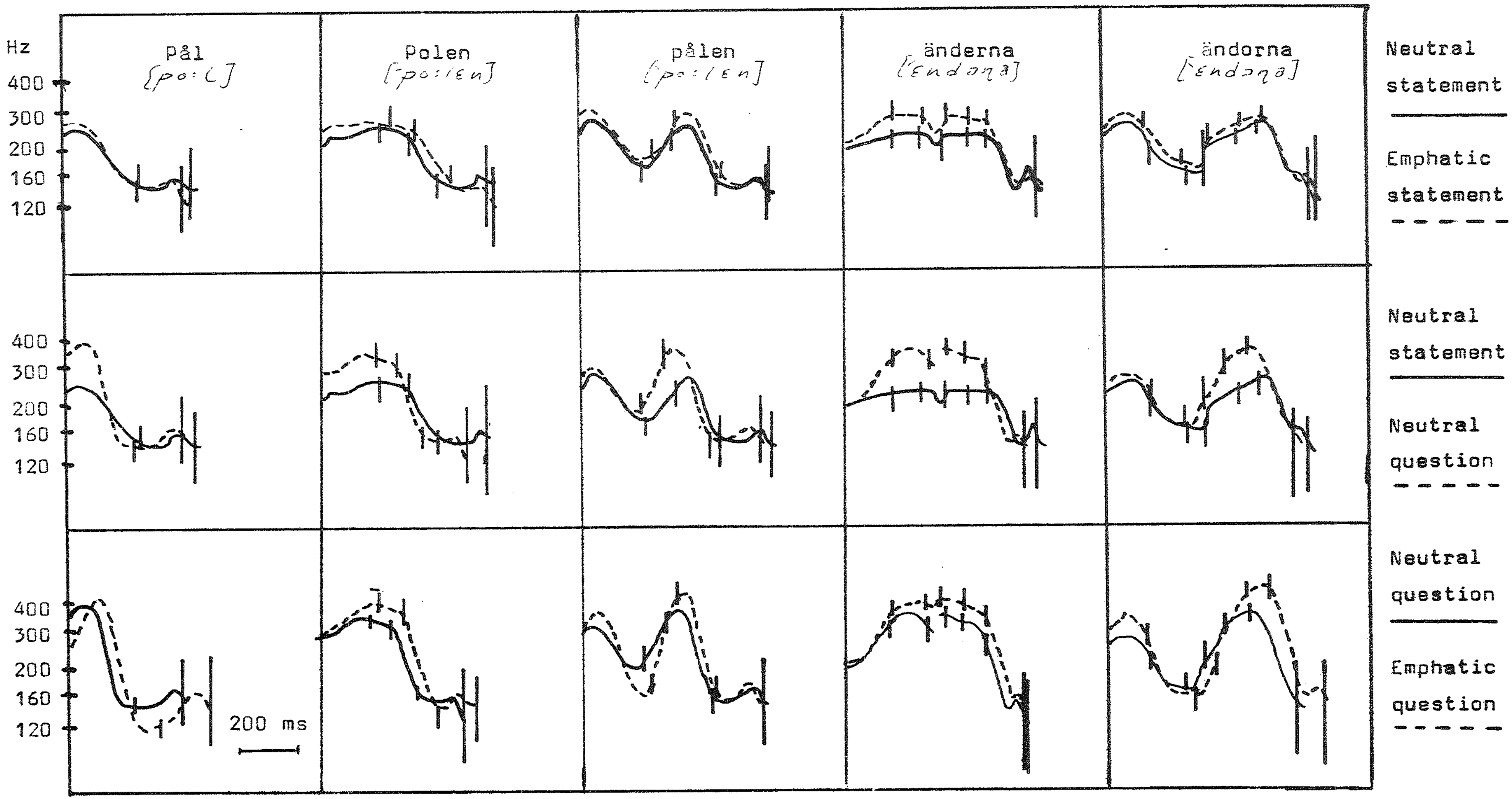


Figure 2.1.2. Contrasting prosodies (F_o). Speaker: CS, Stockholm.

1. Give the vocalic segment of the last syllable falling fundamental frequency from high to neutral.

2 A(cute). Reach high level late in the stressed syllable.

2 TR (unchanged). Reach mid level early in the stressed syllable and fall to reach neutral at the end of the syllable.

3. Join

The rules reflect what is obvious in the contours of Figure 2.1.1, that in the grave words it is the last peak that is modified by the question intonation and in the acute words it is the single peak that is similarly modified. The domain of the question intonation command is the whole word in the utterances consisting of acute words. In the utterances consisting of grave words the domain starts at the beginning of the posttonic syllable and ends with the completion of the utterance.

Emphatic questions

In Figure 2.1.2 the emphatic questions have been superimposed on the neutral ones. We notice that they have roughly the same contours. Some differences are noticeable however. The monosyllabic emphatic question is lengthened and there is a slight lengthening trend in the stressed syllable of the other utterances as well. The last grave word is also lengthened in the posttonic syllable. It is noteworthy that the segment before the pitch peak (the pre-peak segment) is mainly responsible for the increase of duration. The peak is delayed as it were by the higher degree of stress. All the peaks are somewhat raised. This raise is much smaller than what we find when we go from neutral statements to questions. The rate of the rise in the emphatic questions varies a bit but the fall rate remains the same, as was also the case in the earlier discussed prosodies.

Pending further investigation of changes in fundamental frequency brought on by emphasis we shall give the following tentative rules.

1. Length adjustment rules in the stressed syllable, and possibly also in the posttonic syllables of grave words.
2. Generative rules for neutral questions.

Rules 2 will operate on acoustic segments which have been lengthened in a way which cannot yet be specified.

If the duration of muscular activation and relaxation is lengthened without any other concomitant change of the activation pattern, the result should be constant rates, higher peaks and deeper falls.

2.2 Speaker EG, Skåne

Neutral statements

Figure 2.2.1 shows that all the five utterances with statement intonation have a falling fundamental frequency from mid level to low.

The timing of the fall is related to accent. The fall starts early in the stressed syllable for the acute accent and late in the same syllable for the grave one. In the acute accented words the fall includes the consonant following the stressed vowel. After the fall the curve remains at a low level. (The utterance final local maximum of small elevation and duration will be disregarded in the rules for this speaker as for Speaker CS, 2.1.) The fact that the consonant is included in the fall suggests that the pitch movement may be tied to the stressed morpheme rather than the stressed syllable. The word Polen should then be analysed as the definite form of pol. (The definite form is not uncommon in geographical names.) More information is needed to clarify this point.

In the grave words the end of the fall occurs in the last syllable.

Because of the different location of the peaks in the acute and grave

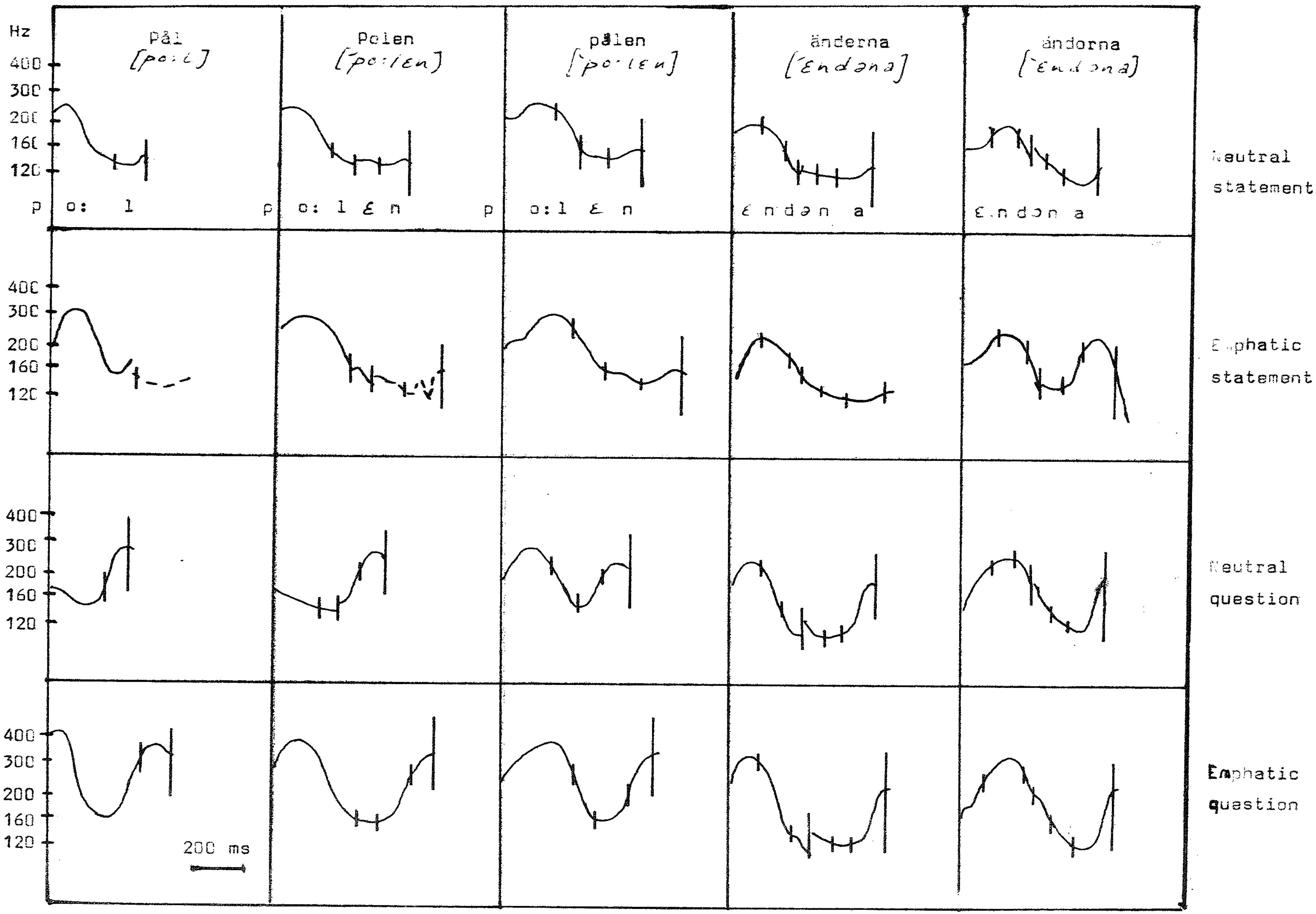


Figure 2.2.1. Acute and grave accents under various prosodies.
Speaker: EG, Skåne. F_o curves traced from mingograms.

accented words, the beginning of the contour is also different. With the early peak in acute there is hardly time for any rise to develop, but with the late peak (grave) the beginning rising part of the contours becomes predominant.

Rules that generate EG's neutral statements:

1. Give low level to the latter part of the last vocalic segment.

2 A(cute). Reach mid level early in the stressed syllable and fall to reach low at the end of the last posttonic consonant.

2 TR. Reach mid level late in the stressed syllable.

3. Join

Emphatic statements

The emphatic statements have contours similar to the neutral ones (Fig. 2.2.2). Emphasis lengthens the utterances however, and as in our earlier emphatic material, it is the stressed syllable that is lengthened most. The peaks are higher and in the first three utterances they are reached later in relation to the articulatory events. Also the duration of the post-peak part of the vowel increases.

A fundamental frequency contour representing a given sentence intonation can be likened to a rubber band with a certain elasticity. Under emphasis the contour can be stretched in various ways and to a certain extent without losing its identity. We are interested in knowing the limits to this stretching.

For the acute accented statements the most yielding part is the stressed syllable. Here the curve can be stretched both horizontally and vertically. When the posttonic vowel begins, the curve has always reached low. For the grave accent, however, also the posttonic syllable(s) have a certain elasticity. The low level is not reached until the last syllable.

We can summarize the rules that will generate the emphatic contours for Speaker EG in the following way:

1. Length adjustment rules.
2. Generative rules for neutral statements, possibly with mid exchanged for high.

Neutral questions

The questions have a falling-rising fundamental frequency contour. For the polysyllabic utterances the rise starts at the beginning of the last vocalic segment. The preceding fall comes from a late peak in a grave accented syllable. In the acute words the fall starts immediately from a neutral level.

The following rules will generate the neutral questions:

1. Give rising fundamental frequency from low to mid to the last syllable starting in the vocalic segment.

2 A(cute). Fall to low in the stressed syllable.

2 TR. Rise to reach mid at the end of the stressed syllable.

3. Join.

Emphatic questions

Apart from the usual lengthenings which again favour the stressed vowel, the acute curves have become double-peaked due to the addition of an extra peak early in the stressed syllable. The difference between the acute and grave utterances is in the timing of the first peak in relation to the acoustic segments. In the grave accent – as usual – the peak comes late in the stressed syllable as compared to an early peak in the acute words. This timing rule is undisturbed by emphasis.

