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CONTENTS Page

THE SCANDINAVIAN WORD ACCENTS

Eva Gårding

INTRODUCTION

The accents

In his manual on Swedish prosody published in 1737 and entitled Oförgripelige Anmerckningar Öfwer Swenska Skalde-Konsten, A. Nicander warns his readers against writing verses such as:

Han ei sumera kan i hop de minsta talen
Ty han är yhr och galen.
'The smallest sums he cannot add
For he's confused and mad.'

Nicander is not concerned with poor quality in general. His warning is directed specifically at the rhyming words talen 'the numbers' and galen 'mad'. These words, though both stressed on the first syllable, are characterized by different accents, viz. ['ta:lən] and [`ga:lən], where ' stands for Accent 1 and ` for Accent 2. For this reason Nicander considers talen/galen a bad rhyme.

According to the Swedish philologist Axel Kock (1884 p. 24), the example in Nicander's manual is the first historical record of the accent distinction in Swedish. The Danish accents (stød [a kind of glottal stop] versus non-stød) were treated in a much broader and more scholarly context in 1747 by Høysgaard. He coined the term stød which means shock or thurst and refers to the strong puff of air which was felt to characterize Accent 1. Although not a professional scholar - he was third mace bearer (tredje pedell) at the University of Copenhagen - Høysgaard was to influence the study of Danish accents profoundly.

In Aasen's famous Norwegian grammar of 1848, the accents are described in terms of both pitch and intensity. Aasen is also concerned with the historical aspects of the accents and their relation to parallel phenomena in the other Scandinavian languages.

The accent distinction is, in fact, common to Danish, Norwegian and Swedish. It implies that a word carries one of two prosodic patterns, Accent 1 (acute) or Accent 2 (grave). The accent distribution is phonologically and morphologically determined and the rules that assign the correct accent to a word 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 mainly distinguished by the presence or absence of stød. This variation, allegedly developed from a common origin, has intrigued generations of scholars. In the course of time, word accents have been treated according to varying linguistic fashions and the tastes of the individual scholars. Phonetic investigations have, of course, also been dependent on the technical equipments available at a certain time.

The purpose of this article is to sum up past and present research on the Scandinavian word accents.

Outline

After a historical review of the chief topics of accent research (Section 1), certain themes are singled out for detailed treatment. Section 2 gives a summary of the rules that assign the correct accent to a given word. Section 3 deals with the phonetic manifestations of the accents and leads up to a tentative typology for the dialects. Perceptual and physiological aspects

are treated in Sections 4 and 5. In Section 6, some models that describe the dialectal variation and the interplay between accents and sentence intonation are presented. The final section (7) contains a number of speculations about the origin of the accents.

Terminology

Stress and accent

The term stress (primary, secondary and no stress) indicates the degree of prominence attributable to a syllable in a sequence. Every syllable with primary stress is considered to carry one of the two accents. In other words, when syllables have primary stress, they have it regardless of accent. The process when stress moves from one syllable to another, as in compounding or derivation, is called a shift of stress. The term shift of accent is used when under similar circumstances one accent is replaced by the other. In some analyses of Norwegian and Swedish the term stress is used to denote Accent 1 and tone to denote Accent 2. This practice will not be followed here.

Tone and accent

Following previous definitions according to which a tone language has lexically significant tone on each syllable (Pike 1948 p. 14), the Scandinavian languages are not tone languages. The Scandinavian accents are lexically not very significant because they are largely predictable from the morphological and phonological structure of the word. Furthermore they do not occure over each syllable but are correlated with stress and juncture.

The acoustic nature of the accents varies according to language, dialect and context. In most of the Danish dialects, the accents cannot be described as "tonal". Also, in Norwegian and Swedish dialects, where tonal character-

istics are predominant for the accent distinction, there are intensity and durational differences as well which cannot be only a consequence of differing pitch patterns.

There are then structural, physical, and practical reasons for not calling the two distinctive prosodic patterns that characterize polysyllables in the Scandinavian languages tones. The term accent will be used because it is vague, general and non-committal. For the same reason Accent 1 and Accent 2 have been chosen rather than the terms acute and grave which have musical connotations that do not fit Danish.

As a mnemonic device the term Accent 1 may be associated with monosyllables which always carry Accent 1, and Accent 2 with bisyllabic stems which as a rule have Accent 2.

The following table shows the variety in terminology found in the literature:

Accent 1	Accent 2
acutus	gravis
single, simple tone	double, complex tone
monosyllabic tone, accent	bisyllabic, polysyllabic tone, accent
scharf geschnitten	schleifend
accent fort	accent doux
stød, Stoss (for Danish)	non-stød, schleifend
toneme 1	toneme 2
tonelag 1	tonelag 2
	circumflex

There is a correspondingly great variety of transcriptional marks used for the two accents in the literature. In the present paper acute /´/ and grave /`/ accents at the beginning of the stressed syllable mark Accent 1 and Accent 2 respectively. The stød is denoted by /ʔ/. Table 01 presents some examples of Norwegian, Swedish, and Danish forms with Accent 1 and Accent 2. The stems are underlined.

Table 01. Examples

Scand. language	Accent 1	Accent 2	Phonetic transription	Engl. translation
No	and, anden (anda)		[ann, ˈannən, ˈanna]	duck, the duck
Sw	and, andan		[and, ˈandən]	
Da	and, anden		[anˀ , anˀən]	
Sw		ande, anden	[ˋandə, ˋandən]	spirit, the spirit
No	ender		[ˈɛnnər]	ducks
Sw	änder		[ˈɛndər]	
Da	aender		[ɛnˀər]	
No		ende, ender	[ˋɛnnə , ˋɛnnər]	end, ends
Sw		ände, ändar	[ˋɛndə, ˋɛndar]	
Da		ende, ender	[ɛnə, ɛnər]	
No	bønder		[ˈbœnnər]	peasants
Sw	bönder		[ˈbœndər]	
Da	bønder		[ˈbœnˀər]	
No		bønne, bønnner	[ˋbœnnə, ˋbœennər]	bean, beans
Sw		böna, bönor	[ˋbø:na, ˋbø:nɔr]	
Da		bønne, bønner	[boenə, boenər]	
No	tank, tanken		[taŋk, ˈtaŋkən]	tank, the tank
Sw	tank, tanken		[taŋk, ˈtaŋkən]	
Da	tank, tanken		[taŋˀg, taŋˀgən]	
No		tanke, tanken	[ˋtaŋkə, ˋtaŋkən]	thought, the thought
Sw		tanke, tanken	[ˋtaŋkə, ˋtaŋkən]	
Da		tanke, tanken	[taŋgə, taŋgə]	

Circumflex accent

In the literature this term is most oftan used to denote Accent 2 in apocopated monosyllabic forms, i.e. forms which can be described as resulting from a reduction of a second syllable. An often used symbol is [^], e.g. [^kom] 'come', as compared to the unapocopated form [ˋkomma]. In most dialects the circumflex accent can be regarded as a combinatorial variant of Accent 2 (Broch 1944 p. 160, Haugen 1967 p. 192).

There are dialects, however, (Kallstenius) in which apocopation is possible also in bisyllabic words with Accent 1, e.g. [hʉn], the apocopated form of ˊhunden 'the dog'. The accent assigned to apocopated forms with Accent 1 is sometimes called circumflex 1. Some historical linguists attribute circumflex accents to old monosyllables regardless of apocopation (e.g. Noreen, Katsnelson).

Level accent

The term level accent (Sw. jämviktsaccent) refers to the accent of short stressed syllables in some Norwegian and Swedish dialects that have retained short stressed vowels followed by one consonant, e.g. [¯viku] as compared to Standard Swedish [ˋvɛkka] 'week'. This accent denoted [¯] in the example above has played a role in the discussions of the genesis of the accent distinction (see Section 7).

1. HISTORICAL REVIEW

The following brief review is based on manuals and monographs dealing with Scandinavian accents and intonation, in particular, Kock (1878, 1901) Meyer (1937), Smith (1944), Kroman (1947), Hadding (1961), Kloster Jensen (1961), Fintoft (1970), Selenius (1972). For further information and sources the reader is referred to these works.

19th Century

For any Scandinavian linguist of the 19th century the origin and development of the accents was a natural field of interest. The scholars who were active at this time seem to have arrived at general agreement about the following correspondences: Accent 1 reflects an Old Norse accent, let us call it *Accent 1, typical of monosyllables; Accent 2 similarly corresponds to an *Accent 2, the accent of the polysyllables. These correspondences are valid for the period after syncopation (ca. 900) which implied the loss of an unstressed syllable for all polysyllabic forms. There was less agreement on the accent situation in the Old Norse of the period before syncopation. The subject has been discussed by e.g. Kock, Verner, and Noreen and led to a thorough exchange of views between the first two. After Verner's review in 1881 of Kock's treatise on the Swedish accents (1878), both scholars were of the opinion that early Old Norse unsyncopated polysyllabic forms must have had two accents, *Accent 1 and *Accent 2. *Accent 1 occurred in bisyllables with an unstressed second syllable (as in *fotir, *wulfar, later to become fœtr, ulfr) whereas *Accent 2 appeared in bisyllabic or polysyllabic forms in which the second or a later syllable had a long vowel and possibly secondary stress. As for the relation between these accents to Indo-European

forms there were divergent opinions. Some scholars claimed (e.g. Noreen 1904) that the forms with *Accent 1 corresponded to Indo-European forms with the stress on the root, whereas *Accent 2 was a reflex of forms with stress on the ending. A recent advocate of this hypothesis is Hamp (1959).

The linguists of the late 19th century were also phoneticians. They treated problems of classification and transcription, they made auditive and introspective analyses, and they were interested in the acoustics and the physiology of speech.

Henry Sweet's analysis of the Swedish accents will serve as an example of an impressionistic description of the accents (1877 p. 8 ff.). 'The simple tone (Accent 1) is a rising modulation as in asking a question in English, the compound (Accent 2) consists of a falling tone (as in answering a question) on the stress syllable with an upward leap of the voice together with a slight secondary stress on a succeeding syllable.'

It is clear that Sweet's description of the accents fits a dialect in Central Sweden (compare Fig. 3.1). I shall let Karl Verner (1881, p. 6 ff.) describe the Danish stød "... beim articulieren des wortes maler (Accent 1) setzt die stimme auf der mit expiratorischem drucke versehenen ersten silbe in tiefem tone an - nach meinem beobachten mindestens einen ton unter der schluss-silbe des accentes nr 2 - sie bleibt eine weile auf derselben stufe stehen um sich gegen den schluss des langen a durch ein jähes portament ungefähr eine quinte hinaufzuschwingen, auf der höchsten stufe klappen die stimmbänder plötzlich zusammen, alle stimmbildung hört während der dadurch entstehenden ganz kleinen pause auf; nach einem momente öffnen sich die stimmbänder wieder, und die schlusssilbe -ler folgt nach auf derselben stufe wie die anfangssilbe."