Rules:

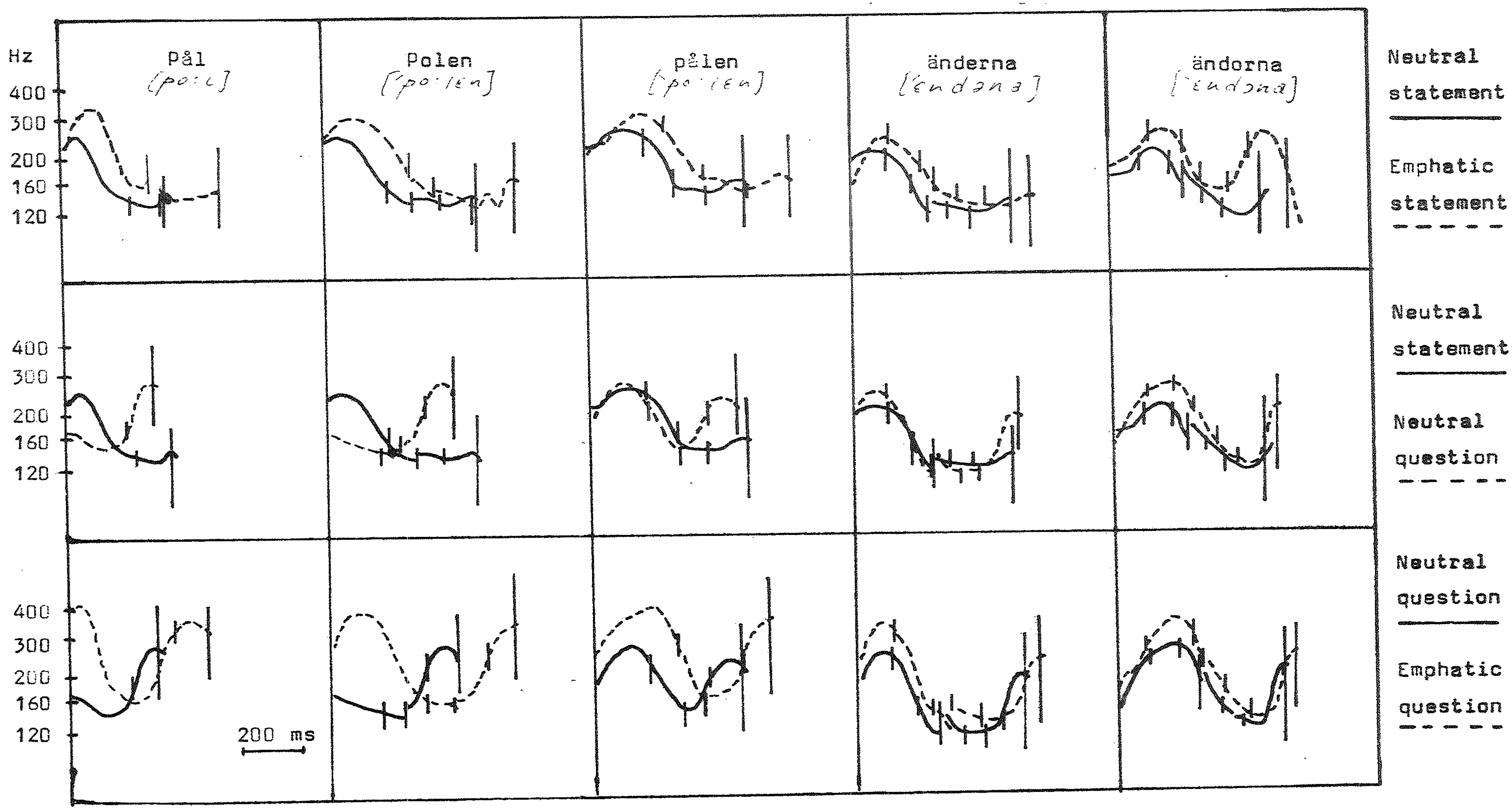


Figure 2.2.2. Contrasting prosodies (F_o). Speaker: EG, Skåne.

1. Give rising fundamental frequency from low to high to the last syllable starting in the vocalic segment.

2 A(cute). Rise to reach high at the beginning and fall to reach low at the end of the posttonic consonant.

2 TR. Rise to reach high at the end of the stressed syllable.

3. Join.

2.3 Speaker ALa, Gotland

Neutral statements

The statements are characterized by a mainly falling fundamental frequency contour (Fig. 2.3.1). The latter part of the last acoustic segment of the utterances has a small rise from low to neutral level. The timing of the main fall is dependent on the accent. For acute words the fall starts in the stressed syllable. For the grave words the fall starts at the beginning of the posttonic syllable. The shape of the curve before the fall is of course also dependent on the accent. The acute polysyllabic words with the earlier peaks are characterized by a slow, smooth rise. In the grave words with the later peaks the rise is preceded by a small dip which gives the curve the shape of an S leaning forwards. The small difference in the shape of the curve in the first syllable of acute and grave words, S (grave) versus no S (acute) may be the result of a difference in timing between the rising commands for the two accents. For grave the command comes later and the dip preceding the rise may be a consequence of a decreased pressure drop across the glottis when phonation starts.

In the monosyllabic utterance the duration of the terminal fall dominates the contour. With the given schema it seems inconvenient to formu-

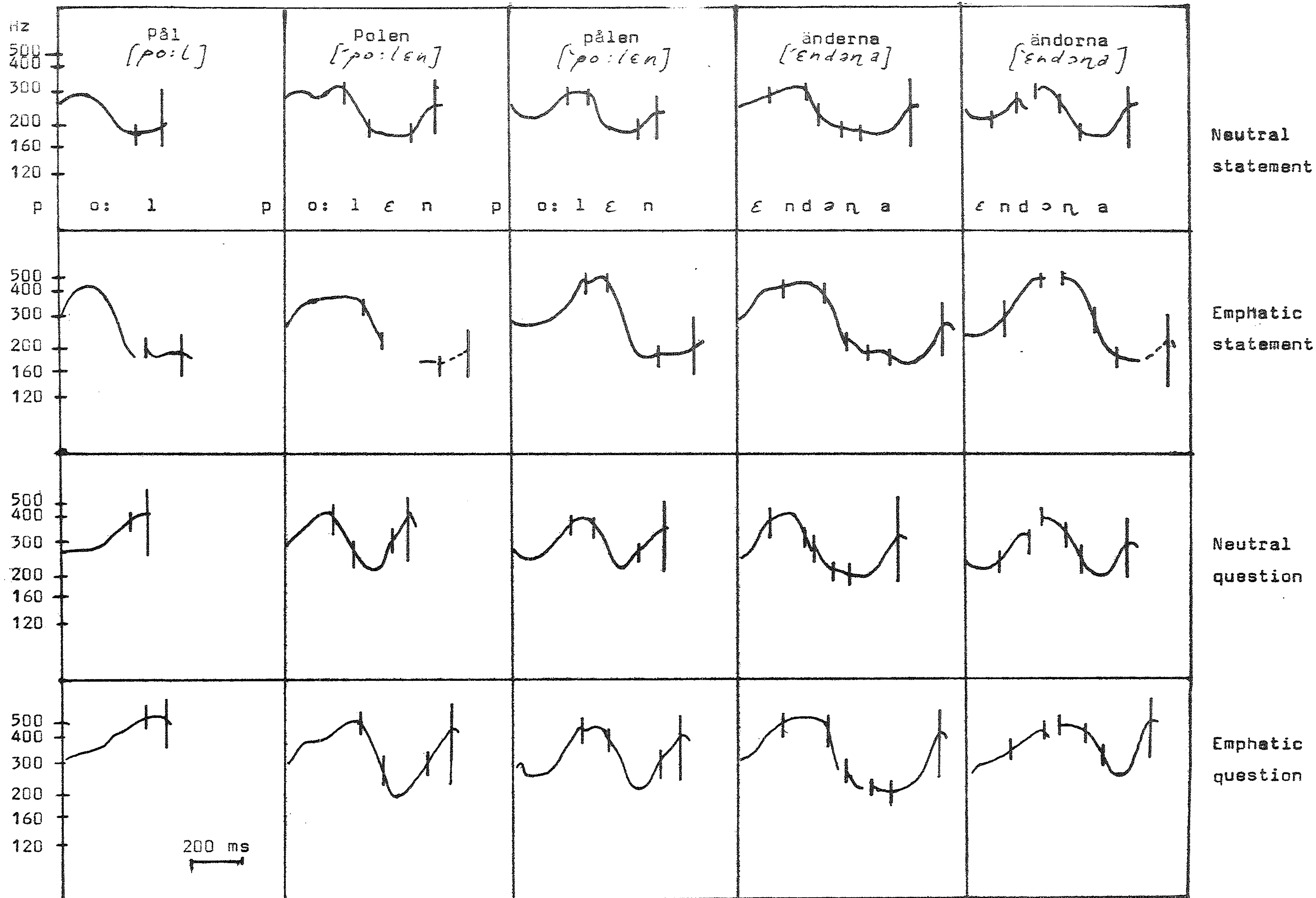


Figure 2.3.1. Acute and grave accents under various prosodies.
Speaker: ALa, Gotland. F_0 curves traced from mingograms.

late rules that include both monosyllabic and polysyllabic statements.

The following rules generate ALa's neutral polysyllabic statements:

1. Give rising fundamental frequency to the latter part of the last syllable from low to neutral.

2 A(cute). Rise to reach mid at the end of the stressed syllable.

2 TR. Stay level one mora and rise to reach mid at the beginning of the posttonic syllable.

3. Join.

Emphatic statements

The emphatic statements have contours that are very similar to the unemphatic ones, as can be seen in Figure 2.3.2. All the emphatic statements are lengthened and this lengthening seems to affect the stressed vowel mostly, in particular the pre-peak portion of the curve. The timing of the rises and falls in relation to the acoustic segments is the same but the peaks are at a higher level. The rate of rise is higher but the falls have similar slopes except in the monosyllabic utterances. Here emphasis produces a faster fall.

Rules:

0. Preparation Rule. Adjust the durations of certain segments.

1. Give rising fundamental frequency to the last voiced segment from low to neutral.

2 A(cute). Rise to reach high at the end of the stressed syllable.

2 TR. Stay level one mora and rise to reach high at the beginning of the posttonic syllable.

3. Join.

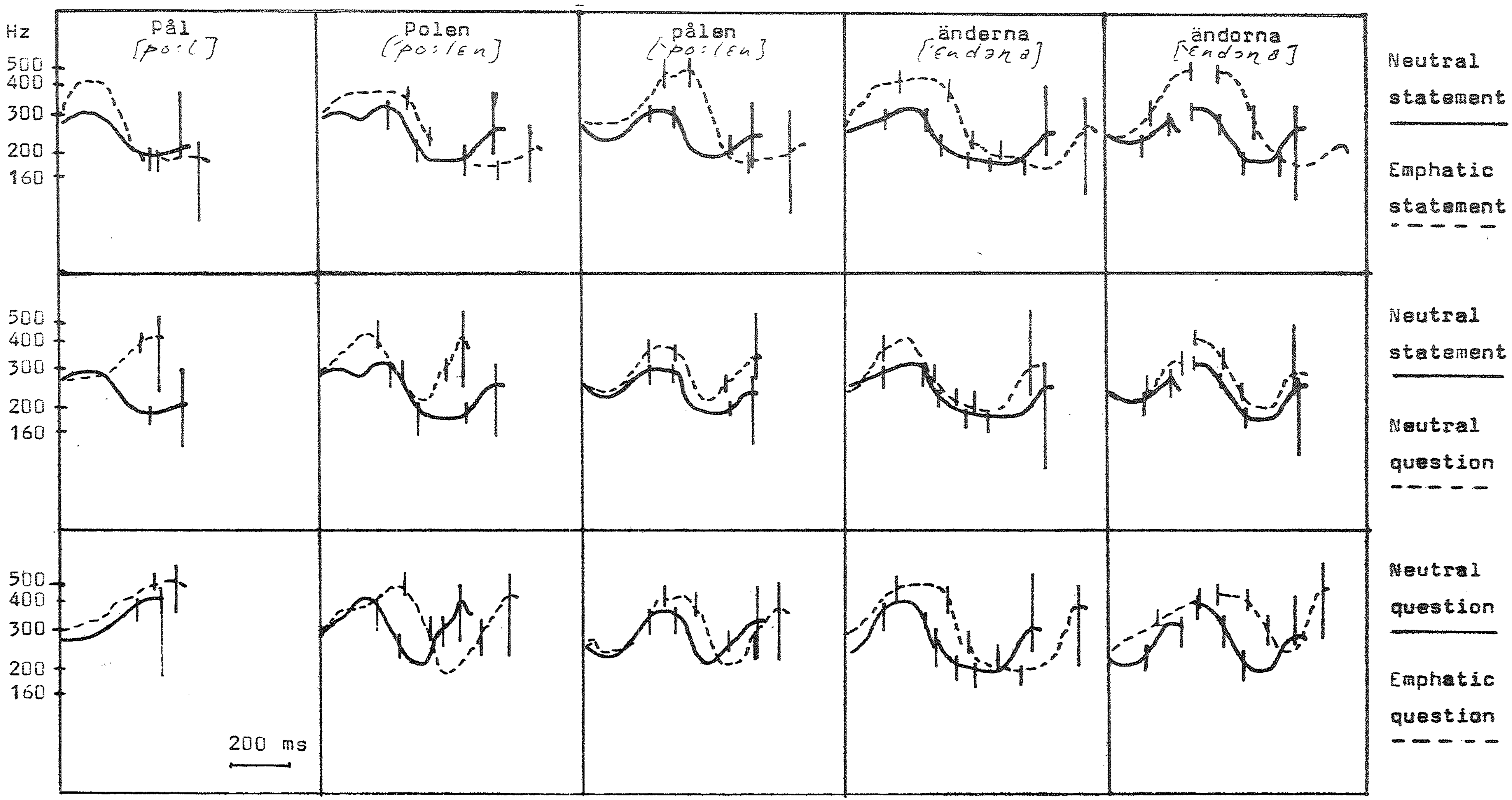


Figure 2.3.2. Contrasting prosodies (F_o). Speaker: ALa, Gotland.

Neutral questions

The questions end in rising fundamental frequency from low to mid level. The rise starts towards the middle of the vocalic segment of the last syllable.

Rules:

1. Give rising fundamental frequency from low to mid to the last syllable starting in the middle of the vocalic segment.

2 A(cute). Rise to reach high at the end of the stressed syllable.

2 TR. Stay level one mora and rise to reach high at the beginning of the posttonic syllable.

3. Join.

Emphatic questions

The emphatic questions are lengthened and the stressed vowel has the largest part of this lengthening. The timing of the rises and falls in relation to the acoustic segments remains roughly the same. The peaks are a little higher and the rate of rise and fall is similar.

Rules:

0. Length adjustment rules.
1. Rules for neutral questions.

2.4 Speaker ALö, Västergötland

Neutral statements

The last vowel of the neutral statements has rising fundamental frequency (Fig. 2.4.1). The rise starts at the beginning of the vocalic segment of the posttonic syllable. In the utterances in which the last syllable ends in a consonant [l, n], this consonant has falling pitch. In the polysyllabic acute accented words, the terminal rise is preceded by a fall

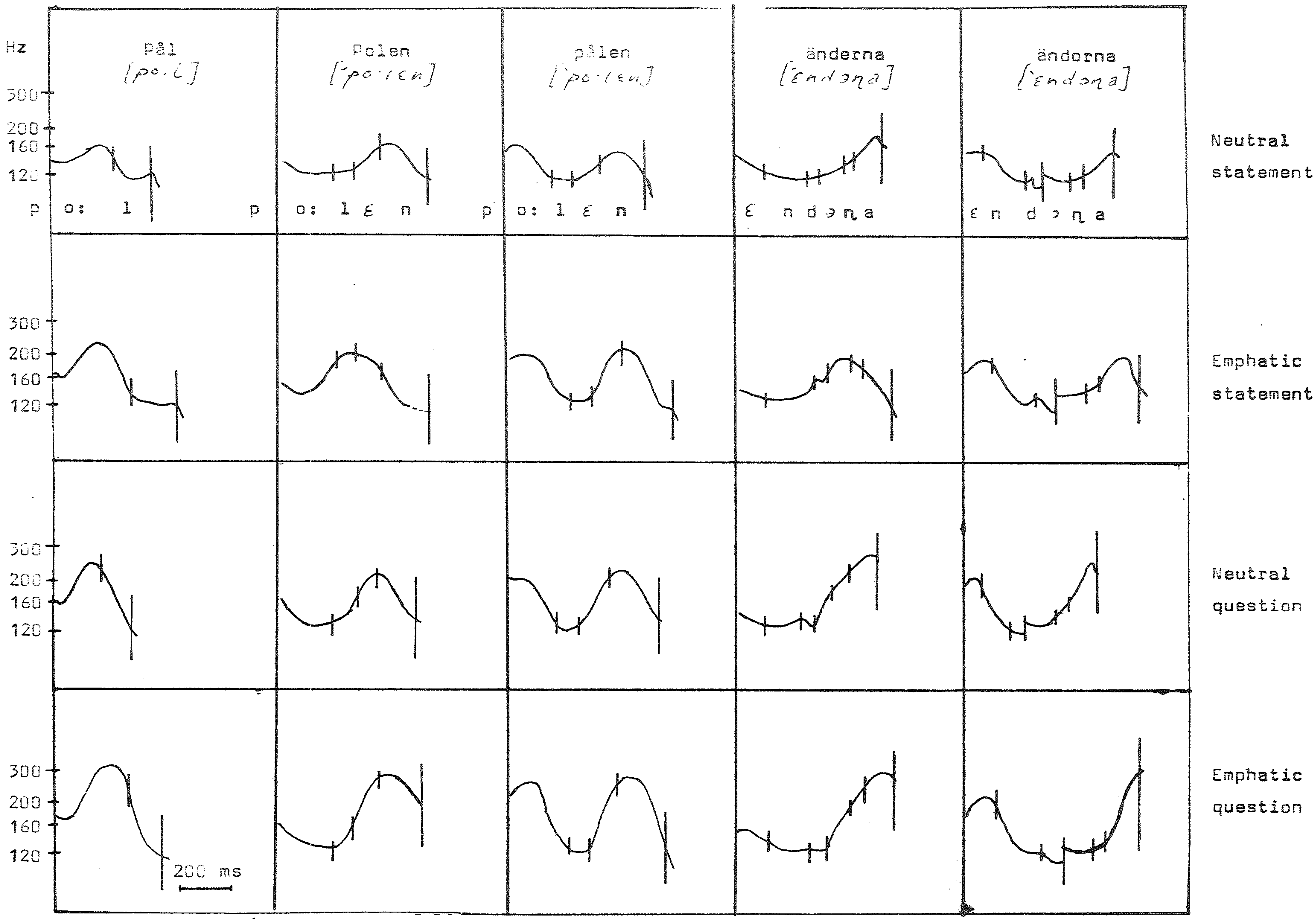


Figure 2.4.1. Acute and grave accents under various prosodies. Speaker: ALö, Västergötland. F_o curves traced from mingograms.

starting from neutral level at the beginning of the stressed vocalic segment. This fall reaches low early and stays there till the rise begins in the posttonic syllable. In the grave accented words, the curve falls from a mid peak placed in the beginning of the vocalic segment to reach low at the beginning of the posttonic syllable. The regular schema does not fit the monosyllabics. The rules that will be proposed in the next chapter fit this dialect better.

Rules that generate ALö's polysyllabic neutral statements:

1. Give rising fundamental frequency (neutral to mid) from the posttonic syllable to the end of the lastvocalic segment.

2 A(cute). Fall to reach low towards the end of the stressed syllable.

2 TR. Rise to reach mid level at the beginning of the stressed syllable and fall to reach low at the end of the same syllable.

3. Join.

Emphatic statements

The emphatic statements end in a rising-falling contour. The rise starts in the middle of the stressed syllable for the acute words and at the beginning of the posttonic syllable for the grave ones. Since the rate of rise is similar for both accents, there will be also a difference in the timing of the fall in relation to the acoustic segments. For the grave accent the fall starts later, more specifically near the end of the last vocalic segment, but for the acute accent the fall begins in the posttonic syllable. We notice also that the valleys and peaks occur relatively later in the longer words as compared to the shorter ones.

For the rules generating all of our earlier curves (except the monosyllabic Gotland statements) it has been possible to use the same schema

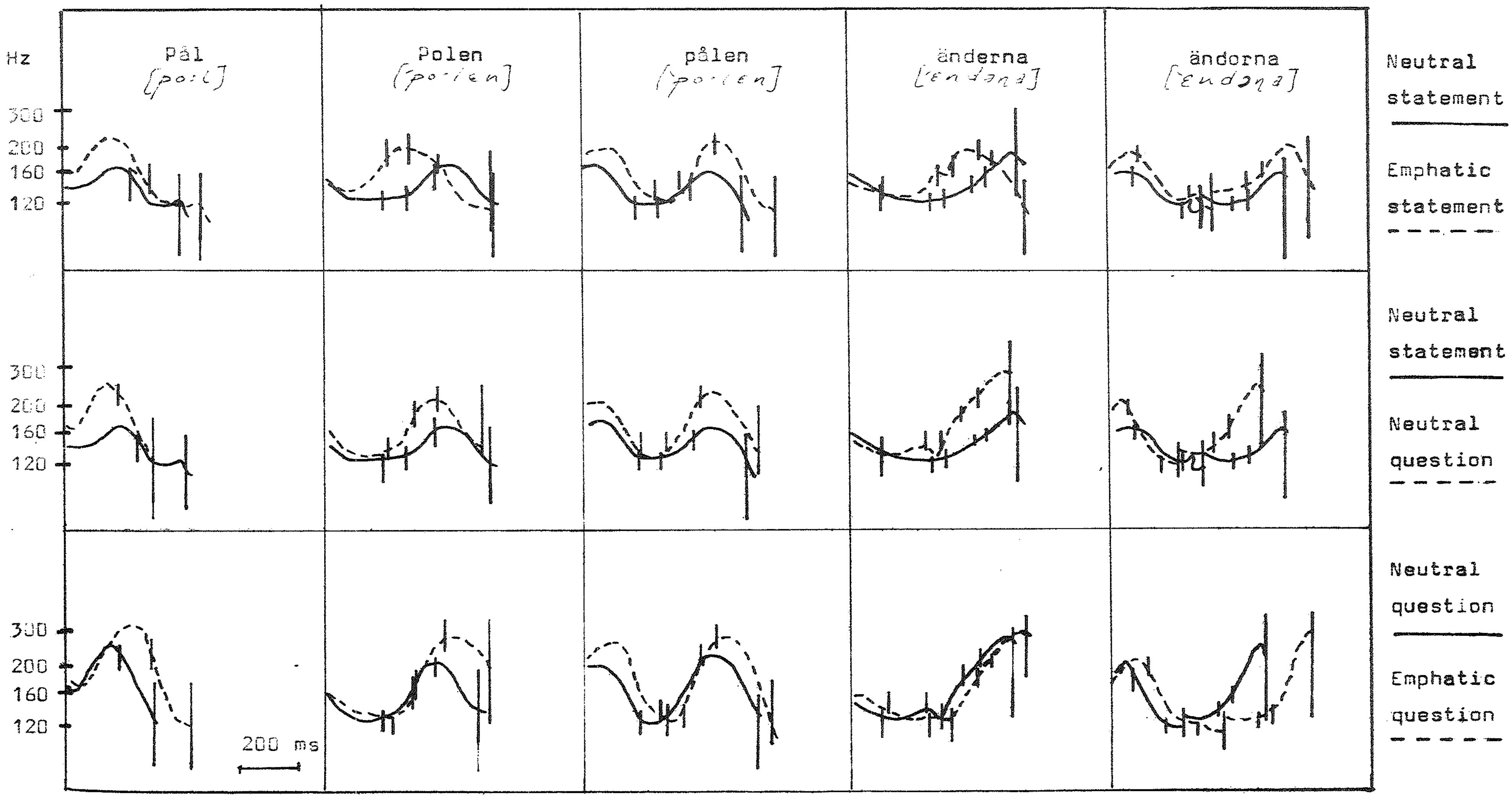


Figure 2.4.2. Contrasting prosodies (F_o). Speaker: ALö, Västergötland.

independently of dialect, prosodic contour and accent. Rule 1 took care of the terminal pitch movement and gave the general direction of the sentence intonation. Rules 2 generated the variations in the stressed syllable due to accent, and Rule 3 joined the beginning with the end in a manner which was automatic and independent of the number of intervening syllables. The reason why the rules could be set up in this way was of course that the intonation of the grave accented words "caught up" with the intonation of the acute ones towards the end of the utterances and had the same terminal characteristics.

It is clear that our earlier schema does not fit Speaker ALö's emphatic statements, for the simple reason that the grave accent does not just modify the basic contours in the middle but it causes a delay of the pitch movements that remains constant all through the utterances. This delay can be estimated to be one mora.

The rules ought to reflect this situation, for instance:

1 A(cute). Fall to reach low in the middle of the stressed syllable.

1 TR. Reach mid level in the stressed syllable as early as possible and fall to reach low at the end of the syllable.

2. Rise to reach high one mora later.

3. Fall from there.

Neutral questions

The neutral questions look as if they had been pronounced with two different intonation contours. The first three utterances end in a rising falling contour and the posttonic part of the trisyllabics, is mainly rising. We notice that the fall of the contour in the bisyllabic utterances occurs in the terminal [n]. For the time being we attribute this fall to the final consonant. The rise starts at the end of the stressed syllable in the polysyllabic acute words and at the beginning of the posttonic syllable in the grave ones. (The rise seems to creep onward a little in the longer words towards the end of the utterance.)

Rules generating ALö's polysyllabic neutral questions up to the last consonant:

1. Give rising fundamental frequency from low to high starting at the beginning of the posttonic syllable.

2 A(cute). Fall to reach low towards the end of the stressed syllable.	2 TR. Rise to reach high level at the beginning of the stressed syllable and fall to reach low at the end of the same syllable.

3. Join.

Emphatic questions

The emphatic questions are lengthened as compared to the neutral ones, but they have similar contours. The lengthening affects the stressed syllable in the acute words and both syllables in the bisyllabic grave words. In most cases the rate of rises and falls does not change with emphasis.

Rules:

0. Preparation Rules.

1. Rules for neutral questions.

Chapter 3

FORM BY SUBSTANCE

In this chapter we shall summarize our earlier observations and try to make them subject to generative rules whose structure is the same for all the dialects.

In our pursuit of constancy we have tried various basic units in the contours, terminal parts, posttonic parts and the entire acute contour. A discussion of these units will follow below. As will be shown, it is the entire acute contour that is best adapted to general rules.

It should perhaps be stressed that our general rules - as they appear here - are not meant to be orders to a vocoder like our earlier rules for individual speakers but are of a more qualitative nature.

Intensity and duration will receive full attention in a following report which will also have a more detailed treatment of the monosyllabics.

3.1. Terminals

A common feature in all the dialects is that fundamental frequency curves derived from utterances with the same sentence intonation (expressing statements or questions) are similar in their final parts, independently of the accent and the number of syllables carried by the utterances. These similar parts - terminals - will be regarded as part of the fundamental frequency response to the sentence intonation command. Figure 3.1 in which the grave accented words have been superimposed on the grave ones bring out this final similarity. The terminals can be described as follows:

	Neutral statements	Neutral questions
Stockholm	Fall from mid	Fall from high
Skåne	Fall from mid	Rise to mid

Gotland	Fall from mid	Fall from high
Västergötland	Rise to mid	Rise to high

We notice (Fig. 3.1) that apart from differences in the direction of the fundamental frequency in the dialects there are also differences in the timing of the terminals in relation to the acoustic segments and syllables. The different timing is dependent on accent, sentence intonation and dialects. The following table brings out these differences. (Only the polysyllabic neutral statements and questions have served as examples.)

Table showing the beginning of the final common part of the pitch curve for acute and grave words in relation to syllable

	Acute		Grave	
Dialect	Statements	Questions	Statements	Questions
Stockholm	early last	early last	early last	early last
Skåne	early stressed	early last	late stressed	early last
Gotland	late stressed	late stressed	early post-tonic	early post-tonic
Väster-götland	early post-tonic	early post-tonic	early post-tonic	early post-tonic

The table shows that there is a great deal of dialectal variation in the timing of the terminals. In Skåne and Gotland the terminal of the grave is delayed as compared to the acute but in Stockholm and Västergötland they are independent of accent. It is clear that the terminals do not constitute a tonal unit that is very useful for dialect independent general rules.