Verner's description of the pitch contour of the words with stød does not

agree with present-day acoustic analyses of Copenhagen Danish. It was in fact already criticized by his contemporary Thomsen, who was of the opinion that Verner described and analysed his own pronunciation of the stød, which was dialectal (Verner was from Aarhus). Thomsen comes back to this criticism repeatedly, eventually in a footnote to his memoir on Verner (1896, quoted by Smith 1944 p. 70).

Thomsen, a comparativist who was well versed in Slavonic languages, was particularly interested in the relation of Scandinavian accents to the accents of the Slavo-Baltic and the Serbo-Croatian languages. A letter to Johan Storm (quoted by Smith, op. cit. p. 68) shows how like Storm he regards the musical element of the stød as unimportant. In the same letter he also draws a parallel between the historical developments of the Serbo-Croatian and the Scandinavian accents. The Accent 2 of the Scandinavian languages is similar to the rising accents of the Serbo-Croatian in that for both language groups "Accent 2" always occurs together with what must have been at least secondary stress (and earlier length) on a follwoing syllable.[1] Thomsen regards Accent 2 as a result of a shift of stress towards the beginning of the word.

Johan Storm made an auditory interpretation of the Norwegian accents that he expressed in musical notes. Accent 1 in the East Norwegian dialect is a rise that corresponds to a musical fourth and Accent 2 is a fall of a third followed by a rise of a fourth.

The physiological and physical correlates of the accents are discussed by Kock in the introduction to his dissertation on the Swedish accents (1878).

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1. The view that Accent 2 developed in words with a strong syllable following the stressed syllable seems to be favoured by linguists familiar with Slavonic languages, e.g. Ekblom (1929-31), Kuryłowicz (1936).

He starts with a criticism of the three categories of accents that Sievers had set up for European languages: geschnitten 'acutus', geschliffen 'circumflex', and gestossen 'stød'. For the acute accent, which is common to most European languages, Kock uses Ellis' definition 'fixed force and free pitch' (Ellis 1873–74 p. 128) and the Swedish Accent 1 is described as typically acute. Kock discusses the question why a stressed syllable so often is accompanied by raised pitch (p. 15, free translation):

The stronger the flow of air through the glottis the more effort is needed to keep the vocal cords in a vibrating position (i.e. close to each other). With increased effort the tension of the vocal cords increases and the pitch rises. Even if a speaker only intends to produce a 'forte' he willy-nilly comes out with a higher note as well (Kock has a reference to Brücke 1871).

In Kock's interpretation of the Swedish accents, Accent 1 has both musical and dynamic characteristics but the dynamic characteristics are more constant and more important. Accent 2, on the other hand, is two-peaked both in pitch and intensity. Compulsory for Accent 2 is a secondary stress (levis) with primary stress. This secondary stress he regards as dynamic.

Kock's acoustical and physiological interest in the accents is typical of a time when linguistic theory and phonetics were perhaps less separated than now.

The larger part of Kock's treatise is devoted to synchronic problems. Apart from the phonetic aspects he treats the geographical distribution, and the rules which determine the accents in the vocabulary. The deviations from the rules and dialectal divergencies receive special attention.

There is in the latter part of the 19th century a growing interest in dialects. Most of the leading linguists have contributed some dialectal de-

scription. Noreen, for instance, described a dialect in Dalarna (Sweden), Thomsen the dialect of Bornholm. Between the years 1880 and 1886 Storm carried out phonetic investigations of 150 Norwegian dialects. Nikolaj Andersen (1897) showed that there were tonal accents in East Slesvig in Denmark.

A chief topic in 19th century linguistics is sound change. In particular the scholars are discussing causes of sound changes and causal relationships between various changes. Germanic sound changes, such as breaking, i-umlaut and the voicing of intervocalic consonants were regarded as causally related to the Germanic accent shift. This term refers to the general shift of stress towards the root syllable in Germanic languages as compared to Indo-European.

In his work on the Swedish accents, Kock discusses a causal relationship between different manifestations of Accent 2 and different developments of the vowels of the endings. For the Svea dialects, which had the greatest importance for Standard Swedish, Kock "hears" or postulates a secondary stress (levis) in a later syllable of the Accent 2 manifestations. This secondary stress caused a preservation of the original vowel a of the ending (Sw. `tala 'talk' as compared to Da. and No. `tale). Dialects in which the ending had been apocopated or weakened (Denmark, Norway, Gotland, Dalarna) have no levis. The change of tenues into mediae is related to the loss of secondary stress and the weakening of the vowels of the endings (Da. købe 'buy' as compared to Sw. köpa). Scanian (Skåne) - a South Swedish and East Danish dialect - is an exception since according to Kock it has a combination of levis and weakened stops.

20th Century

Structuralism brought about a predominant interest in the abstract side of the language, its distinctive units and the relations between these units.

The function and the place of the accents in the phonological system became important.

As an example of a structural treatment of the accents, I shall summarize Borgström's analysis of the prosodic system of East Norwegian (1938)[1]. Borgström observes how the prosodic properties, pitch (high [Accent 2]: low [Accent 1]), stress (stressed:unstressed) and quantity (long:short) combine and arrives at a three level system in the prosodic hierarchy. Pitch combines with stress in a '<u>betonungskorrelation</u>'. At the highest level quantity combines with the pitch-stress correlation to give long and short vowels which can have either of the two pitches (accents). At the next level quantity only combines with stress (this accounts for the fact that there is distinctive length but no distinctive pitch difference in the second element of compounds). The third level is characterized by negative values, i.e. unstressed vowels without pitch and quantity distinction. In final stressed syllables there is no distinctive pitch. Words like <u>lys</u> 'light' and <u>allé</u> 'avenue' can only have one pitch, which is identified with the low pitch (Accent 1) and therefore must be regarded as the unmarked member of the opposition.

The relationship of the three categories of quantity, stress, and tone in Norwegian is given the following form by Haugen (1967). (The analysis could also hold for Swedish.) Notice that Haugen starts from the syllable which in its long form has either a long vowel or a short vowel followed by consonant.

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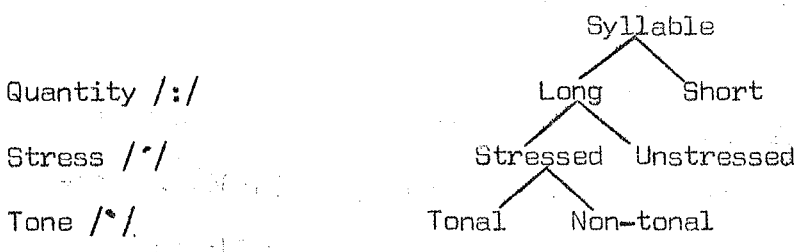
1. A structural analysis of the Norwegian accents was also given by Broch (1935).



Compared to Borgström's analysis the difference is that only Accent 2 /ˋ/ is regarded as a tonal feature. Accent 1 is analysed as stress.

The fact that the pitch curve of monosyllables varies with the context has sometimes led to the assumption that they have different accents (Vanvik 1961).

In Hjelmslev's glossematic analysis of Danish (1948) the stød is considered as a kind of consonant, whose appeareance is determined by the structure of the stressed syllable and the following syllable. It occurs for instance always when the stressed vowel is long (double in Hjelmslev's notation) and when two consonants of which the first one is a sonorant follow a short vowel. In order to fit the facts, Hjelmslev postulates underlying forms (latent in his own terminology), which may be different from the manifested ones.

For the stød to be maintained in the definite form of monosyllabic nouns, the definite suffix (e.g. [-ɛn]) is interpreted as n. Past participles with the ending -en have no stød (Accent 2). The postulated form for this suffix is -ɛn which prevents the appearance of the stød. With this analysis Hjelmslev does not need the stød or the non-stød in his inventory of abstract units. He does need syllabic junctures and an adjustment of the shape of certain syllables, however.

An analysis of the stød as a signal for certain syllabic structures was also proposed by Aage Hansen (1943) and Poul Andersen (1958). Martinet (1937) treated the stød as a prosodeme. For more recent constributions, see Rischel

(1969) and Basbøll (1972). Basbøll (1971) summarizes Hjelmslev's views of the Danish stød.

Although Malmberg had applied structural principles to his studies of accents (1940, 1955) there was no comprehensive structural analysis of Swedish phonology until Elert's of 1957. Elert returned to the subject in later publications (1964, 1966, 1970, 1971). In his 1964 thesis he analysed the phonological system of connected speech. This made him emphasize the connective function of the accents.

Let us look at some of the examples given by Elert (1970 p. 45).

(1)	en ˋstormans ˊdräkt	the costume of a magnate
(2)	en ˊstor ˋmansdräkt	a large costume for men
(3)	en ˋstormansdräkt	a costume of a magnate
(4)	en ˊstor ˊmans ˊdräkt	the costume of a big man

In all the examples, Accent 2 /ˋ/ shows that at least one syllable more than the stressed one belongs to the same word. The domain of Accent 2 in compounds includes the stressed syllable and all the following unstressed syllables.

Jasanoff (1966) also described Accent 2 as a junctural phenomenon.

For generative analyses the reader is referred to Section 2.

Experimental work

Experimental analyses of the accents became possible with the development of the kymograph. The new techniques were introduced in Sweden by E.A. Meyer who was lecturer of German at the University of Uppsala. As a complement to the kymograph he developed a pitch writer which translated the oscillograms of the kymograph into pitch curves.

Meyer collected accent data from all Scandinavia. With this material he

made a contribution to Scandinavian dialectology. His data will be treated in more detail in Section 3. Meyer's techniques were passed on to the Norwegian phonetician Selmer, who worked along the same lines as Meyer (Section 3).

Spectrographic analyses were first used by Haugen and Joos for Norwegian and for Swedish by Fant, Malmberg, Hadding, and Witting. Experiments with synthetic speech were conducted by Malmberg at the Haskins Laboratories and by Jassem and Fintoft at the Speech Transmission Laboratory in Stockholm (Section 4).

The first physiological investigation of accents was undertaken by Rousselot (1901-08, p. 873 from Smith op.cit. p. 78 ff.). Rousselot made kymographic recordings of vocal cord vibrations. One of his subjects was Otto Jespersen. From his registrations Rousselot could conclude that in the production of the stød there was seldom a complete closure of the glottis.

Smith's investigations confirm this observation. A summary of Smith's work and of more recent physiological studies will be given in Section 5.

2. ASSIGNMENT RULES

The diachronical exposition is based on statements given in standard manuals and monographs, e.g. Kock (1978), Wessén (1926), Naes (1965), Skautrup (1944). It agrees in all essentials with Oftedal (1952). See Section 7.