3.2. Sentence intonation and acute

In the utterances consisting of neutrally stressed acute words, the shape of the fundamental frequency curve in the stressed syllable is dependent on the sentence intonation in the following way: Preceding a falling or a raised level-falling sentence intonation, the acute accent will have rising pitch, before a rising sentence intonation it will have falling

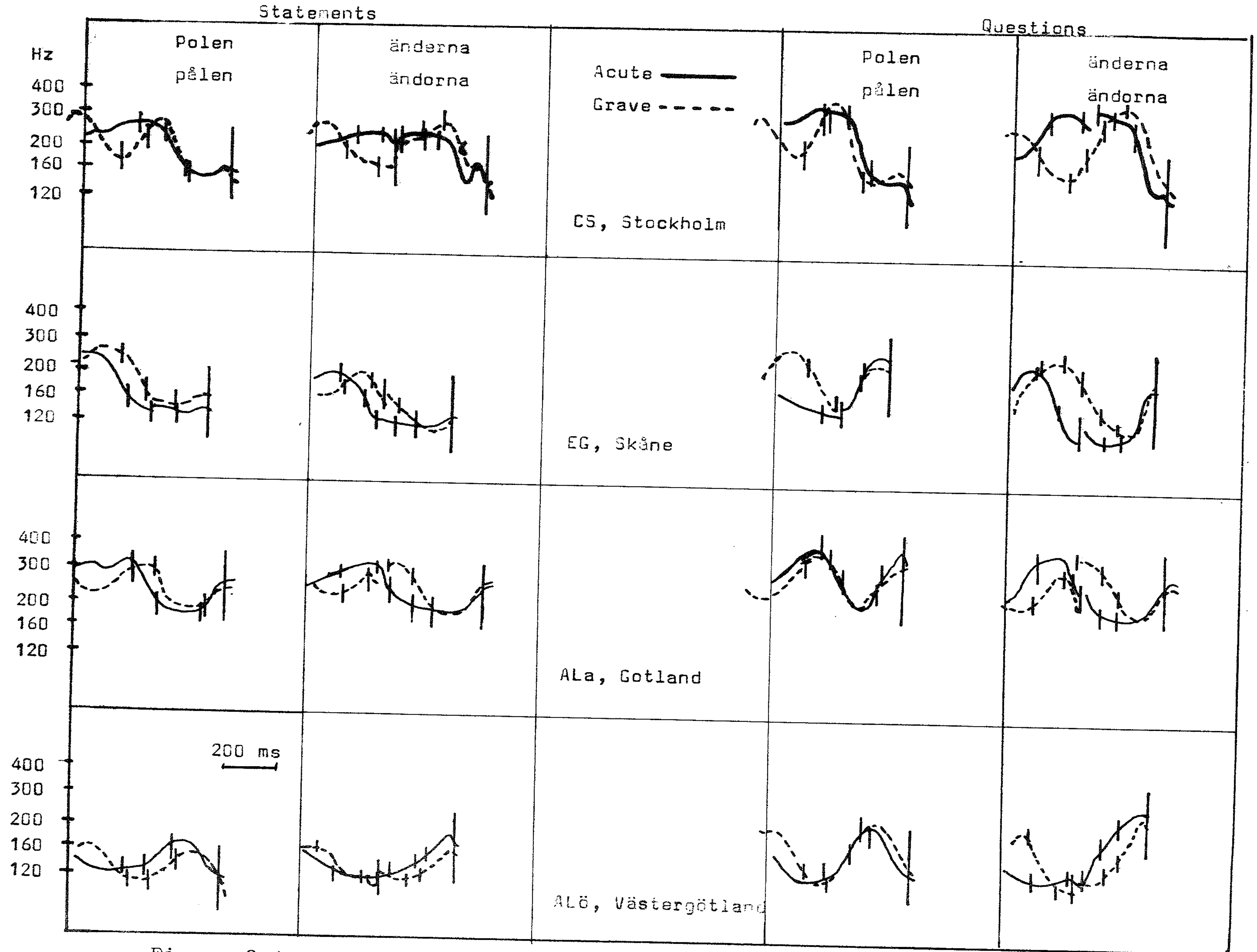


Figure 3.1. Dialectal variation of acute and grave accents in statements and questions.

(or low) pitch. In the material studied here these relations are general and independent of dialects and prosodies. (A Västergötland statement [rising sentence intonation] with the acute accent looks very similar to a Skåne question with the same accent [rising sentence intonation]). This means that the acute accent turns up in different fundamental frequency shapes in one and the same dialect depending on the general direction of the fundamental frequency imposed by the sentence intonation. Since the situation seems to be similar in other languages, analysed as having no word accent but only stress and intonation, and since we want our analysis of Swedish to fit a general intonation model, we shall regard the acute accent as stress and its pitch manifestation as dependent on sentence intonation. This is a common point of view (see Elert 1970, p. 46, and literature quoted there).

3.3. Basic intonation unit = acute + sentence intonation

A sentence cannot be uttered without having both stress and intonation. We shall now regard these components as one unit, called the basic intonation unit of the sentence. As we shall see later, it will be needed for our analysis of the grave accent and useful for our general rules.

In terms of rises and falls the basic intonation unit of the polysyllabics of our four speakers can be described as follows:

	Statements	Questions
Stockholm	rise mid-fall	rise high-fall
Skåne	rise mid-fall	fall-rise mid
Gotland	rise mid-fall(rise)	rise high-fall(rise)
Västergötland	fall-rise(fall)	fall-rise high(fall)

(Pitch movements within brackets may be irrelevant.)

The table shows that only the Västergötland speaker uses rising intonation in statements. This is a famous characteristic of all Swedish dialects belonging to the Götamål and also of East Norwegian dialects. (Tonal type 2B, Table 1.2 and Figs 1.1 and 1.2.) The Skåne speaker alone marks her questions by reversing the intonation pattern of the statements.

In this way the South Swedish speaker behaves similarly to speakers of other Germanic languages such as Danish, German and English. The others choose to rise to and fall from a higher level. This way of intoning questions is similar to question intonation patterns in some Slavic languages and Hungarian, to give just a few examples. We shall also recall that Skåne statements are different from those in Stockholm and Gotland in the timing of the fall, which is early in the stressed syllable as compared to late for the others.

3.4. Grave accent = precontour + basic unit

Figure 3.1 with the superimposed accents derived from our four dialectal prototypes shows, what has been mentioned in connection with the analysis of Meyer's data (1.2), namely that the pitch movements in the acute curves recur in the grave ones. The grave curves can be described as having an extra happening or feature in the beginning of the stressed syllable, which delays and to a certain extent shrinks or modifies the basic, acute curve. All the grave accented words, independently of dialect, are characterized by a rise somewhere in the stressed syllable. As we shall see later, the absolute timing of this rise and its further development depends on the timing and the general direction of the basic intonation.

We shall now try to find some common basic principle for how acute accents are turned into grave ones.

In the following table (Table 3.1) we shall present some pertinent data collected from Figure 3.1.

The table shows that the shape of the grave curves can be obtained by adding a pitch movement (grave precontour) to the basic unit (acute accent). This pitch movement is for Stockholm and Västergötland a peak (rise-fall or fall), for Skåne a rise, and for Gotland a low. We notice that the duration of the precontour and hence the delay

Table 3.1. Constructive elements for the grave accent

Statements	Shape of grave precontour	Shape of basic contour (acute)	Delay of basic contour	Shape of grave
Stockholm	rise-fall	rise-fall	2 morae	rise-fall = rise-fall
Västergötland	rise-fall	fall-rise	1 mora	rise-fall = rise
Skåne	rise	fall	1 mora	rise = fall
Gotland	fall-rise	rise-fall	1/2 mora	fall-rise = fall
Questions				
Stockholm	rise-fall	rise high-fall	2 morae	rise-fall = rise high-fall
Västergötland	rise	fall-rise high	1 mora	rise-fall = fall-rise high
Skåne	rise	fall-rise	1 mora (?)	rise = fall-rise
Gotland	fall	rise-fall-rise	1/2 mora	fall-rise = fall-rise

= means boundary between stressed and posttonic syllables of the basic unit is 2 morae (one stressed syllable) for Stockholm. For Västergötland and Skåne it is approximately one mora (or less) and for Gotland half a mora.

There is then an interesting constancy in our dialectal variety. The grave accent is made up of a precontour and the acute contour.

Since acute and grave words are approximately equally long, the acute contour has to shrink in accordance with the time unit given for the delay in the table above.

3.5. General rules

We shall now cast the preceding discussion in the form of a set of general rules. These rules will generate fundamental frequency curves for statements and questions in the four dialects we have chosen as representatives of the whole language area. The new rules reflect our analysis of the acute accent as being part of the basic intonation unit and the grave accent as precontour plus delayed basic unit. They will not have the precision of our previous rules for individual speakers, but they will reflect what we regard as essential dialect independent principles in Swedish intonation. The input to our rules consists as usual of phrases of one to four syllables including information of acoustic segments, syllable boundaries, prosody, and dialect.

Grave words are marked [+tone] and first pass through a special tone rule which gives them the precontour required by the dialect (Table 3.1). Figure 3.2 shows a block diagram of the process. Formally:

[+tone] Add precontour according to dialect.

Phrases marked [−tone] bypass this rule. All the phrases are then taken care of by the basic rules which are essentially the same as Rules 1, 2 A, and 3, used earlier to generate the contours of our individual speakers. Only 2 A needs some modification since it was expressed in terms

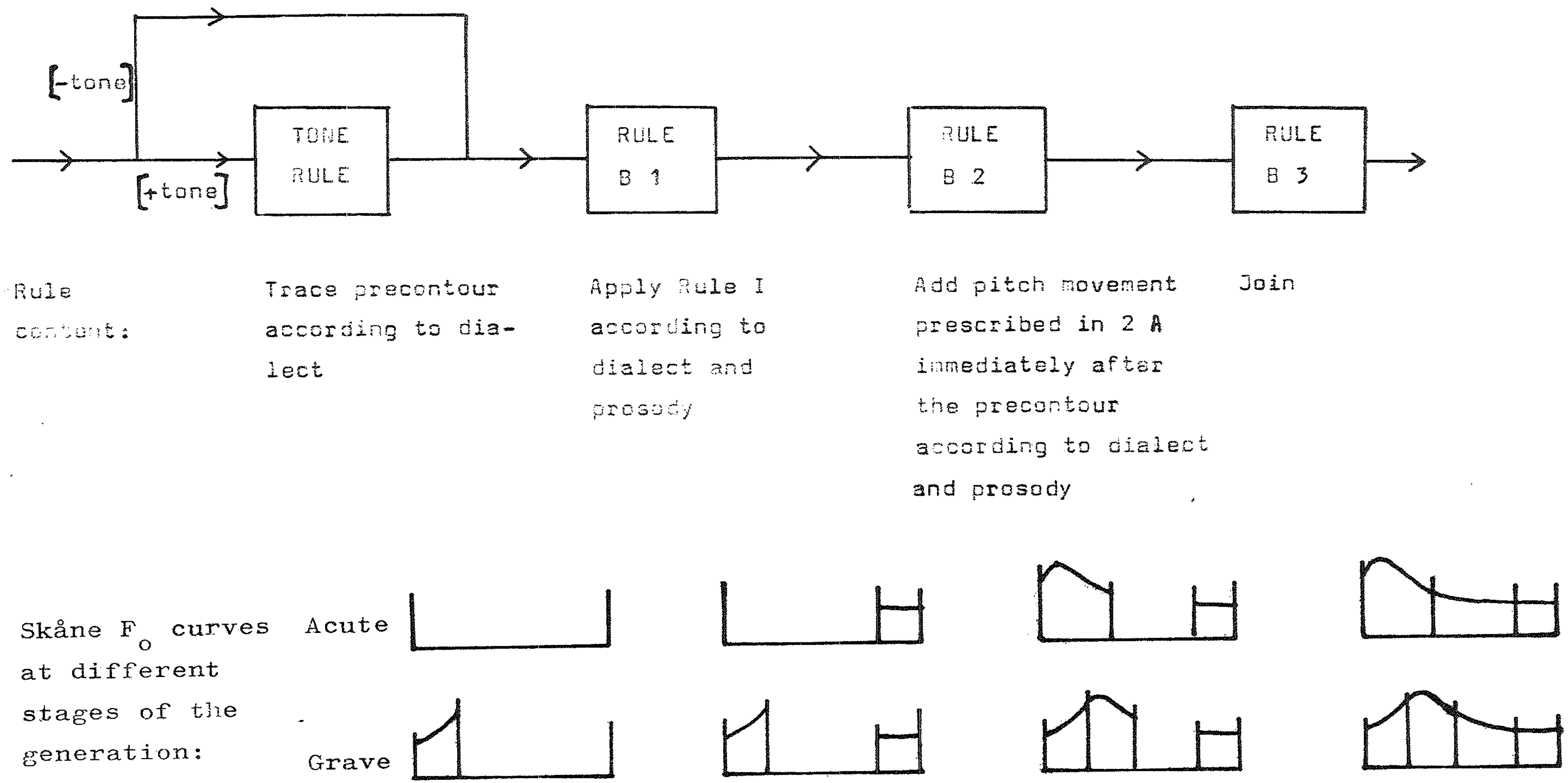


Figure 3.2. The working of the general rules. See text 3.5.

suitable for a stressed syllable only. The new modified rules will look as follows:

B(asic) 1. Apply Rule 1 according to dialect and prosody.

B 2. Apply pitch movement prescribed in 2 A according to dialect and prosody immediately after the precontour.

B 3. Join.

When there is no precontour (as for the acute words), B 2 is of course identical with 2 A. One of the effects of the precontour is to delay the basic intonation unit. The time of the delay is determined by the duration of the precontour. Rule B 3 automatically takes care of the needed shrinking.

3.6. Comparison of the rules for the grave accent

Our former rules (Rules 2 TR) prescribed pitch movements for the stressed syllable of the grave accented words. According to our modified rules, the pitch of the stressed grave syllable is split into a precontour and a remainder which is spliced together with a time compressed basic intonation unit. The new rules reflect the interdependence of the acute and grave accents, which is common to all the investigated dialects. On the other hand the splitting and splicing and the evaluation of the delay in morae is perhaps rather subjective. We shall come back to a motivation of this process in a later publication that will treat the prosody of compounds.

3.7. Grave, a petrified "double stress" pitch contour?

Figure 3.1 shows that the stressed syllable connected with the grave accent is very stable in its pitch configuration. It is always manifested by pitch raised to a level above neutral and its general shape is practically undisturbed by the sentence intonation. Taken at its face value, it seems to deserve the status of an autonomous tone accent. But Table 3.1 shows that there is an interdependence between the shape of the precontour and the shape of the basic contour which recalls the dependence of the acute accent on sentence intonation. If the shape of the basic contour starts with a rise, the precontour will end in a fall and vice versa. In other words, knowing the shape of the early part of the basic unit we can predict the pitch movement of the grave accent.

Has this relation any significance? One explanation or interpretation of this stable relation between the grave precontour and the beginning of the basic unit is that these two tonal movements are reflexes of what was once the fundamental frequency response to two connected stressed syllables of which the first one had a pitch movement subordinated to that of the second which in its latter part was exposed to modifications imposed by sentence intonation.

There is historical justification for regarding the grave accent as a development of an earlier "double stress" pitch contour. The grave accent appears in words in which a posttonic syllable can be associated with length or stress in an earlier period of the language. Later, stress and length were lost but the pitch movements combined with the stresses were retained. We are well aware that we are not presenting a new hypothesis about the development of the grave accent. Similar views were expressed for instance by Ekblom (1929-31) and Kuryłowicz (1936). What is perhaps interesting is that we arrived at this hypothesis by an analysis of a piece of "substance", in this case the fundamental frequency curves derived from present day speakers of present day dialects.

3.8. Modified general rules

We shall leave the historical speculations and return to the fact that the grave precontour is practically predictable from the early part of the basic contour. This may of course be reflected by the rules. One

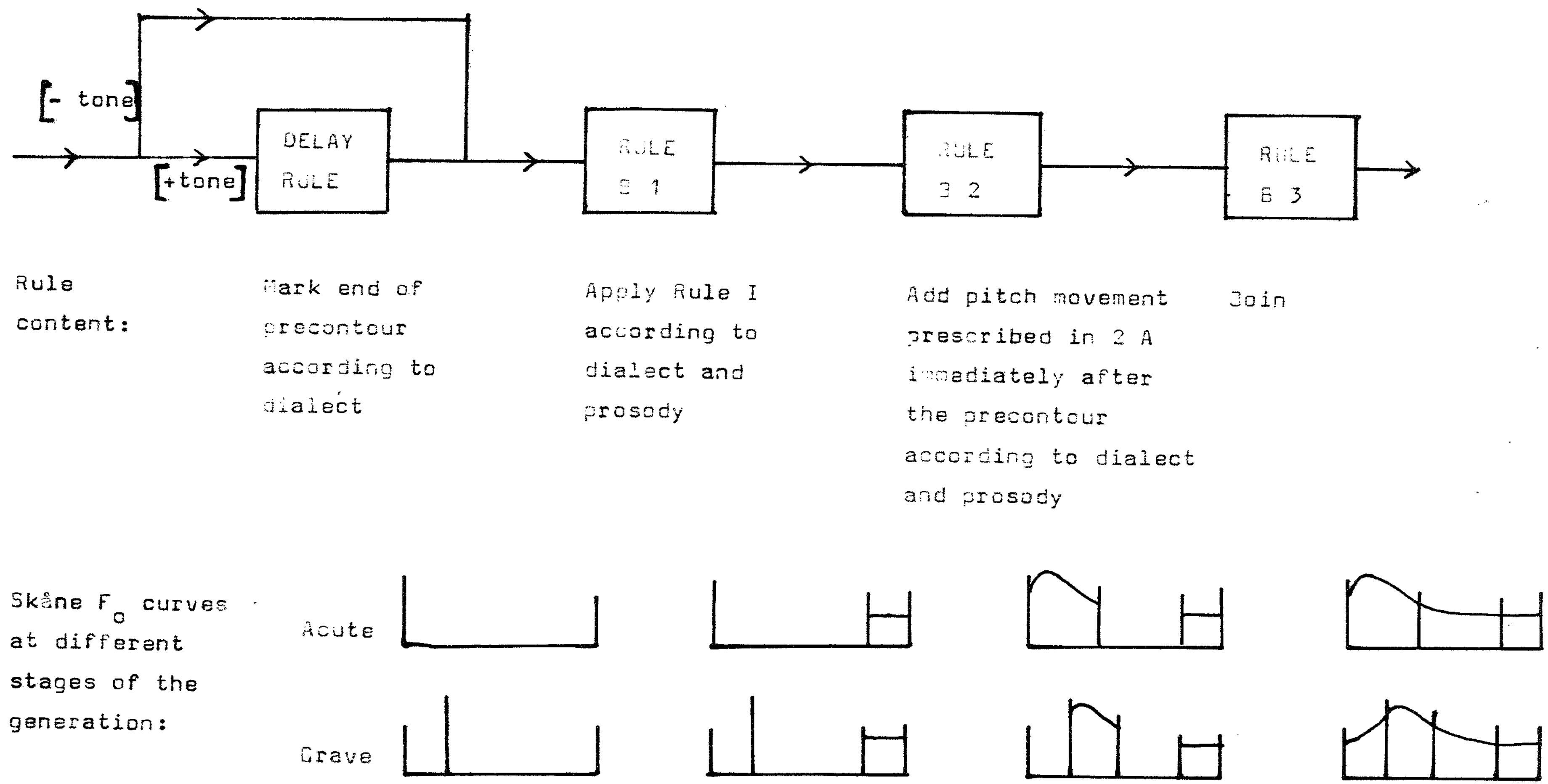


Figure 3.3. The working of the modified general rules. See text 3.8.

possible way of achieving this is to let the grave words pass through a delay rule which leaves a blank in the pitch curve for a time unit determined by the dialect. Later, passing through the join rule (3), expanded to embrace all blanks and not just the empty space between the stressed syllable and the end, the grave missing precontour will be filled in automatically from a neutral beginning. Figure 3.3 illustrates this process.

For the grave accent we may posit underlying forms with two stresses (of which one may be secondary) and regard the grave tone accent as a surface manifestation of double stressed forms. We shall come back to this solution in connection with our analysis of the compounds.

It may be claimed that the underlying double stressed forms that are posited for words with the grave accent have some reality for present day speakers.

In emphatic speech there is for all the dialects a larger increase of intensity and duration in the second syllable of the grave words as compared to the comparable syllable of the acute ones. If we assume that the grave has a second, latent stress, it looks as if the emphatic command were, "add energy to all stressable syllables", and that as a consequence of this command the latent stress comes to the fore. In Skåne grave the second syllable may under emphasis even get a peak in the fundamental frequency curve. (Fig. 2.2.2 first row, Item N:o 5.)

Deprived of phonation, as for instance in whisper, a speaker will also resort to his latent double stressed patterns, if he feels forced to bring out the acute-grave contrast (Jensen 1958, Hadding-Koch 1961, Segerbäck 1966).

3.9. Emphasis and fundamental frequency

The fundamental frequency response to emphasis is clearly dependent on the shape of the curve in the corresponding neutrally stressed syllable.

We have made the following observations:

If the corresponding neutrally stressed syllable has a pitch peak, this peak will be pushed to a later position in the syllable and upward on the frequency scale to a higher level. If the corresponding neutrally stressed syllable has a low after an early peak (Stockholm grave) this low will also be pushed forward and downwards to a lower level on the frequency scale. If there is no peak in the stressed syllable (as in contours with mainly rising sentence intonation, e.g. Västergötland) emphasis will cause a pitch peak to develop at the beginning of the stressed syllable.

3.10. Duration and intensity

Duration and intensity will be treated in more detail in a later report. Here we shall just sum up a few observations that have been made earlier in passing. Grave words are longer than acute ones for our Stockholm and Västergötland speakers. It should be noticed that in these dialects the lengthened grave is correlated to a more complicated pitch movement than the grave accent of the other dialects. Emphasis has a lengthening effect not only on the stressed syllables but also on the later syllables of the grave accented words.

Summary

1. Swedish has two accents distinguished by differences in fundamental frequency (pitch). The pitch curves derived from words with these accents show a great variety of patterns depending on the dialect (E.A. Meyer 1937, 54). When these patterns are classified by the number and the location of the pitch peaks, the dialects fall into four main types (Gårding 1970). Our first object was to complete Meyer's material by new registrations of accents, varying both dialect and prosody (intonation and stress

pattern). Recordings were made with speakers representing the four tonal types. The speech material consisted of mono-, bi-, tri- and tetrasyllabic words with contrastive accents in the polysyllabics. The words were uttered as neutral and emphatic statements and as neutral and emphatic questions. The recordings were analysed by means of spectrograph, pitch meter and intensity meter. The present report is mainly concerned with pitch.

2. The pitch contours by which an individual speaker manifests his accents under the four selected prosodics are described by means of a set of rules thought of as instructions to a fictitious vocoder. The rules vary with the dialect and so far only apply to the words under observation. It is clear, however, that they have more general validity.

Inputs to the rules are phrases of one to four syllables with primary stress on the first syllable. The input utterance is syllabified and carries the following information, stress (stress or not for each syllable), type of stress (emphasis or not), accent (grave or not), intonation (question or not). The rules are descriptive or "output oriented". The first two rules make use of four relative pitch levels (low, neutral, mid, high) and prescribe the pitch movement in the stressed and final syllables. They specify where in the syllable the pitch turns (early, mid, late) and the range of the movement (from mid to low, etc.). The third rule completes the pitch curve of the utterance. For all the dialects and prosodies the rules proceed in the following order:

(1) Pitch is assigned to the terminal part.

(2) Pitch is assigned to the stressed syllable (different rules for different accents).

(3) Possible blanks between the stressed syllable and the terminal part are filled in by interpolation.

The third rule makes the program applicable to phrases with any number of unstressed syllables.

3. There is a constant relation between pitch manifestations of the two accents in all the dialects and prosodies. For a given prosody and dialect the pitch curve of the acute accent recurs with some delay in the grave one. The pitch of the stressed syllable of a grave word remains practically unperturbed by the prosody. In view of these facts we regard the acute accent as the basic intonation unit and the grave accent as consisting of a precontour followed by a delayed and time compressed basic intonation unit. The precontour is typical of the dialect but largely independent of prosody. This relation is formalised in a set of general rules. The first rule generates the precontour for the grave accent. The following rules generate the basic intonation unit and take care of the needed time compression (Fig. 3.2).

One possible linguistic interpretation of these relations is that the grave accent is the "petrified" pitch remainder of what was once the fundamental frequency response to a stress pattern combining two stressed syllables.

4. There is another constant relation in our contours which is dialect independent. The actual shape of the precontour is largely dependent on the shape of the basic unit. With a predominant fall in the basic unit (falling sentence intonation) the precontours will be rising (Skåne, Gotland). With a rising or rising falling basic unit (Stockholm, Västergötland) the precontour will be falling.

This constant dialect independent relation between the precontours and the basic unit makes it possible to modify our general rules. In the modified rules the input [+tone], i.e. the grave accent, generates a dialect dependent delay of the basic unit (Fig. 3.3). The precontour is then taken care of by a join rule with a neutral beginning.

The linguistic interpretation of the relations summarized under (4) is that the shape of the precontour of the grave accent is dependent on the sentence intonation of the dialect.

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Appendix 1

Information about the speakers

CS female, born in 1950. Grew up in Stockholm. Parents from Stockholm and Skåne.

CÖ male, born in 1945. Grew up in Stockholm. Parents from Skåne and the Swedish west coast (Dalsland and Halland).

EG female, born in 1920. Grew up in Landskrona. Parents from Skåne. Lived most of her life in Lund.

PL male, born in 1944. Grew up in Malmö. Parents from Småland and Halland.

ALa female, born in 1950. Grew up in Hangvar, Gotland. Parents from Skåne and Småland.

TS male, born in 1950. From Slite, Gotland.

ALö male, born in 1944. Grew up in Borås. Parents from Västergötland.

JA male, born about 1950. Grew up in Västergötland.

Appendix 2

Material

Test words	Translation
Speakers: TS, JA, EG, PL	
´Pål	Paul
´Polen	Poland
´anden	the wild duck
ba`nanskalet	the banana-skin
`pålen	the pole
`badkaret	the bath-tub
`simbassäng	the swimming-pool
`badkar	bath-tub
`anden	the spirit
`värden	values
´tomten	the site
´värden	the host
`tomten	the brownie, Santa Claus
Speakers: EG, PL	
´överstarna	the colonels
`pållen	the gee-gee
´änderna	the wild ducks
´pollen	pollen
`ändorna	the ends
`baderskorna	the bathing-women
Speakers: ALa, ALö, CS, CÖ	
`tomtarna	the brownies
´värden	the host
ba`nanskalet	the banana-skin

´tomten	the site
´överstarna	the colonels
´änderna	the wild ducks
´Pål	Paul
´Polen	Poland
`värden	values
`simbassäng	swimming-pool
´värd	host
`pålen	the pole
´anden	the wild duck
`tomten	the brownie, Santa Claus
`baderskorna	the bathing-women
`badkaret	the bath-tub
`anden	the spirit
`ändorna	the ends
`badkar	bath-tub

<u>Speakers</u>: ALa, ALö, EG, PL

´bɑ:b

´bɑ:bab

`bɑ:bab

´bɑ:babab

`bɑ:babab

Appendix 3

Table 1.1. Durations of segments, locations of maxima and minima
Speaker: CS, Stockholm

		p	o	l	ɛ	n	the whole word	F_o max 1	F_o max 2	F_o min
Acute	1'	170	190^20	80			460	260		
enframed	1	160	210	70	20^60	110	630	260		
	2'	220	200^50	130			600	290		
	2	210	220	60	20^100	160	790	280		
	3'	200	200^30	100			540	260		
	3	170	210	80	20^80	120	670	260		
	4'	170	180^30	130			520	375		
	4	170	210	60	20^80	100	620	350		
Acute	1'		30^220	170			440	240		
isolated	1		200^	100	100	170	560	240		
	2'		50^210	150			420	270		
	2		160^70	70	130	140	580	260		
	3'		70^180	160			400	375		
	3		170^	80	120	120	490	350		
	4'		100^210	170			480	400		
	4		170^20	70	120	130	510	385		
Grave	1	150^	180⌄30	70	80^30	120	670	250	240	170
enframed	2	190	30^190⌄	80	90^20	140	740	280	260	160
	3	(310)	30^200⌄	80	100^20	120	850	260	260	170
	4	150	30^190⌄	80	90^20	110	660	280	325	160
Grave	1		20^190⌄20	100	40^110	170	630	260	240	160
isolated	2		20^210⌄20	90	40^110	170	650	300	280	180
	3		30^150⌄30	80	40^100	180	610	300	350	190
	4		40^160⌄20	90	40^100	150	600	350	425	160