Diachronical

It was observed by the early comparativists that the monosyllables of the post-syncopation period of Old Norse have modern equivalents with Accent 1 in all the Scandinavian languages. The polysyllables of the same period have modern cognates with Accent 2. This correspondence has a high degree of accuracy. Most monosyllables were monomorphemic and the great majority of the polysyllables were polymorphemic. It is natural to assume that the monosyllables and the polysyllables of Old Norse had different prosodic patterns or "accents" and that these patterns involved features of both stress and pitch. Characteristics of pitch may have been concomitant features of stress. The distribution of the patterns, judging from the statements above, was determined by the number of syllables, and no contrast in accent was possible between word boundaries. This rule concerns simple words. But Old Norse also had compounds as is evidenced by the oldest Runic inscription (~ 425). Compounds – particularly in Norwegian and Swedish – usually have Accent 2. Hence we can conclude that their Old Norse analogues had the accent characteristic of polysyllables. There are in the modern languages compounds of specific categories, however, which have Accent 1, e.g. the names of the days of the week. It is very possible that these categories had a special position also in Old Norse. At least there is nothing to contradict this statement. There may then have been two accent patterns for polysyllables in the common

language and the earlier rule (one accent for monosyllables, another for polysyllables) traditionally given by the handbooks would in that case not be valid for the whole vocabulary.

The following table illustrates the accentual relations in Old Norse for simple words:

	monosyllabic	bisyllabic
monomorphemic	1	2
polymorphemic	1	2

1 and 2 refer to the accents.

Various later changes in word structure, stress distribution and vocabulary affected the manifestation and function of the accents.

Word structure

Two new categories of bisyllables developed. The first category is due to the suffixation of the postponed definite pronoun (before 1200). The second category is the result of the so called insertion of svarabhakti vowels in final clusters in which r, l or n follow after other consonants (1200-1400). These new categories retained the prosodic characteristics of the monosyllables and consequently the Scandinavian languages now had two large groups of bisyllabic sequences within word boundaries with different prosodic patterns.

Accent 1	Accent 2
New bisyllables	Old bisyllables
Specific compounds	Compounds in general

The manifestations of these two accents may of course have varied depending on the dialect. A common feature of all the Accent 1 manifestations, however, must have been a strong stress in the first syllable followed by weak

stress, whereas the Accent 2 manifestations probably had stress more evenly distributed over the two syllables.

With the changes in word structure resulting from these two processes, the distribution of the accent patterns is no longer determined by the number of syllables, not even for the simplexes, but by the morphological and phonological structure of the words. The rule for stems can be given approximately as follows:

Monomorphemic stems usually have Accent 1.

Polymorphemic stems (except compounds of specific categories) usually have Accent 2.

The accent rules of words are illustrated by the following table. (For the sake of simplicity, bisyllables have been chosen rather than polysyllables.)

	monosyllabic	bisyllabic second syllable [ə]	bisyllabic second syllable Other vowel
monomorphemic	1	1	2
polymorphemic	1	1	2

The table shows that there are two patterns for bisyllabic words which can be regarded as determined by the phonological structure of the second syllable. With [ə] in this syllable as a concomitant feature of weak stress, the word has Accent 1 independently of the number of morphemes. With an unreduced vowel and, presumably, secondary stress in the corresponding syllable, the word has Accent 2.

Stress

Reductions of vowels in the suffixes of polymorphemic stems have been causally related to changes in stress. For instance, in Danish, Norwegian, and some Swedish dialects the verbal suffix -a has become -e. In some dialects the

vowel has been reduced completely, a phenomenon known as apocopation. Nevertheless, Accent 2 is retained in these dialects. It is possible to interpret this development as indicative of a reduction of stress and a retention of pitch, i.e., in modern phonetic terminology a separation between the pulmonary and laryngeal commands. The result is contrastive prosodic patterns which differ mainly in pitch.

For trisyllabic forms in which the root is followed by two morphemes, e.g. `tvill-ing-ar 'twins', `flick-or-na 'the girls', Kock found graphic evidence of a shift of stress pattern in the Middle Swedish period (1878 p. 123 ff.). Secondary stress (levis in Kock's terminology) was earlier carried by the first morpheme following the root (-ing and -or in the exemples given) but towards the end of this period this secondary stress had shifted to the last syllable. Due to this development there is a noticeable tonal-accent contrast also in trisyllabics.

In Danish the tonal contrast between the accents has been reinforced by the development of the stød which is supposed to have occurred in the same period (Jespersen 1897).

The reduction of secondary stress gave two kinds of unstressed suffixes to the language with different effects on the word accent. One category, the reduced ones, requires Accent 2; the other category (comprising the suffixes that remained unstressed) does not affect the accent of the words. As an example let us choose the monosyllabic root and free form, ´sten 'stone'. The plural form is `stenar with a change of accent, which is determined by the earlier stressed plural suffix. The definite form is ´stenen because the definite suffix, which was unstressed from the beginning, does not bring about any shift of accent. Other examples are suffixes with one homophonous surface form [-ər], which when derived from a plural suffix may call for Accent 2, `viner 'wines', but as a tense marker will not shift the accent, ´viner 'whines'.

Vocabulary

Towards the end of the Middle Ages, all the Scandinavian languages have two accent patterns for polysyllables. From this time onwards there has been a great influx of foreign words of diverse origin. These new words could then be given one of two patterns.

The treatment of loanwords suggests that there are other factors than morphemic and syllabic structure which are decisive for the accent assignment. Certain endings which cannot be analysed as morphemes seem to play an important role.

An additional factor is the level of linguistic sophistication of the integrators. Let us take som loans from English as examples. The word pudding is an early loan in Swedish. It has Accent 2 probably because it was referred to the large group of native words with the suffix -ing that requires Accent 2. Recent loans from the English have Accent 1, ´camping, ´smoking 'tuxedo'. At the time when these words were integrated, the knowledge of English was greater and more spread and it was natural to let the words keep their original accent which to a Swede is equivalent to Accent 1.

Synchronical

The preceding survey has shown that Old Norse may have had fairly general accent rules that were determined by the number of syllables between word boundaries.

At a later stage - in the 12th or 13th centuries - changes in word structure and reduction of stress in certain suffixes gave two patterns for polysyllabic words and the accent rules were governed by both phonological and morphological structure.

The new foreign words that were integrated into the Scandinavian languages were associated with one or the other pattern depending on their phonologic-

al and morphological shape, the time and place of their integration and the level of linguistic sophistication of the integrators.

The result is that the synchronic accent rules cannot be easily stated. There will always be a large number of exceptions.

I shall start with a short summary of the now prevailing relations of the accents to phonology, morphology, and syntax. For a more detailed survey of the function of the accents on various levels in grammar, the reader is referred to Haugen (1967).

Phonology

The great majority of Scandinavian words are stressed on the first syllable. A considerable number of polysyllables have stress on the second and there are many tetrasyllables with stress on the third. French loans, particularly of recent date, are stressed finally.

Accents occur only in connection with primary stress. Accent 1 can occur in any stressed syllable independently of order. Words with stress on the last syllable have Accent 1. From this follows that all monosyllables have Accent 1 and that only polysyllabic words can have an accent contrast. It also follows that Accent 2 never occurs on the last syllable before word boundary. Accent 2 frequently starts on the first.

Morphology

Roots. Most Scandinavian root morphemes are monosyllabic. There is a great number of polysyllabic roots of foreign origin with stress on the last syllable. These two categories have Accent 1 according to the phonological rule stated earlier. Bisyllabic native roots have either Accent 1 or Accent 2. The category with Accent 1 contains roots that were monosyllabic in Old Norse. They still behave like monosyllables when inflected (Sw. ´segel 'sail',

'segl-et 'the sail'). A considerable number of native bisyllabic roots have Accent 2 (Sw. `sommar 'summer', `afton 'evening', `nyckel 'key', etc.). Some bisyllabic foreign roots stressed on the first syllable have Accent 1; others have Accent 2.

Inflection. A great number of unstressed inflectional suffixes normally require Accent 2. Hence a root morpheme taking Accent 1 as a free stressed form will be part of Accent 2 when combined with these suffixes. Some examples are plural suffixes for nouns and adjectives and the past tense suffix.

A small number of unstressed inflexional suffixes do not change the accent of the root morpheme. A statistically very important group in this class is the definite suffix for nouns.

Derivation and compounding. In derivation the stress as a rule remains on the root. Only a small number of affixes shift the stress from the root to the affix. The accent will then be determined by the foregoing phonological rules, i.e. Accent 1 will occur with a shift of stress to the last syllable and Accent 2 with a shift to the first. Most syllabic derivational suffixes require Accent 2. Examples are Swedish `kär-lek 'love', `vikt-ig 'important'.

There is a basic rule for compounding common to Norwegian and Swedish. If two or more stressed items are compounded the resulting complex will receive Accent 2 (No. `solskinn, Sw. `solsken 'sunshine').

The situation in Danish is more complicated (see e.g. Andersen, Hjelmslev, 1961 sec. ed. p. 324 ff.).

In spite of these deviations the relations of accents to phonology and morphology are fairly uniform in present day Scandinavian languages.

Dialectal differences exist as well. For compounds the South Swedish rules are not surprisingly more like the East Danish rules than the Central Swedish

ones (Malmberg 1972, Bruce 1973). The treatment of compounds shows dialectal variation also in Norwegian and Danish. The Jutland dialects (West Denmark) have different compound rules from the so-called Island dialects (P. Andersen, 1965 p. 97).

Syntax

Up till now we have had no instance of accent rules operating on larger sequences than the word. There is at least one All Scandinavian example of accent shift in a phrase. The unstressed adverb för meaning too shifts the Accent 2 of the following word to Accent 1. Example: Sw. `många 'many', för ´många 'too many'.

In East Norwegian dialects the accent rules operate regularly and productively at the phrase level. These dialects obviously do not permit stressed syllables before certain types of phrase juncture. There are then accent contrasts in phrases like 1) and 2) below for Norwegian dialects.

Norwegian	Swedish	English
1) ´ta på	´ta på	touch
2) `ta på	ta ´på	put on

Similar examples have been reported for Swedish provincial dialects (e.g. Hansson 1969, p. 20).

Restrictions for the stød in Accent 1 words

The appearance of the stød in Accent 1 words is mainly phonologically conditioned. The stød only occurs in certain types of stressed syllables (cf. Hjelmslev 1948 and Basbøll 1971, 1972). The prerequisites (Da. stød basis) are a long vowel or a short vowel followed by a sonorant consonant. For the East Jutland and Funen dialects the stød basis is more restricted.

These relations are obviously tied to the physiology of the stød. The stød, which implies a closure or near closure of the glottis, does not appear when the glottis is open for a voiceless consonant. The timing relations of the stød to the segments of the syllable (in the vowel if it is long and in the following consonant if the vowel is short) also suggests a physiological explanation.