1. Neutral statement
2. Emphatic statement
3. Neutral question
4. Emphatic question

Prime after a figure means monosyllabic word

Two (or three) measurements for a segment means that it is divided into subsegments by a max (^) or a min (⌄). See text 1.5

Measurements in msec and Hz

Appendix 3

Table 1.2. Durations of segments, locations of maxima and minima
Speaker: CS, Stockholm

		ɛ	n	d	ə	n	a	the whole word	F_o max[1]	F_o max[2]	F_o min
Acute	1	160	100	50	100	50	100	560	240		
enframed	2	170	100	60	80	50	90	560	240		
	3	160	110	60	90	60	100	590	240		
	4	150	120	50	60	60	100	540	325		
Acute	1	170	110	60	90	60	190	680	230		
isolated	2	170	120	60	80	70	170	680	300		
	3	140	140	40	60	90	140	620	350		
	4	150	130	40	80	70	150	620	375		
Grave	1	60^90	120⌄	70	120	70	40^60	640	260	260	160
enframed	2	90^80	120⌄	80	100	70	70^40	660	240	240	160
	3	50^90	100⌄	70	100	70	30^80	610	240	260	160
	4	60^100	110⌄	60	100	60	30^90	610	290	375	150
Grave	1	80^80	120⌄	60	120	80	10^160	720	260	260	160
isolated	2	80^90	110⌄	60	110	70^	200	740	280	260	160
	3	60^90	100⌄	60	100	70^	170	660	260	375	160
	4	60^100	130⌄	70	120	70^	190	750	340	475	160

1. Neutral statement
2. Emphatic statement
3. Neutral question
4. Emphatic question

Prime after a figure means monosyllabic word

Two (or three) measurements for a segment means that it is divided into subsegments by a max (^) or a min (⌄). See text 1.5

Measurements in msec and Hz

Appendix 3

Table 2.1. Durations of segments, locations of maxima and minima

Speaker: EG, Skåne

		p	o	l	ε	n	the whole word	F_o max^1	F_o max^2	F_o min
Acute enframed	1'	190	40^160	100			500	280		130
	1	180	60^120	80	120	110	680	280		140
	2'	220	150^130	120			610	350		140
	2	220	140^110	90	100	110	760	325		150
	3'	150	70^160	80			460	300		120
	3	180	40^140	70	100	100	630	300		140
	4'	240	80^170	60			550	350		110
	4	190	70^160	80	90	100	690	375		120
Acute isolated	1'		60^190	120			370	240		130
	1		50^150	90	100	130	520	240		140
	2'		120^220	200			550	350		140
	2		120^170	80	140	150	660	300		140
	3'		150⌄70	80^20			330	280		140
	3		170	50⌄20	90	50^40	430	280		140
	4'		60^190⌄110	90^70			520	425	375	160
	4		100^220	60⌄20	120	100^	620	400	350	160
Grave enframed	1	160	160^30	70	100	140	670	250		140
	2	200	130^120	60⌄10	90	50^60	720	300	310	170
	3	180	160^50	80	100	120	700	280		140
	4	210	180^60	70	100	110	720	350		140
Grave isolated	1		150^60	90	110	130	540	240		140
	2		200^70	120	140	160	700	300		140
	3		120^60	100	20⌄70	60^60	510	280	220	140
	4		230^50	80	50⌄80	90^	600	400	350	160

1. Neutral statement
2. Emphatic statement
3. Neutral question
4. Emphatic question

Prime after a figure means monosyllabic word

Two (or three) measurements for a segment means that it is divided into subsegments by a max (^) or a min (⌄). See text 1.5

Measurements in msec and Hz

Appendix 3

Table 2.2. Durations of segments, locations of maxima and minima
Speaker: EG, Skåne

		ɛ	n	d	ə	n	a	the whole word	F_0 max 1	F_0 max 2	F_0 min
Acute enframed	1	110^40	90	30	70	60	80	480	220		120
	2	150	40^60	40	60	50	90	500	250		120
	3	100^40	100	40	60	60	90	490	240		120
	4	90^60	110	60	70	60	90	550	280		120
Acute isolated	1	130^	100	50	70	70	160	590	200		120
	2	130^20	110	40	80	90	160	650	230		120
	3	120^	100	70	80⌄	80	110^30	610	240	200	120
	4	80^60	120	70	100⌄	70	150^	660	300	220	130
Grave enframed	1	140	80	20^20	60	60	90	480	220		120
	2	150	30^90	40	30⌄60	70	70^	550	240	240	140
	3	140^	100	50	80	50	90	520	240		120
	4	140	80^30	40	80	60	90	520	280		120
Grave isolated	1	110	60^50	50	60	70	150	560	200		120
	2	160	30^90	50	40⌄60	70	50^90	650	240	230	130
	3	120	90^20	50	80	70	20⌄110^	580	260	200	120
	4	120	90^60	20	90	80	20⌄140^	650	350	220	120

1. Neutral statement
2. Emphatic statement
3. Neutral question
4. Emphatic question

Prime after a figure means monosyllabic word

Two (or three) measurements for a segment means that it is divided into subsegments by a max (^) or a min (⌄). See text 1.5

Measurements in msec and Hz

Appendix 3

Table 3.1. Durations of segments, locations of maxima and minima

Speaker: ALa, Gotland

		p	o	l	ˈɛ	n	the whole word	F_o max 1	F_o max 2	F_o min
Acute enframed	1'	160	140^30	60			400	310		200
	1	150	150^10	60	90	80	550	315		190
	2'	180	210^50	80			510	335		260
	2	190	170^40	80	110	90	680	350		190
	3'	130	120^70	80			390	340		220
	3	120	160^30	70	80	80	550	325		180
	4'	170	200^40	80			490	450		300
	4	170	200^40	90	100	60	660	450		180
Acute isolated	1'		100^210	130			450	290		190
	1		190^60	80	80⌄100	90^	610	310	240	180
	2'		90^260	120			480	425		190
	2		210^90	80	150⌄60	110^	710	375	220	180
	3'		250	100^			360	400		–
	3		170^30	80	70⌄90	70	510	425	400	210
	4'		330	50^40			430	500		–
	4		250^40	90	60⌄120	90^	640	500	425	200
Grave enframed	1	200	210	70^	100	90	680	300		200
	2	–	250	80^	100	90	–	500		260
	3	100	170	60	10^80	80	500	320		220
	4	190	250	80^	110	80	720	425		200
Grave isolated	1		240	30^40	140⌄60	100^	600	290	230	200
	2		290	60^40	200⌄	150	730	475		180
	3		230	40^50	90⌄90	100^	600	375	340	210
	4		280	50^50	100⌄100	90^	680	475	400	220

1. Neutral statement
2. Emphatic statement
3. Neutral question
4. Emphatic question

Prime after a figure means monosyllabic word

Two (or three) measurements for a segment means that it is divided into subsegments by a max (^) or a min (⌄). See text 1.5

Measurements in msec and Hz

Appendix 3

Table 3.2. Durations of segments, locations of maxima and minima
Speaker: ALa, Gotland

		ɛ	n	d	ə	n	a	the whole word	F_0 max 1	F_0 max 2	F_0 min
Acute enframed	1	130	70^40	40	50	60	90	480	325		180
	2	140	80^60	50	90	70	90	590	350		190
	3	130	60^30	40	50	60	60	440	350		200
	4	140	60^70	50	100	70	80	580	450		200
Acute isolated	1	140	80^50	50	100	80	60⌄ 130^	700	325	250	190
	2	190	70^90	80	110	80	70⌄ 150^	840	450	280	180
	3	130	70^70	30	80	70	50⌄ 140^	640	425	325	200
	4	170	120^60	70	100	90⌄	200^	820	500	400	200
Grave enframed	1	120	100	50	20^60	50	80	490	325		200
	2	160	130	40	10^90	70	90	600	375		190
	3	120	90	40	10^80	60	80	500	350		190
	4	160	120	80^	140	80	110	690	450		200
Grave isolated	1	120	110	60^	100	80	80⌄ 120^	660	325	240	180
	2	150	140	90^	130	90	100⌄ 110^	830	500	210	180
	3	140	120	40^	100	70	60⌄ 140^	680	400	300	200
	4	160	140	50^	110	80	60⌄ 130^	740	475	500	230

1. Neutral statement
2. Emphatic statement
3. Neutral question
4. Emphatic question

Prime after a figure means monosyllabic word

Two (or three) measurements for a segment means that it is divided into subsegments by a max (^) or a min (⌄). See text 1.5

Measurements in msec and Hz

Appendix 3

Table 4.1. Durations of segments, locations of maxima and minima
Speaker: ALö, Västergötland

		p	o	l	ɛ	n	the whole word	F_0 max 1	F_0 max 2	F_0 min
Acute enframed	1'	160	200^60	90			520	180		140
	1	^110	180⌄40	60	90^	100	590	150	180	130
	2'	160	190^80	120			550	200		140
	2	^120	70⌄170	70	50^30	130	640	160	200	130
	3'	130	220^10	100			450	200		180
	3	^110	120⌄90	60	70^20	100	580	150	200	140
	4'	120	200^50	90			470	270		200
	4	^110	150⌄90	60	70^	90	580	160	280	130
Acute isolated	1'		190^70	160			420	150	160	120
	1		^180⌄20	80	100	30^160	580	140	170	120
	2'		150^150	180			480	220		120
	2		^100⌄150	30^50	80	180	580	150	200	140
	3'		150^40	110			300	240		120
	3		^160⌄60	60	100^	170	540	170	210	130
	4'		210^80	150			440	325		120
	4		^220⌄20	70	100	30^130	570	170	280	130
Grave enframed	1	110	60^160⌄	70	80	30^80	600	170	180	120
	2	120	70^200⌄	80	90	30^100	700	200	200	120
	3	80	50^160	20⌄40	100	40^70	570	180	190	120
	4	80	60^190⌄	60	90	30^80	610	240	250	120
Grave isolated	1		40^150	40⌄40	90	60^120	550	170	160	120
	2		80^170	40⌄40	110	20^170	640	200	210	120
	3		60^130	40⌄30	110	40^160	580	200	220	120
	4		70^160	40⌄40	110	50^150	610	260	280	120

1. Neutral statement
2. Emphatic statement
3. Neutral question
4. Emphatic question

Prime after a figure means monosyllabic word

Two (or three) measurements for a segment means that it is divided into subsegments by a max (^) or a min (⌄). See text 1.5

Measurements in msec and Hz

Appendix 3

Table 4.2. Durations of segments, locations of maxima and minima

Speaker: ALö, Västergötland

		ɛ	n	d	ə	n	a	the whole word	F_o max[1]	F_o max[2]	F_o min
Acute	1	^110	80⌄50	60	60	70	20^50	510	160	180	120
enframed	2	20^110	100⌄40	60	70	60	40^60	550	160	200	120
	3	^120	70⌄80	60	80	60	20^70	560	160	200	130
	4	^120	90⌄120	40	60	70	40^50	590	180	240	130
Acute	1	^120	140⌄30	40	100	40	80^40	600	160	180	120
isolated	2	^120	140⌄40	40	60^20	60	130	620	150	200	130
	3	^120	20⌄120	40	80	60	110^	560	140	280	130
	4	20^110	150⌄	60	90	60	90^30	620	160	300	120
Grave	1	50^60	150⌄	70	120	60	50^40	600	180	180	110
enframed	2	80^20	170⌄10	60	110	70	50^90	680	190	200	120
	3	40^70	150⌄	60	90	70	50^30	560	180	200	120
	4	70^40	200⌄	60	100	60	60^20	610	220	280	120
Grave	1	70^20	170	30⌄20	120	50	110^30	620	160	160	120
isolated	2	80^30	190⌄	70	100	70	90^60	700	200	200	120
	3	40^30	110	60⌄	120	50	100^20	520	200	240	120
	4	90^20	200	80⌄	110	50	140^10	700	320	300	120

1. Neutral statement
2. Emphatic statement
3. Neutral question
4. Emphatic question

Prime after a figure means monosyllabic word

Two (or three) measurements for a segment means that it is divided into subsegments by a max (^) or a min (⌄). See text 1.5

Measurements in msec and Hz

ARE YOU ASKING ME, TELLING ME OR TALKING TO YOURSELF?

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In a study of Swedish intonation, Hadding-Koch (1961) distinguished among three functional categories of utterance and their correlated fundamental frequency (f_0) contours. The first category ("question") occurred when a speaker wanted an answer from a listener; it was characterized by a relatively high f_0 at the stress peak and a rising terminal glide. The second category ("statement") occurred when a speaker wanted a listener to believe or agree with him; it was characterized bv a lower f_0 at the stress peak and a falling glide. Later perceptual studies of synthetic speech, in which the f_0 contour of an utterance was systematically varied, have largely supported these descriptive analyses (Hadding-Koch and Studdert-Kennedy 1964, 1965a and b; Studdert-Kennedy and Hadding 1972; in press. Listeners tended to classify contours with an apparent terminal rise and/or high f_0 at the stress as questions, contours with an apparent terminal fall and/or low f_0 at the stress as statements (cf. Uldall, 1962).

The third category of utterance, described by Hadding-Koch, had a level terminal glide ("terminal sustain"). With a relatively even and moderately high overall f_0, this type of contour occurred when the speaker was musing or talking to himself. With various other f_0 patterns in earlier sections of the contour, level terminal glides also occurred in exclamations and in some other type of utterances expressing a somewhat emotional reaction. These are not treated here. Common to all these contexts is the fact that the speaker was not primarily interested in eliciting a listener's response – in fact, no listener need be present at all. Moravcsik (1971) quotes Householder as differentiating "statements which disclaim knowledge, but

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exhibit indifference towards obtaining it from real questions by a feature (±Hearer) indicating hearer's involvement" (p. 81, fn 1). We would like to propose a similar feature though with a somewhat different definition.