There is a small category of Danish monosyllables that have stød-basis but no stød (e.g. ven 'friend'). This and other deviations from the earlier stated rule that Accent 1 corresponds to stød and Accent 2 to non-stød were summarized by Basbøll (1972 p. 7) to serve as a point of departure for a discussion of markedness. According to the Prague school notion of markedness Accent 1 (i.e. the stød) is the marked term in Danish and Accent 2 in Norwegian and Swedish.

Generative rules

The accents have been treated according to the principles of generative grammar by various authors. The first generative description of the tonal accents in Scandinavian languages is that of Rischel for Norwegian (1963). More recent treatments of Norwegian have been presented by Hovdhaugen (1969) and Fretheim (1970). Rischel (1970) and Basbøll (1972) are the authors of generative descriptions for Danish. Generative analyses of Swedish have been made by Öhman (1966), Teleman (1969), Lindau (1970), Kiefer (1970, 1971), Elert (1970, 1971), Linell (1972).

It is a common characteristic of the analyses of Norwegian and Swedish that only Accent 2 is considered to be marked. Accent 1 is treated as stress and Accent 2 is stress plus a tonal feature. For Danish stød is the marked term.

The following table illustrates the situation that generative rules for accents have to cope with

	monosyllabic	polysyllabic
monomorphemic	1	1 or 2
polymorphemic	1	1 or 2

In other words, the morphemic analysis of the polysyllabic words will be essential. In particular we have the following problematic categories. (The examples, largely taken from Linell (1972) are Swedish but illustrate the complexities of accent assignment in all the Scandinavian languages.)

1. Polysyllabic, monomorphemic words

   a) There is one category of native words, which behave in a monosyllabic way in inflection (´vatten 'water', ´vattnet 'the water'). Words belonging to this category were monosyllables in Old Norse. Most generative analyses posit underlying monosyllabic forms for these words. When the forms are subject to the tone rule they are monosyllabic and therefore receive the correct Accent 1.

   b) One category of native words have Accent 2 (`sommar 'summer', `morgon 'morning', `nyckel 'key').

   c) A third large category of words (loans) have Accent 1 (´radar 'radar').

   d) A fourth large category of words (loans) have Accent 2 (`sammet 'velvet').

2. Polysyllabic, polymorphemic words

   a) Most inflectional and derivational suffixes require Accent 2 and therefore shift the accent when attached to a root with Accent 1 (-ar pl.; ´sten 'stone', `sten-ar; -ig adj.; `sten-ig 'stony').

b) The definite suffix for nouns does not shift the accent (ˈsten-en 'the stone', ˈbo-na 'the nests').

3. Words ending in stem-formatives of questionable morphemic status

A great many of nouns and the infinitive of verbs end in the stem-formatives -a, -e (ˈflicka 'girl', ˈställe 'place', ˈfinna 'find').

Teleman (1969) and Linell (1972) have made comparisons of different treatments of accents in generative analyses of Swedish and their implications for the grammar. The complexities of the situation have been summed up by Haugen as follows (1967 p. 201. The term tone refers to Accent 2.): 'In the basic native patterns of the language, the incidence of tone is rigidly prescribed by the phonological, morphological, and syntactic structure. ... If it were not for the definite article, the quasisyllabic e, and the intrusion of loanwords, it would still be (as it was in Proto-Scandinavian) an automatic accompaniment of polysyllabicity.'

Productivity

The rules by which accent is assigned to new words, compounds and phrases will be called productive rules. So far they have not been treated systematically. Some of them will be given here.

Simple words. Loans are easily integrated into the Scandinavian languages. If the stems are monosyllabic they get Accent 1. They are inflected by means of the native suffixes and subject to the accent shifts required by these suffixes. For the assignment of accent to bisyllabic nominal stems stressed on the first syllable there are conflicting tendencies. Many speakers use Accent 1, perhaps as a mark of the foreign origin of these words. But the phonetic shape may be decisive in some cases. In some Swedish dialects for

instance, the word radar 'radar' is given Accent 2, probably because of its phonetic similarity to nouns of the second declension in the plural (e.g. ˋsten-ar 'stones').

Word and phrase formation. Apart from the productivity of accents in inflection there are at least the following productive accent shift rules at the level of word and phrase formation. Rule 1 is not valid in this general form for Danish.

1. If two stressed items are compounded, the resulting complex will receive Accent 2 (E6 [ˋe:sɛ̆ks], NK [ˋɛŋko:]).
2. A shift of stress in a word due to contrastiveness only produces Accent 1 (Sw. ja[g] sa ˊexplosion, inte ˊimplosion 'I said explosion, not implosion').
3. An enclitic addition of a pronoun to a stressed form does not cause a shift of accent (e.g. Sw. har du sagt det [ˊsaktɛ̆] 'have you said it', sett den [ˊsɛttɛ̆n] 'seen it').

These three productive rules have a common denominator. For Accent 2 to develop, certain order and stress conditions must be present. Accent 1 may be shifted to 2 if it is followed by another stressed syllable. Contrastive stress, however, which adds a degree of stress to primary prevents the accent shift. It is quite possible that these rules have been operative for hundreds of years. Rules 1 and 2 may then have caused the development of two different patterns in compounds. Rule 3 finally has prevented a shift of accent in the monosyllabic stems when the unstressed pronoun, which was later to become the definite suffix, was added.

Conformity

The accents are not marked in the written language. A native Scandinavian

normally does not make any accent mistakes in his own language although there are categories of words in which he may hesitate or alternate in his use of accents. Nevertheless he notices when the assignment rules are not followed by foreigners or by speakers of different dialects.

The overwhelming majority of initially stressed bisyllabic words have Accent 2. At one stage in the process of language aquisition, some children use this pattern for all bisyllables.

A Swede probably has the same attitude to the Norwegian accent manifestations as to those of another Swedish dialect. The Danish accents however, are not considered as equal to the Swedish ones. A Swede speaking Danish tends to generalise the stød in all stressed syllables.

Foreigners have great difficulty in mastering the accents. This holds for pronunciation as well as assignment rules. Accent 2 is often mistaken for a word stressed on a later syllable.

The rendering of early French oxytones as Accent 2 in Scandinavian languages (No. `stasjon 'station', Sw. `russin 'raisin') shows that there is more similarity between these categories than between oxytones and Accent 1.

Many foreigners who have learnt to speak Swedish well and fluently generalise Accent 2 for polysyllables (particularly the double-peaked pitch pattern, compare Section 3).

3. MANIFESTATIONS

Differences in fundamental frequency (pitch), intensity and duration have been shown to accompany the accents. Since pitch is considered to be of primary importance for the accent distinction in Swedish and Norwegian, this variable has been treated first and separately for the two languages. Data about intensity and duration for the accents of the two languages have been collected under a common heading. The Danish accent manifestations are described separately. Finally all the accent data are brought together in a tentative accent typology for all Scandinavia (Table 3.2).

Norwegian and Swedish

Pitch

Sweden

Figure 3.1 presents accent data from the whole Scandinavian area collected by Meyer (1937 and 1954). Meyer used slightly schematized fundamental frequency curves of bisyllabic words with contrastive accents in statement intonation to demonstrate the dialectal variety of accent manifestations in Scandinavia. In his description and comparison of the pitch curves, Meyer commented on the number and the location of the tone peaks (Tongipfel). According to Meyer the so called Svea dialects (Central Sweden, Part 1, 1937) exhibit two kinds of "intonation", Svea intonation proper and the Mining district intonation (Bergslagen i.e. part of Dalarna and Västmanland). In the Svea intonation Accent 1 has a peak towards the end of the first syllable and Accent 2 has a peak in the second syllable, preceded by a fall in the first one. The accents of the Mining district have only one peak each but the peak comes later in the grave words. Meyer also mentions in passing a third type of intonation common to the Göta dialects (between Southern and Central Sweden).

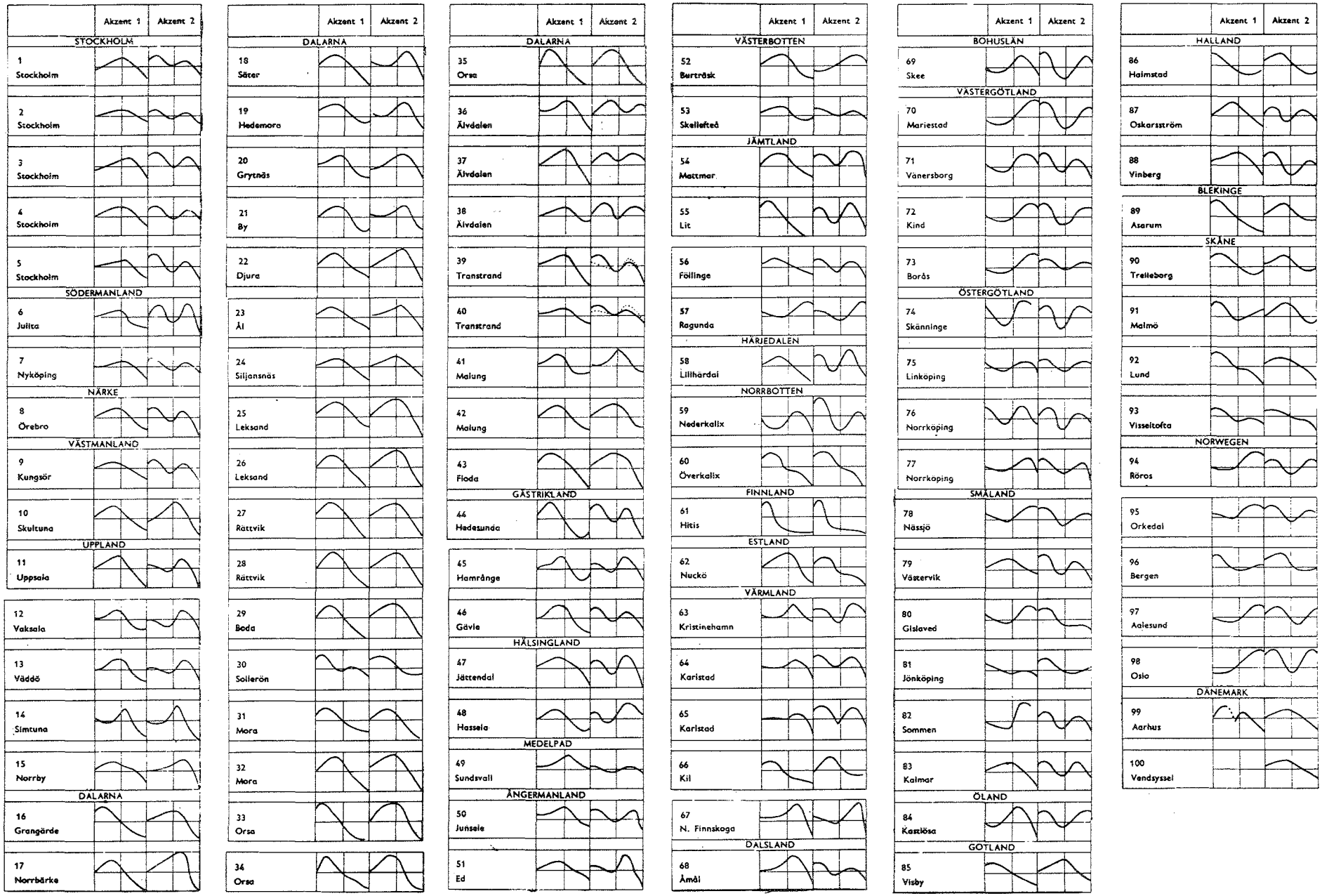


Figure 3.1. Schematic Accent 1 and Accent 2 pitch patterns of a hundred Scandinavian dialects according to E.A. Meyer: Die Intonation im Schwedischen, part II. From Öhman 1967.

Meyer aimed at a systematic treatment of Swedish intonation and accent variation as a contribution to Scandinavian dialectology. However, 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.

The criteria that were used by Meyer for a categorization of the Svea dialects can also be used for the rest of his material. The following table shows a tentative tonal typology for Swedish dialects.

Table 3.1

Tentative tonal typology for accents in Swedish dialects based on Meyer's material of bisyllables in statement intonation.

Type	Accent distinction	Accent 1	Accent 2	Region
0	None			North of Sweden Finland
1	Timing of pitch peak	One peak	One peak	
1A		Early in the stressed syllable	Late in the stressed syllable	South of Sweden (former Danish provinces)
1B		Late in the stressed syllable	Early in the post tonic syllable	Gotland, Bergslagen
2	Number of pitch peaks	One peak	Two peaks	
2A		Late in the stressed or early in the post tonic syllable	One in each syllable	Central Sweden, (Svea dialect region)
2Aa		In the stressed syllable	In the stressed syllable Apocopation	Öland (Baltic), North of Sweden
2B		In the post-tonic syllable	One in each syllable	Between Southern and Central Sweden (Göta dialect region)

A selection of representative speakers for a new collection of accent data was made according to this tentative typology (Gårding and Lindblad 1973). We shall come back to these data later.

Note on the level accent

The accent manifested in bisyllabic words with a short stressed syllable in dialects which had preserved a syllable length distinction (short and long stressed syllables) had been given various phonetic interpretations depending on the aural impression of the investigator. It was usually regarded as a special, level accent which was set apart from the manifestations of Accent 1 and the long syllable Accent 2 words (e.g. Noreen). Meyer's material includes recordings of such 'level' accents. His data show that the pitch curves of these accents are in fact not different from the Accent 2 manifestations of the corresponding long syllable words (Meyer 1937 p. 234). In other words, the level accent for the Dalarna dialects investigated by Meyer has a late peak in the beginning of the posttonic syllable (Type 1B).

Finland (East Swedish)

At present Swedish is spoken by some 300.000 people in Finland. In a dissertation dealing with the accents of a provincial Swedish dialect spoken in the South of Finland (West Nyland), Selenius summarizes data found in various monographs and handbooks (1972 Ch. 2). The following survey of East Swedish accents reflects her views (personal communication) and is based on sources mentioned by her and Naert (1968).

Contrary to general belief in Sweden (also among linguists) there is an accent contrast in some East Swedish provincial dialects. Apart from the accents documented for West Nyland by Selenius, dialectologists have observed

accents in East Åboland and West Åland (Selenius p. 28) and in Oravais, East Bothnia (Thors, personal communication). The accents of the dialect of West Nyland have manifestations similar to those of Central Sweden (Type 2A).

Various theories have been advanced to explain the accentual situation of Swedish spoken in Finland. One such theory is that the accent contrast was general to begin with but disappeared in the bilingual areas. According to Ahlbäck the transition to simple accents did not occur later than the 15th century (Selenius p. 28).

Since Swedish spoken in the cities had lost the accent contrast, manifestations of Accent 2 came to be regarded as provincial. There is also evidence that a provincial accent contrast met with opposition in the schools and that tonal accents were discouraged by the teachers (Nordling 1936, Selenius p. 27 and p. 43).

In his dialectal investigations Ahlbäck made a special study of the relation between accents and apocope (1945, 1947, 1956). Ahlbäck found that in the accentless dialects apocopation is general. In dialects with accents, apocopation is not completed.

Norway

The main sources for the following survey of the Norwegian accent manifestations have been Aasen (1848), Storm (1874, 1892), Selmer (1920, 1921, 1927, 1948), Haugen and Joos (1954), Kloster Jensen (1961), and Fintoft (1970).

As mentioned in the introduction, Aasen (1848 and 1899) described the accents in terms that suggest that he attributed both tonal and dynamic characteristics to the accent distinction. A syllable with Accent 1 is stronger and lower and sounds final, whereas a syllable with Accent 2 is weak

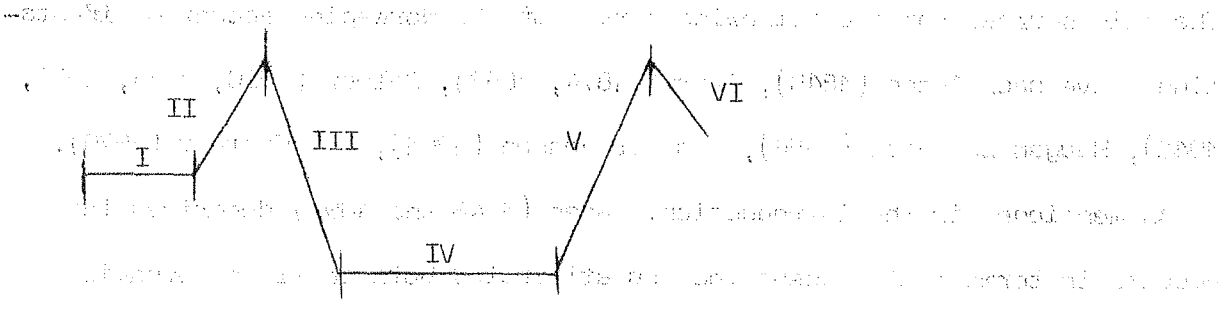
and light and sounds incomplete. (Second Edition 1899, p. 49.) According to Storm (1892 p. 246) the tonal characteristics of the Norwegian dialects are common to large areas and not as varied as in Sweden. He attributed this difference to different types of settlement in the two countries, isolated farms in Norway as compared to concentrated villages in Sweden.[1]

Following contemporary practice Storm divided the Norwegian dialects into East Norwegian and West Norwegian. (A survey of Norwegian dialect research is given by Hoff [1968].) The two dialect areas are separated by high mountains. As examples of the accents typical of these two dialect areas, he chose Oslo and Bergen and gave in musical notation an interpretation of his aural impression (1892 p. 247) which comes very close to a modern, machine made pitch analysis.

Storm's student Selmer was the first Norwegian phonetician to make instrumental analyses of the accents. His equipment was the kymograph and the pitch writer developed by Meyer.

In his first study (1920), Selmer describes the accents of Oslo. He tries to abstract the influence of articulation on the pitch curve and bring out the essential features of the accents in schematic diagrams.

The schematic figure for the Accent 2 of bisyllabic word looks as follows:



The second syllable starts in connection with Stage IV.

1. Before Meyer the villages of Bergslagen were believed to have strongly varying accent patterns. Meyer found that one-peaked accent patterns were common to the area and coined the term Bergslagsintonation.

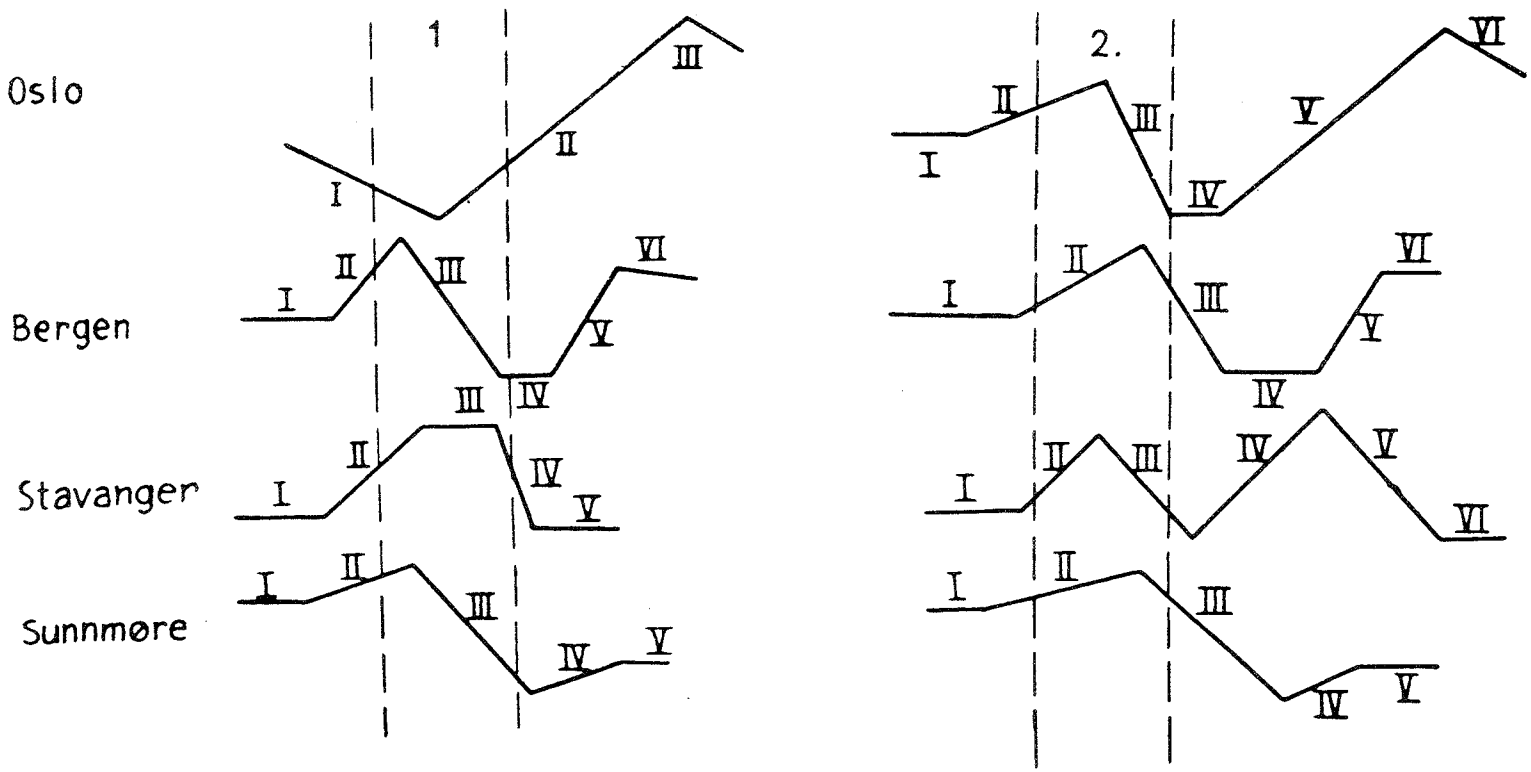


Figure 3.2. Schematic Accent 1 and Accent 2 pitch patterns of some Norwegian dialects according to E.W. Selmer. Dotted lines show approximate borders of the stressed syllable. From Haugen and Joos 1954.