As a first step, the present study was intended to assess the perceptual validity of the third category. The hypotheses were that (1) listeners can reliably identify fundamental frequency contours which display a level terminal glide rather than a terminal rise or fall, (2) listeners can reliably form a category of utterances defined by the speaker's talking to himself rather than addressing a listener, (3) "talking-to-self judgments, if they occur, are made of contours characterized by a moderate, even f_o, ending with a level glide.

Method

The stimuli were those used in a previous study (Studdert-Kennedy and Hadding, 1972; in press). They were prepared by means of the Haskins Laboratories Digital Spectrum Manipulator (DSM) (Cooper, 1965). This device provides a spectrographic display of a 19-channel vocoder analysis, digitized to 6 bits at 10 msec intervals, and permits the experimenter to vary the contents of each cell in the frequency-time matrix, before resynthesis by the vocoder. For the present study we were interested in the channel that displays the time course of the fundamental frequency of the utterance, since it was by manipulating the contents of this channel that we varied f_o.

The utterance "November" [no'vɛmbɚr] was spoken by an American male voice into the vocoder and stored in the DSM. F_o was then manipulated over a range from 85 Hz to 220 Hz. The f_o values at the most important points of the contours (starting point, peak, turning point, and end point) were chosen to represent four different f_o levels of a speaker with a range from 65 Hz to 250 Hz. The four levels were based on a

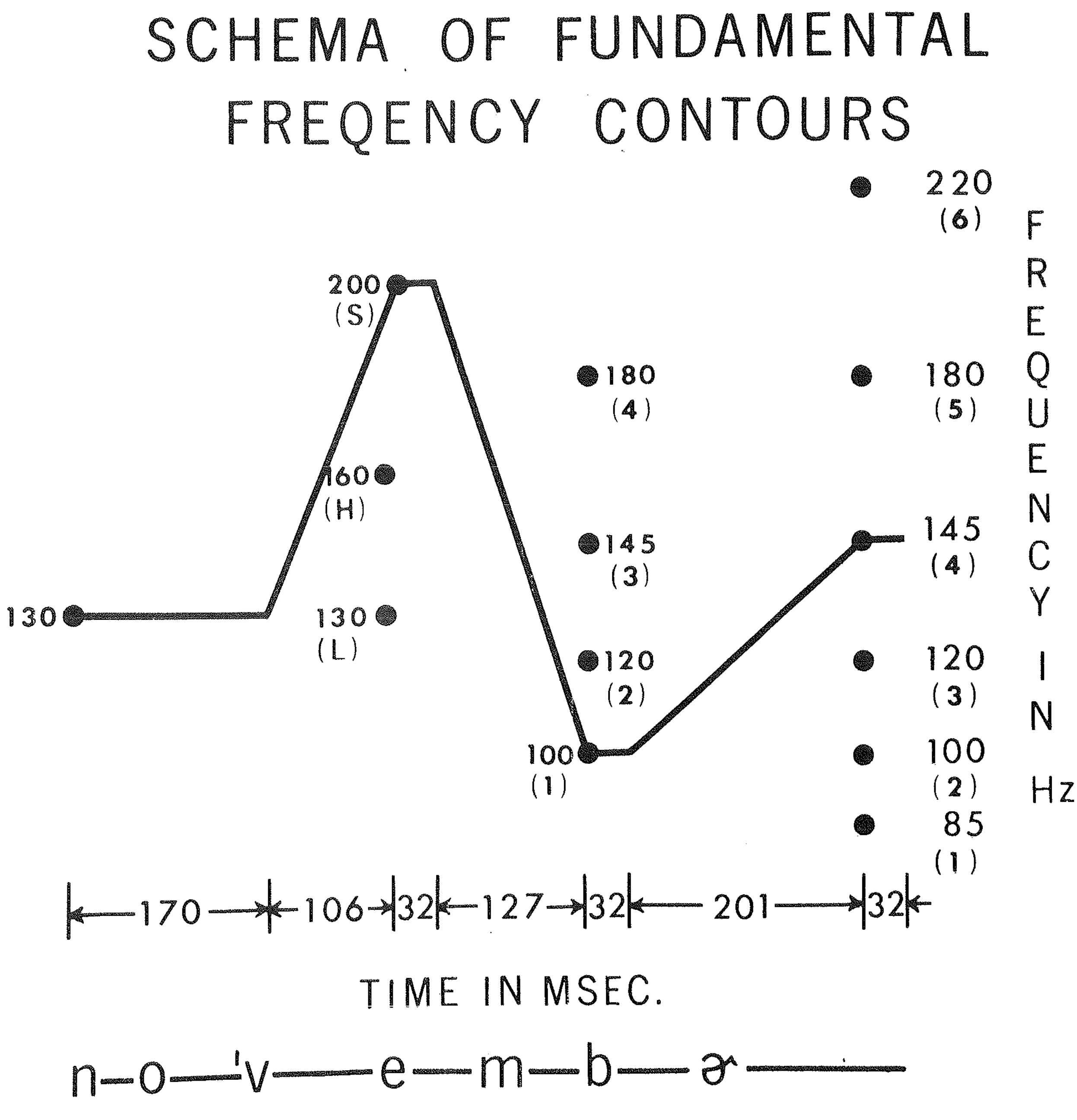

Figure 1. Schemata of fundamental frequency contours imposed on the utterance "November" [no'vɛmbər]

previous analysis of a long sample of speech by a speaker with this particular range (Hadding-Koch, 1961, pp. 110 ff.).

The contours are schematized in Figure 1. All contours start on a f_o of 130 Hz, sustained for 170 msec, over the first syllable (the "pre-contour"). They then move, during 106 msec, to one of three "peaks": 130 Hz (L, or low), 160 Hz (H, or high), 200 Hz (S, or superhigh). They proceed, during 117 msec, to one of four turning points: 100 Hz (1), 120 Hz (2), 145 Hz (3), 180 Hz (4). Finally, they proceed, during 201 msec, to one of six end-points: 85 Hz (1), 100 Hz (2), 120 Hz (3), 145 Hz (4), 180 Hz (5), and 200 Hz (6). Peak, turning point, and end point are each sustained for 32 msec. The combination of three peaks, four turning points, and six end points yields 72 contours, each specified by a letter and two digits (e.g., S14 for the contour of Figure 1) and each lasting 700 msec.

The 72 contours were recorded on magnetic tape from the output of the vocoder in two forms: (1) carried on a speech wave [no'vɛmbər], (2) as a frequency-modulated sine wave. Each set of 72 was spliced into five different random orders with a five-second interval between stimuli and a ten-second pause after every tenth stimulus.

A group of 22 Swedish graduate and undergraduate volunteers (10 of whom had served as subjects in our earlier experiments) was tested in a series of three sessions, each lasting about 45 minutes. They listened to the tests over a loudspeaker in a quiet room. In a given session they heard the five test orders for one type of stimulus only. All subjects heard the sine wave stimuli in their first session (so as to reduce the possible influence of speech mechanisms on judgments of nonspeech stimuli). Half the group then made linguistic judgments of the speech stimuli in their second session, psychophysical judgments of the same stimuli in their third session; half the group took the tests in reverse order.

In the sine wave session and in the speech psychophysical session, subjects were asked to listen to the terminal glide of each contour and to judge whether it was rising, falling or level in pitch. In the linguistic session, they were asked to picture three situations: a speaker addressing a question to a listener, a speaker making a statement to a listener, and a speaker not addressing a listener, but talking to himself. The subjects' task was then to listen to each utterance and assign it to its appropriate category: question, statement or "talking-to-self". The third category is not, of course, logically exclusive of the first two, and proved difficult to explain. Nonetheless, subjects agreed to try to use it and, in the event, were able to do so with fair consistency.[1]

Results

No systematic differences between groups due to the order in which they made their judgments were observed. Data are therefore presented for the combined groups. Figure 2 presents the sine wave, speech psychophysical and linguistic results for the three series of contours (H3, L3, L2) in which at least one contour was judged as expressing "talking-to-self" on more than 50 % of the group's judgments. Percentages of fall, level and rise judgments (sine wave and speech psychophysical) or of statement, "talking-to-self" and question judgments (linguistic) are plotted against terminal glide, measured as rise (positive) or fall (negative) in Hz from turning point to end point. Each data point represents a percentage of 110 judgments (22 subjects judged each contour five times).

Consider, first, the sine wave results (Figure 2, left column). For each series of contours the only contour judged more than 50 % of the time to be terminally level in pitch is the contour for which the ter-

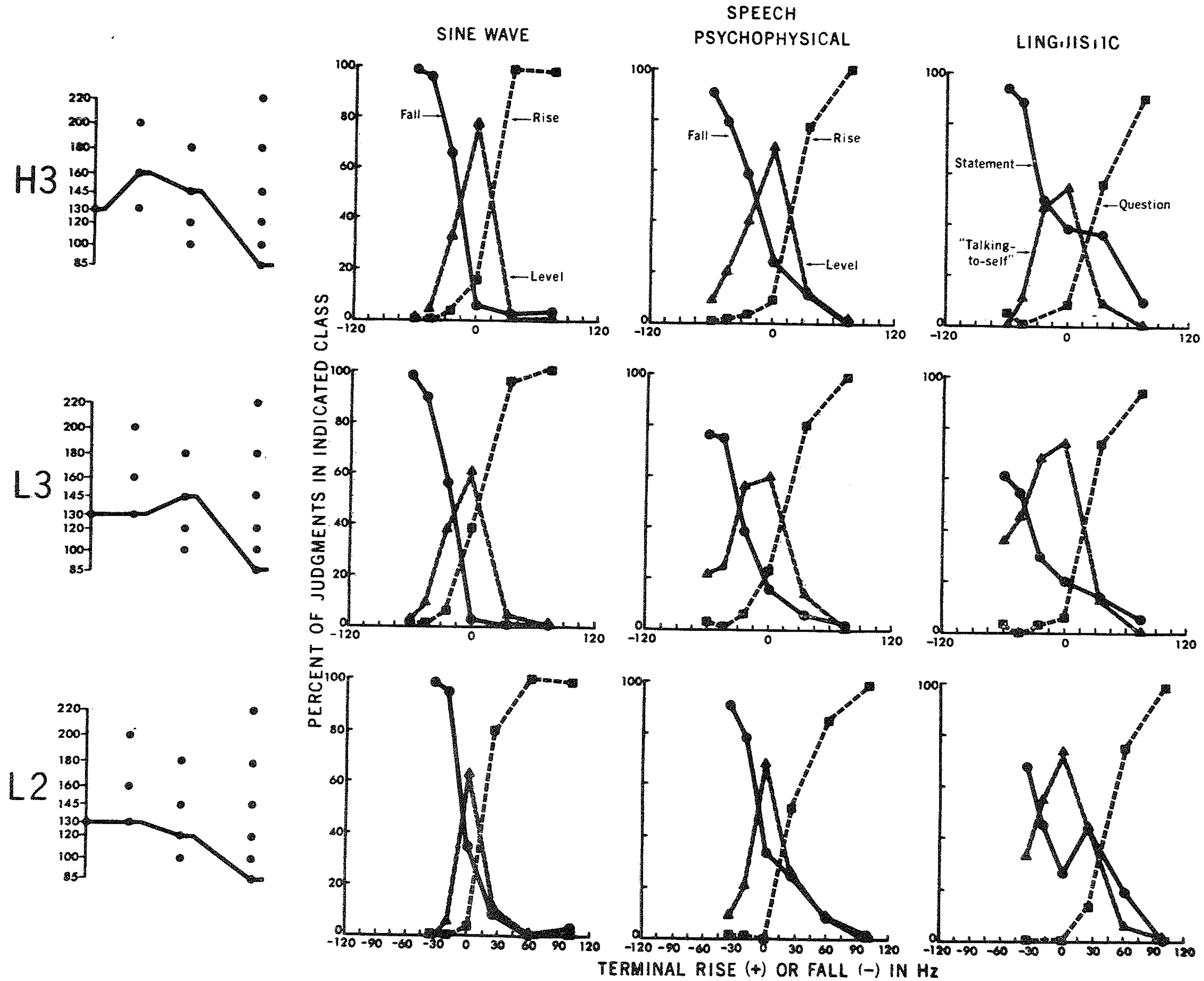

Figure 2. Percentages of fall, level and rise responses (sine wave and speech psychophysical) or of statement, "talking-to-self" and question responses (linguistic) as a function of terminal glide in Hz. Data for 22 subjects on the three series of contours for which at least one contour was judged "talking-to-self" on more than 50 % of the group's judgments.