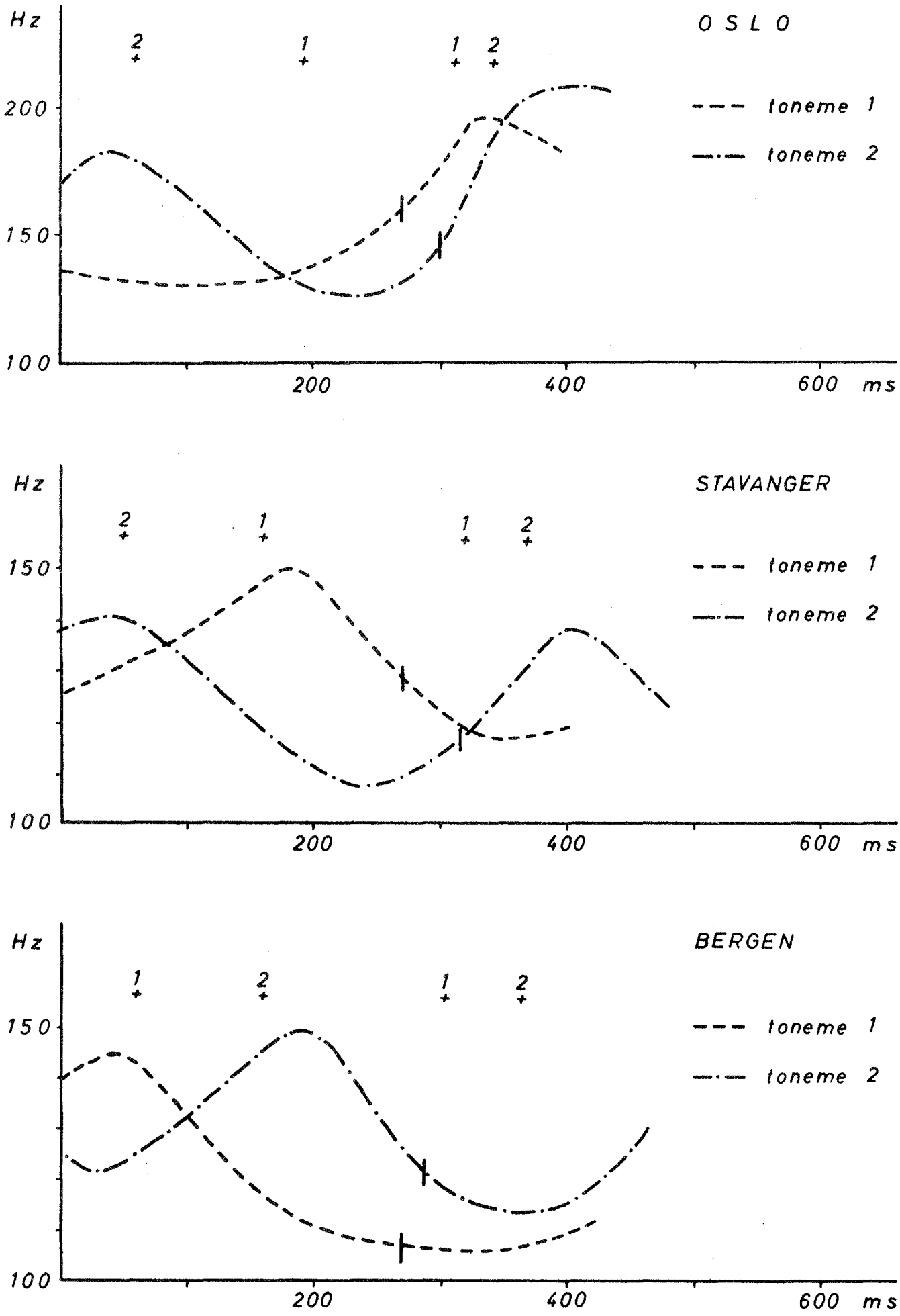
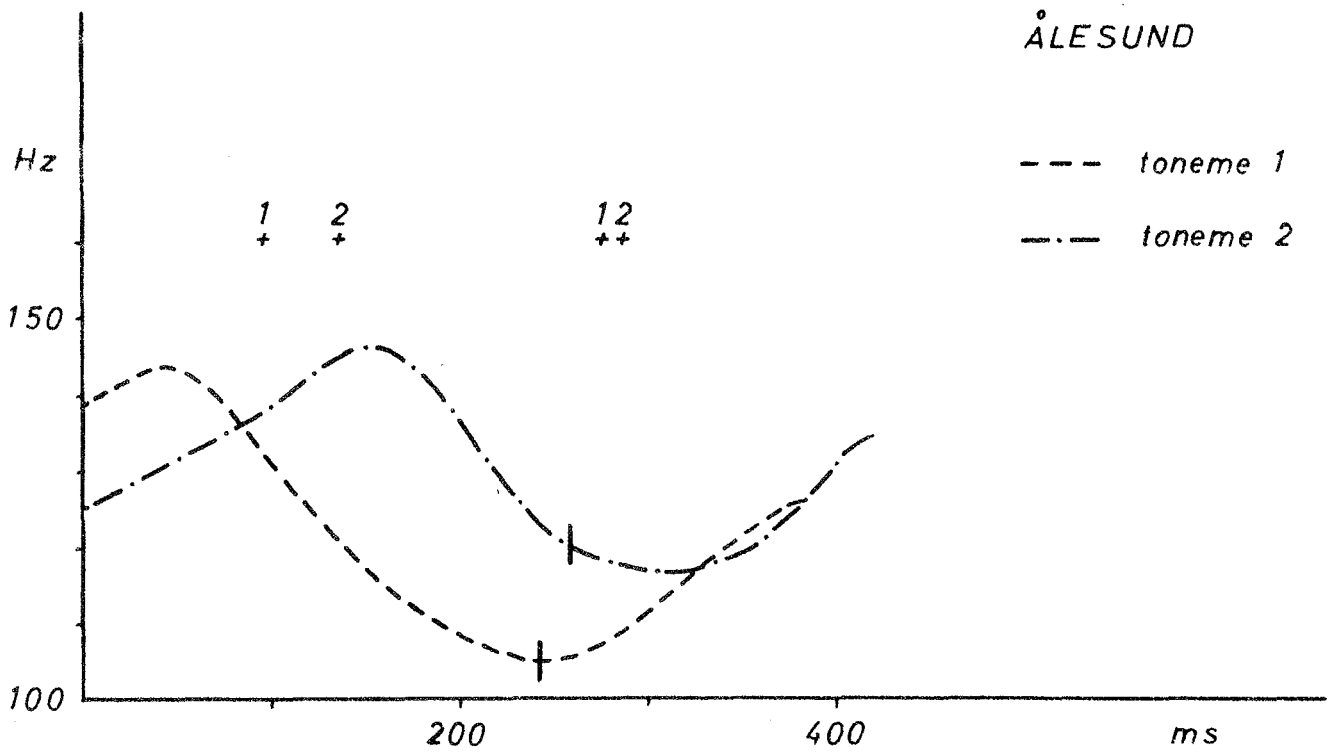


Figure 3.3:A. Typical Accent 1 and Accent 2 pitch patterns of bisyllabics in Norwegian dialects according to K. Fintoft, 1970. Vertical line shows the beginning of the last vowel. The crosses correspond to the average position of the intensity maxima.



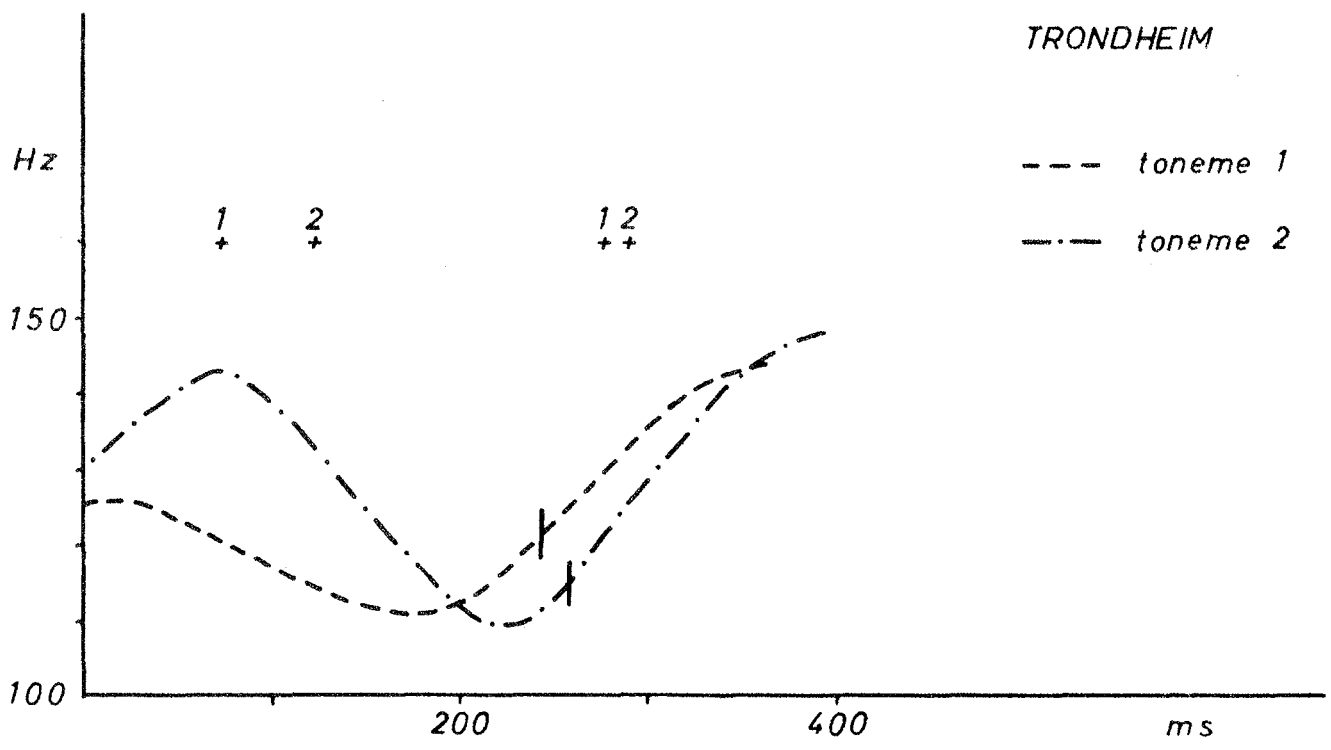


Figure 3.3:B. Typical Accent 1 and Accent 2 pitch patterns of bisyllabics in Norwegian dialects according to K. Fintoft 1970. See Fig. 3.3:A.