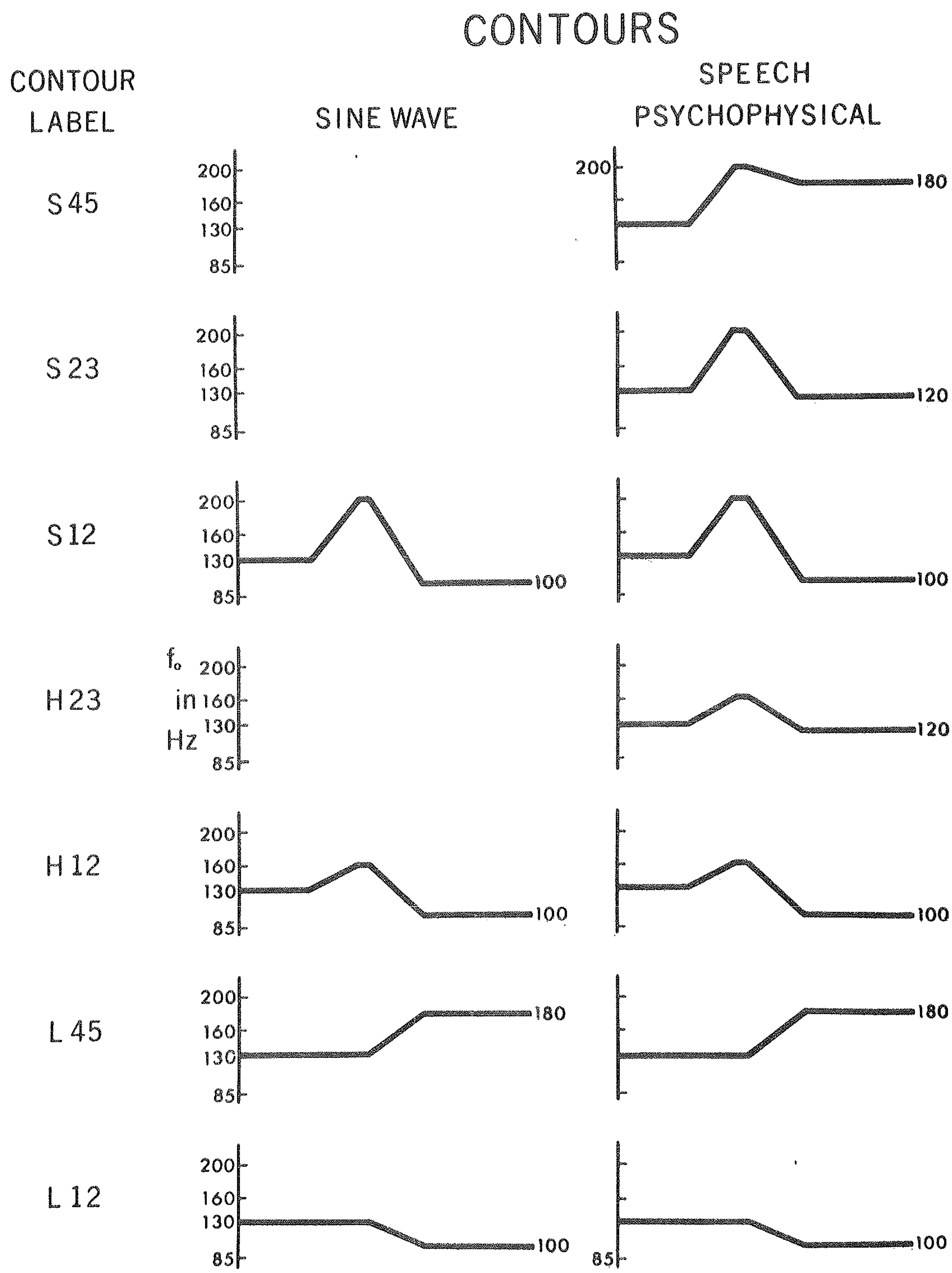

Figure 4: Schemata of all terminally level contours judged "level" on less than 50 % of the group's judgments.

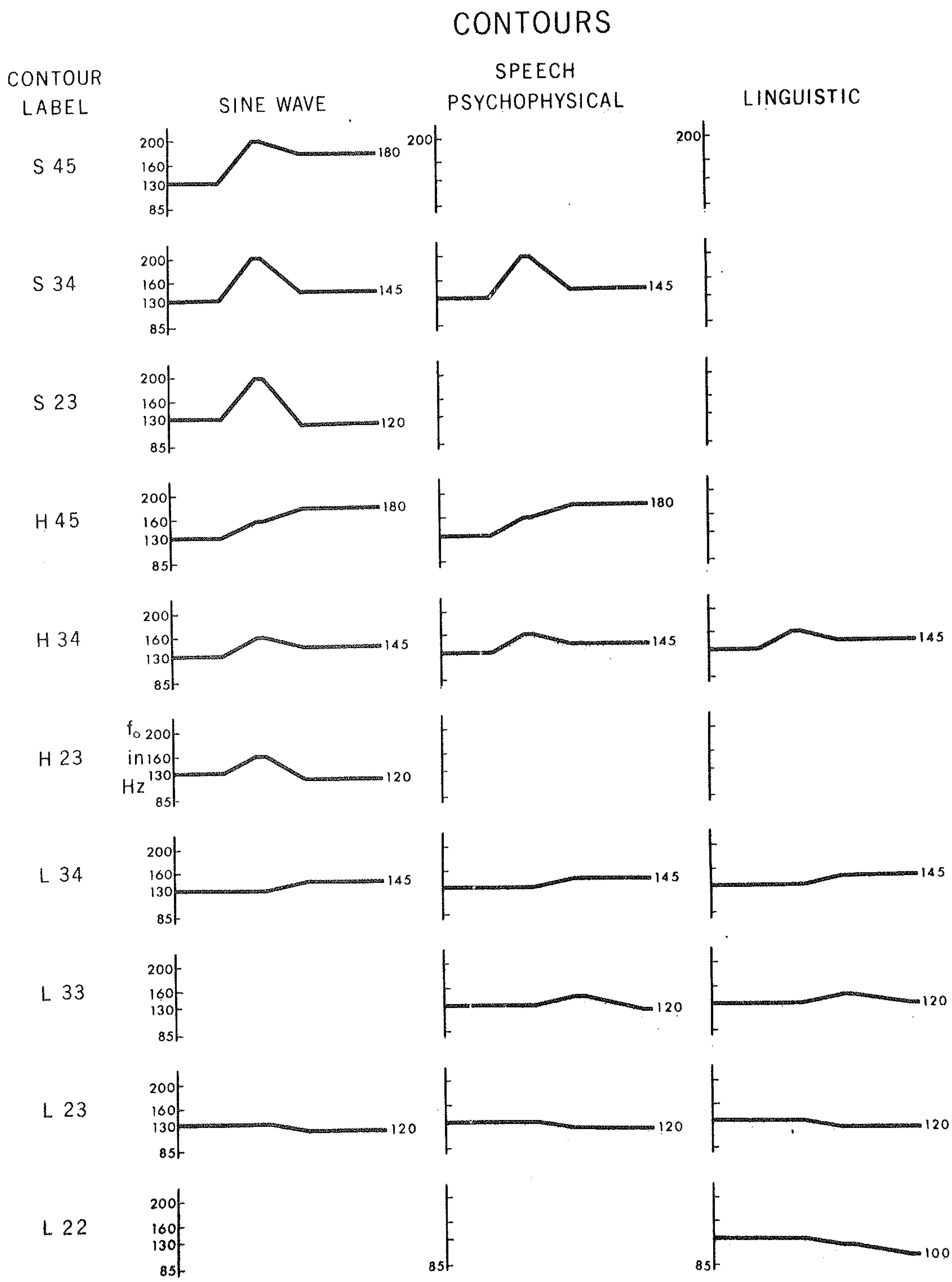

Figure 3. Schemata of all contours judged "level" (sine wave and speech psychophysical) or "talking-to-self" (linguistic) on more than 50 % of the group's judgments.

minal f_0 glide was, in fact, level. "Level" judgments increase and decrease systematically on either side of this zero value, with a stronger tendency to hear a slight fall as level than a slight rise. Since "level" judgments never reached 100 %, either for the terminally level contours of Figure 2 or for the nine other terminally level contours presented, it is evident that listeners did not find the judgment easy. However, their errors were primarily "misses" rather than "false alarms". That is to say, while four of the twelve terminally level contours failed to draw more than 50 % "level" judgments, none of them drew as many as 50 % "fall" or "rise" judgments, and none of the sixty terminally rising or falling contours drew as many as 50 % "level" judgments.

These results are summarized in Figures 3 and 4. Figure 3 (left column) sketches the eight sine wave contours judged "level" more than 50 % of the time. Figure 4 (left column) sketches the four terminally level sine wave contours for which "level" judgments did not reach 50 %. Note that three of the latter (S12, H12, L12) display a fall from the peak to a turning point 30 Hz below the onset level of the contour; one (L45) displays a rise from the peak to a turning point 50 Hz above the onset level of the contour.

Figure 2 (center column) presents speech psychophysical results. In each graph it is again the terminally level contour that collects the highest percentage of "level" judgments. But the spread of "level" judgments over terminally falling contours is clearly broader than for the corresponding sine wave contours. This is particularly noticeable for the L3 series, where one terminally falling contour (L33, middle row) actually draws 56 % "level" judgments. Nonetheless, this is the only "false alarm", so that, with five of the twelve terminally level contours being judged "level" more than 50 % of the time, the errors were again primarily "misses". Figures 3 (center column) and 4 (right column) summarize these results.

Figure 2 (right column) presents the linguistic judgments. In each series it is the terminally level contour that draws the highest percentage of "talking-to-self" judgments. But there is a clear tendency for these judgments to invade the statement category. In one series (L3, middle row) the invasion matches quite strikingly that made by "level" judgments into the "fall" category of the speech psychophysical data. However, the tendency appears in all three series so that each has a terminally falling contour that draws close to 50 % "talking-to-self" judgments: H33 (46 %), L33 (58 %), L22 (55%). Figure 3 (rignt column) summarizes these results. Note the weight of "talking-to-self" judgments in the moderate to low stress peak series. No contour in the S-series meets the 50 % criterion, only one in the H-series, four in the L-series. The latter include two contours with level terminal glides, two with terminal glides that fall by 20-25 Hz.

Finally, we note that, while the preferred question contours of our previous study (Studdert-Kennedy and Hadding, 1972; in press) were totally unaffected by the introduction of a third category, the preferred statement contours did not fare so well. Nine of the twenty-three statement contours on which subjects displayed at least 90 % agreement in the previous study dropped below that level in the present study. Three of these (L33, L22, L23) were among the five contours collecting more than 50 % "talking-to-self" judgments.

Discussion

Listeners to brief (700 msec) frequency modulated sine wave contours can, with some reliability, identify those that sustain a level frequency over the last 265 msec. But their performance is not perfect. While they seldom hear a rising or falling terminal glide as level, they do with fair frequency hear a level glide as rising or falling. They tend to be misled not by the initial rise to the peak, but by the rise of fall from peak to turning-point, that is, by the movement of the contour during the 127 msec immediately preceeding the terminal sustain: Figure 4 (left column) shows that two of the four terminally level contours that were "missed" display no onset-to-peak movement, but all four display a movement of at least 30 Hz from peak to turning-point, and end on a frequency at least 30 Hz above or below the precontour level of 130 Hz. We may therefore say that, exactly as in our previous study (Studdert-Kennedy and Hadding, 1972; in press), listeners seem to use the precontour as an anchor and then have difficulty in separating the terminal glide from the immediately preceding section of the contour if that section displays a marked movement to a point well above or well below the anchor.

The speech psychophysical results display a similar pattern. All four of the contours missed in the sine wave judgments were also missed in the speech psychophysical, and three more were added. Two of those added (S23, H23) display a strong fall from peak to turning point, but end on a frequency only 10 Hz below the precontour level; the other (S45) displays a fall of only 20 Hz from peak to turning point, but ends on a level 50 Hz above the precontour. In other words, there is clear overlap between sine wave and speech psychophysical data.

Even where the two sets of data do not agree, as in the tendency for listeners to judge certain terminally falling speech wave contours as "level", the errors would seem to arise from the same source as the sine wave errors, namely, from a simple inability to separate terminal glide from earlier sections of the contour. Thus, if the first 467 msec of the contour are relatively level (as in the H3 and L3 series, where all frequency variations between onset and turning point are within 30 Hz of the precontour) listeners may fail to detect the slight terminal fall and then judge it to be "level" (see Fig. 2, center column). In other words, they do not, as might be predicted from the analysis-by-synthesis model of Lieberman (1967), accept glide as level when the stress peak is exceptionally high, but rather when the entire section of the contour preceding the terminal glide is relatively low and level.

Turning to the linguistic data, we may say that listeners are indeed able to identify an utterance as that of a speaker talking to himself and that they may even do so with more consistency than they make the corresponding psychophysical judgment (see Fig. 2: L34, L23). Nonetheless, they are not perfectly consistent. One reason for this is that the categories statement and "talking-to-self" are not mutually exclusive, and so compete for certain contours. This is evidenced by the tendency of "talking-to-self" judgments to take over the statement category at level terminal glide (see Fig. 2: L23, Linguistic) and by the fact that three of the four contours collecting more than 50 % "talking-to-self" judgments in the present study drew more than 90 % statement judgments in our previous study. Combined with this, a second factor may have contributed to listener uncertainty: intensity. Talking to ourselves we speak softly. But all utterances in the present study were of equal intensity so that a listener, choosing between the two competing categories, may have been pushed toward statement by a relative intensity more apt for addressing others than self.

In considering the linguistic results, we should bear in mind that, while psychophysical judgments were made on the terminal glide, linguistic judgments were made on the entire contour. If, therefore, sine wave, speech psychophysical and linguistic judgments coincide, we may reasonably conclude that terminal glide controlled linguistic decision. From Figure 2 and 3 it is evident that, as far as the third category ("level" or "talking-to-self") is concerned, the three groups of judgments do coincide on certain contours that exhibit a level (H34, L34, L23) or slightly falling (H33, L33) terminal glide. This agreement confirms the importance of the terminal glide in linguistic judgments of intonation contours. While our previous study gave clear evidence of the connection between terminal rise/fall and judgments of question/statement, the present study demonstrates a clear connection between terminal sustain and judgments of "talking-to-self".

However, terminal glide is not the only determinant of linguistic decision. Figure 3 shows that one terminally contour (L22) was judged as "talking-to-self" more than 50 % of the time, but did not reach criterion on speech wave "level" judgments, while two speech wave contours (S34, H45), correctly heard as "level" more than 50 % of the time did not reach criterion on "talking-to-self" judgments. In fact, of the five acceptable "talking-to-self" contours, four display no stress peak (L34, L33, L23, L22), one displays a moderate peak but then drops to within 15 Hz of the precontour level (H34). Evidently, we expect people talking to themselves not only to end their utterances with a level (or slightly falling) glide, but also to maintain an even, low to moderate pitch over earlier sections of the contour. The initial hypothesis is therefore largely confirmed.

To sum up, this study has provided experimental support for the validity of the third category described by Hadding-Koch (1961), and for the adoption of a new prosodic feature, [±Listener], implemented by variations in fundamental frequency and, perhaps, intensity. The communicative function of the feature [+Listener] is presumably to draw and hold a listener's attention. Further evidence of its operation and of its functional development might be gained from systematic study of "egocentric" and "other-directed" speech in young children.

Footnote

We might have avoided some of the difficulties in the linguistic session, by asking subjects to use only two categories: talking to a listener and "talking-to-self". However, we wished to compare the results with those for the psychophysical sessions, and two-category psychophysical data would have concealed potentially interesting information on the subjects' capacities for discriminating terminally level from terminally rising or falling glides.

Acknowledgement. This work was supported in part by a grant tn Haskins Laboratories from the National Institute of Child Health and Human Development.

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