Stages I, IV, and VI are not essential for the accent since they cover initial, medial, and final consonants which are not necessarily present in the word. Stage II may also vary in duration and shape (probably with the degree of stress, E.G.) but stages III and V which occur in the first and the last vowel are always present. According to Selmer's analysis a fall-rise is essential for the Accent 2 of the Oslo dialect.

Using the same method, Selmer investigated the dialects of Bergen (1921), the Faroe Islands (1924), Stavanger (1927), and Sunnmøre (1948). Figure 3.2, taken from Haugen and Joos (1954 p. 58), shows the accent manifestations in dialects investigated by Selmer. Vertical lines have been drawn by the authors to show the approximate borders of the stressed syllables.

The figure shows how closely the Norwegian accent manifestations agree with the Swedish ones. The North West dialects of Bergen and Sunnmøre are essentially the same as the South Swedish patterns (an early peak for Accent 1 and a late one for Accent 2). The South West accents of Stavanger with one peak for Accent 1 and two for Accent 2 are similar to the accents found in the Svea dialects, and the East Norwegian dialect of Oslo finally corresponds with the Göta dialects (a low in the stressed syllable of Accent 1 followed by a rise, and two peaks for Accent 2).

Fintoft's material (1970), which includes Ålesund and Trondheim, is analysed by spectrography. It corroborates the earlier results. Of the two new dialects, Ålesund obviously belongs to the North West dialect type represented by Bergen in Selmer's material, whereas Trondheim is similar to the East Norwegian type (Oslo).

In his instrumental accent analyses, Selmer also included dialects that were considered not to possess any accent distinction. By recordings he could show that there are dialects in the extreme north in which the pitch curves in words of the two categories are similar (1948).

Another part of Norway with dialects without distinctive accents is the area around Bergen. A detailed study of the accentual situation in this region was made by Kloster Jensen (1961). Fintoft's and Kloster Jensen's works, which both emphasize perceptual aspects of the accents, will be treated in more detail later (4).

Duration and intensity

Norwegian and Swedish

In his material of minimal pairs from different Norwegian dialects, Fintoft measured the durations of acoustic segments. His results show (1970) that the segments of Accent 2 words are not shorter than the durations of the corresponding words with Accent 1. For some dialects they are in fact significantly longer.

According to Malmberg (1962) Accent 2 words of South Swedish have a longer stressed syllable than Accent 1 words. Elert (1964) found the opposite relation for the Stockholm dialect.

This difference between the dialects is probably connected with the different pitch patterns of the accents. For both dialects longer duration is found in the stressed syllable with rising pitch. In our recently collected accent material (Gårding and Lindblad 1973), there is a tendency for the second syllable to be longer in Accent 2 than in Accent 1 in dialects with double-peaked Accents 2.

Intensity in words with contrastive accents has been measured for Norwegian by e.g. Kloster Jensen 1955 and Fintoft 1965, 1970, and for Swedish by Holmberg 1958, Fant 1958, Malmberg 1957, 1962, Hadding 1961, and Segerbäck 1966. The results show that there is a strong correlation between intensity

and pitch. The two accents can be recognized almost as easily by the intensity envelope as by the pitch curve.

In all the Norwegian and Swedish dialects investigated, the intensity peak of the stressed syllable in any bisyllabic accent pattern is as a rule higher than that of the second unstressed syllable. But the second syllable of Accent 2 has relatively more acoustical energy than the corresponding syllable of Accent 1. This circumstance can be correlated to the pitch pattern in the following way. There are two main pitch patterns for Accent 2 (Table 3.1): The second syllable has a peak of its own or the first syllable has a late pitch peak. In the first case the peak of the second syllable will contribute to the total energy of this syllable (where Accent 1 has no peak). In the second case the late peak of the stressed syllable contributes more than the early peak in the corresponding Accent 1 words. The rate of fall is similar.

The net effect is relatively more energy in the second syllable of Accent 2 words, which may explain why these words are often interpreted by foreigners as stressed on the second syllable.

The 19th century phoneticians talked about double-peaked dynamic accents as different from double-peaked tonal accents. There is one type of dialects which could be characterized as dynamically double-peaked and tonally single-peaked, namely Type 2B, i.e. the Götamål of Sweden and the East dialects of Norway. Accent 1 has low tone in the stressed syllable and the pitch rises towards high in the second. Nevertheless the word has two intensity peaks, one towards the middle of the first syllable with a corresponding pitch low and one in the second syllable connected with the high pitch of that syllable.

In other accent manifestations the position of the intensity peaks is

well correlated with the pitch peaks. There is one observation made by Fintoft (1970 p. 239) which also holds for Swedish material (Hadding 1961, Gårding et al. 1970). In all the investigated dialects, the intensity peak tends to occur nearer the middle of the stressed syllable than the pitch peak. In other words, if the pitch peak occurs early in a syllable, the intensity peak occurs somewhat later, if the pitch peak occurs late, it is preceded by the intensity peak. (Similar findings have been reported by Lehiste for Serbo-Croatian 1961.) It seems then that the intensity maximum is attracted to the middle of the syllable. The reason is perhaps that this is the place of the largest mouth opening.

All these observations are very much on the descriptive side. It is hard to do better with the acoustic signal alone, where the results of laryngeal and pulmonary activities are difficult to separate. Further analysis must rely on aerodynamic and physiological data.

Danish

The following description of the Danish accent manifestations is based on a survey made by Poul Andersen for an anthology of studies in Danish (1970) and a number of dialectal monographs scattered over a long period of time. (Nikolaj Andersen 1897, Marie Bjerrum 1948, Bennike and Kristensen 1898-1912, Brøndum Nielsen 1927, Anders Bjerrum 1944, Ella Jensen 1944, Kroman 1947, Inger Ejskjaer 1954, Gunhild Nielsen 1959.)

Some of the data are impressionistic records of what a particular scholar heard in terms of pitch, intensity and quantity. The more recent works are based on kymographic recordings of the pitch curve or analyses by means of some pitch extracting device.

In Standard Danish words with Accent 1 (category) have stød in the stressed syllable and words of the Accent 2 (category) are characterized by the absence of this feature.

The stød is produced by means of a momentary closure or near closure of the vocal folds. The closure occurs in connection with voice at a point in time which seems to be related to the beginning of the vowel. The acoustic effect of this speech gesture is an abrupt fall in the fundamental frequency followed by a short gap in the speech wave which may be interspersed by slow and irregular vocal fold vibrations. According to an investigation by Riber Petersen (1973 and personal communication), the acoustic record of the støds produced by one subject did not display either gap or creak. The only manifestation of the stød was a dip in the pitch curve. It is perhaps a sudden drop in pitch that should be regarded as the common feature of all the stød variants. Figure 3.4 shows some examples of the stød ~ no stød contrast. It occurs in all but the southern dialects of Zealand and Funen (see map Fig. 3.5).

There are a number of dialects which do not have the stød. Among those there is one category of dialects (Bornholm and the islands south of Zealand) which do not have any accent distinction. Another group of dialects (the south of Jutland and Funen and the islands south of Funen) have an accent contrast which is mainly tonal in character. The dialect described in a doctoral thesis by M. Bjerrum (1948) will serve as an example of a tonal Jutland dialect. She sums up the distinction found in aural and instrumental (kymographic) analyses between the two accents in the following way (p. 53).

Accent 1	Accent 2
One pitch peak	Two pitch peaks
Somewhat lower peak value	Somewhat higher peak value
One intensity peak, falling intensity	Two intensity peaks
Pitch peak in the middle of the syllable	First peak in the first fourth of the syllable
Shorter duration	Longer duration

Similar differences had been found in the islands south of Funen. According to Kroman (1947 p. 71) there are double-peaked Accent 2 manifestations in these dialects. The tonal accents were regarded as a heritage from a Swedish settlement in these areas. (Compare dialects in Central Sweden, Table 3.1.) Kroman's hypothesis created some debate since it clashed with the generally accepted theory that the tonal accents were relics from an earlier tonal period of the language (Poul Andersen 1970 p. 98). Poul Andersen sketches the tonal accents of the islands south of Funen (p. 99) in a way which permits us to make the following statements:

Accent 1 has an early peak.

Accent 2 has a late peak.

Andersen's description of these dialects indicates that they are different from the tonal Jutland dialects.

The Danish accentual types cannot be categorized adequately without reference to the phenomenon known as apocopation. By this term is meant the weakening and reduction of the vowel of certain endings. As a result of apocopation, bisyllabic forms may appear as monosyllables. Apocopation is a characteristic of all the Jutland dialects. The result of this process is very often a new category of monosyllabic forms which may retain some of the prosodic characteristics of the earlier bisyllabics. Consequently there will be two kinds of monosyllabic words with distinctive prosodic characteristics. Ringgaard (1963) lists a number of prosodic contrasts found in Jutland monosyllables. Apocopated Accent 2 words in tonal dialects may be characterized by a complex two-peaked pitch movement, often called the circumflex accent, as compared to a simple pitch movement in Accent 1 monosyllables. (For examples see Bjerrum 1948 p. 50-51.)

Other phonological processes mentioned in connection with the Danish

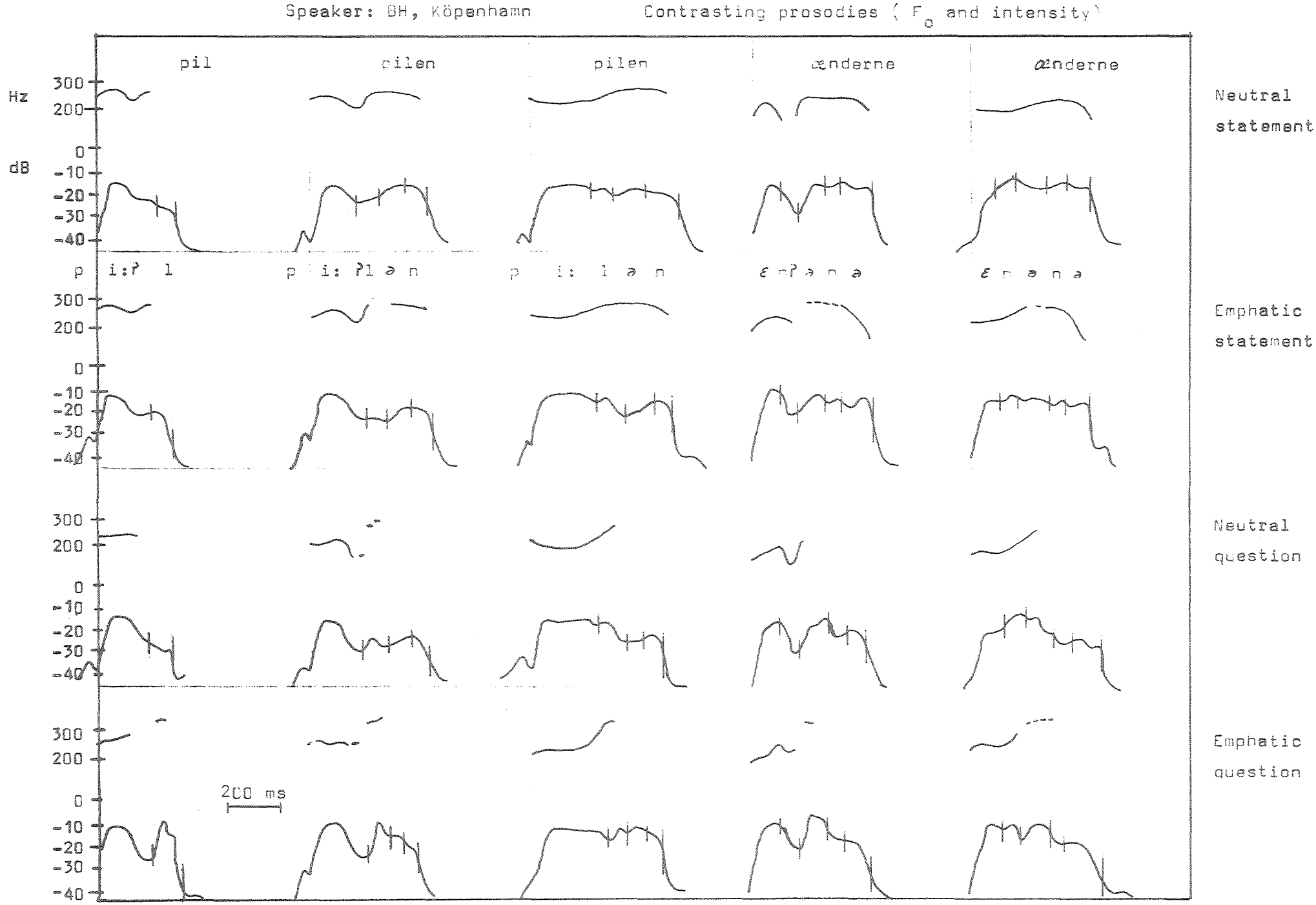


Figure 3.4. Danish accents. Pitch- and intensity curves from utterances with the stød : no stød distinction in different prosodies. Copenhagen speaker. From Lindblad 1973.

accents are the West Jutland stød and the development of a stop parasite in certain dialects. The West Jutland stød was given extensive linguistic and instrumental analysis by Ringgaard (1960). According to Ringgaard's findings, WJ stød only occurs before originally medial stops and may be regarded as a concomitant feature of the stop consonant. By means of cine-radiography, Ringgaard could show that there is an energetic contraction of the glottis (both at the level of the true and the false vocal cords) which precedes the oral stop closure. The aural impression of this stød is similar to the glottal stop found in English dialects. With the apocopation that occurred in the 13th century in the Jutland dialects, the WJ stød acquired distinctive function.

Examples:

English	hat	hats
Accent 1		Accent 2
Standard Danish	hat	hatte
Jutland	[hat]	[haʔd] (here [d] stands for a voiceless and unaspirated stop)

The Jutland pair above may be regarded as an example of an opposition between no stød for Accent 1 and stød for Accent 2, that is a reversal of the contrast found in Standard Danish. But this reversal is only superficially contradictory. The Accent 1 word of the example cannot develop the stød connected with this accent since it lacks the phonetic prerequisites for it (long vowel or short vowel+sonorant, compare Section 2) and the stød of the Accent 2 word is neither structurally nor physiologically equivalent to the Standard Danish stød. According to Ringgaard the West Jutland stød is not a prosodic feature as the stød of the standard dialect but part of a complex stop gesture. This view has been contested by Ella Jensen (1961). The interpretation of the WJ stød must be regarded as controversial (see Andersen p. 104).

The development of a stop parasite (or fricative) after the closed vowels i, y, u, in the Accent 1 words of some dialects has been interpreted as due to the rapid fall of intensity in these words. (Ejskjaer 1954 p. 17, Poul Andersen 1955, Ella Jensen 1959, § 11.)

Tentative Scandinavian Accent Typology

We shall now extend our typology for Swedish accents to cover the whole Scandinavian area. As before this typology aims at capturing only the gross features of the accent manifestations. We have seen that out of the five tonal types found in Swedish dialects, four have their counterparts in the Norwegian dialects. The only one missing is Type 1B of Dalarna and the Island of Gotland.

The Danish accent manifestations - although more deviant - can be fitted into this general schema. For the great majority of the Danish dialects the dominating feature in the accent distinction is the stød. These dialects will form a new and separate category in the typology, denoted S. The non-tonal dialects of Jutland, which are all apocopating, will be regarded as a subgroup of S, called Sa. It is not quite homogeneous. The dialects of the west differ from those of the east by the appearance of a glottal stop, the West Jutland stød, in connection with certain stop consonants in Accent 2 words. This manifestation will be denoted by Sa W.

The Danish dialects with a tonal accent distinction seem to have mainly two different kinds of manifestations. One group (South Jutland) apparently has two pitch peaks for Accent 2 words and is further characterized by apocopation. As a subgroup of Type 2 A, it will be denoted by 2 Aa. The other group of dialects (islands south of Funen) give a subclass of Type 1, 1 C. The criteria that have been used to establish the tentative typology presented

here are summarized in Table 3.2. The data of Table 3.2 are displayed in a map showing the geographic distribution of the accent types (Fig. 3.5).

In drawing this map, it has not been possible to follow the same principles for all the Scandinavian countries owing to the difference in available data.

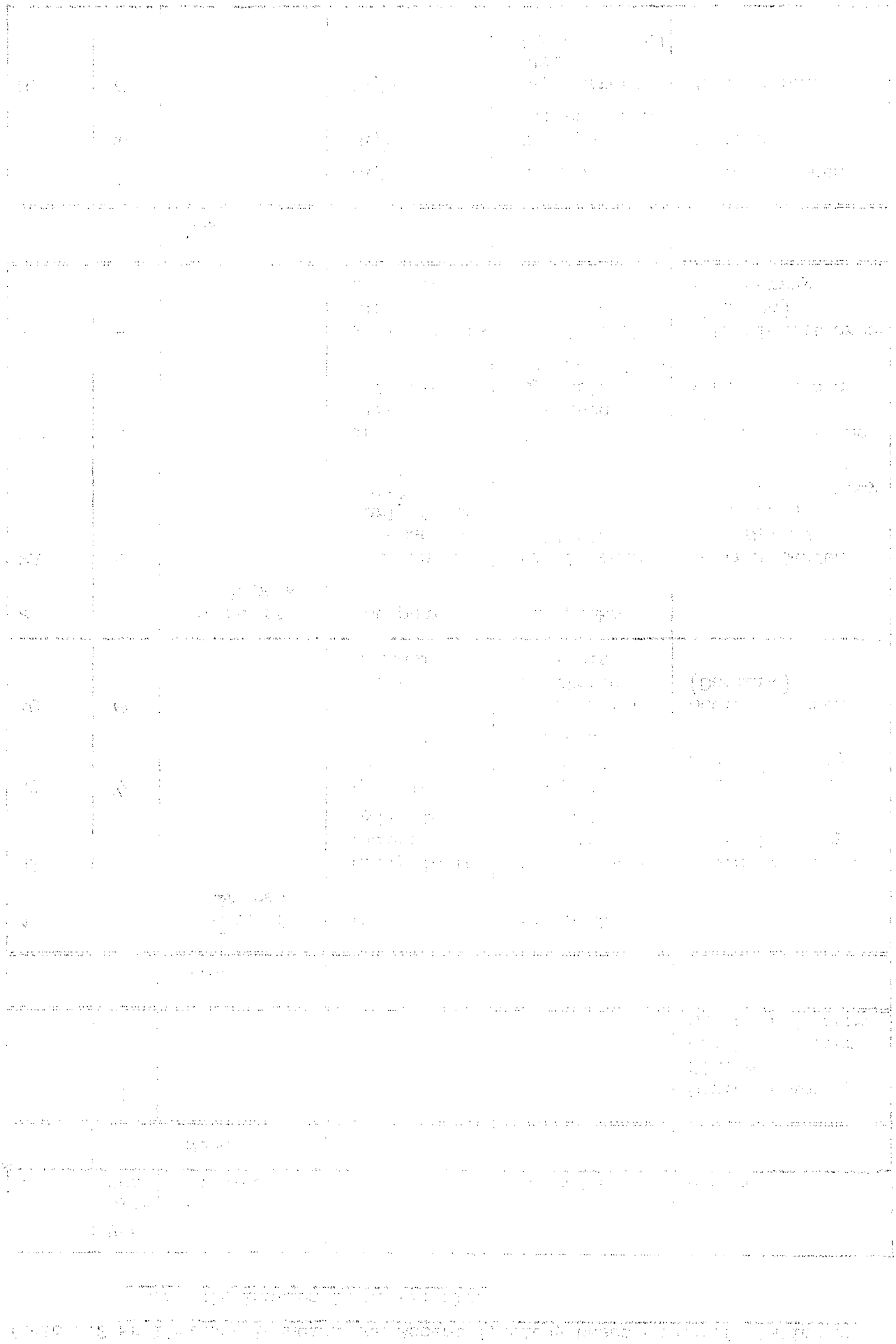
Meyer's accent data are unique. They cover a large geographical area, they are obtained by one individual scholar who uses the same methodology and the same instrumental technique. There is no comparable data collection for ony other Scandinavian country. The tonal dialect map for Sweden has been made in collaboration with S. Benson, following the principles developed at the Dialect Archives of Lund University (see e.g. Benson 1958). A symbol in the map of Sweden refers to my typological interpretation of Meyer's data. For the other countries, I depend on various information, mentioned earlier.

The typological table shows some interesting regularities in the tonal accent manifestations. When both accents have one peak each, the peak of Accent 1 always precedes that of Accent 2. When one of the accents has two peaks as compared to one for the other, it is always Accent 2 that has two peaks.

The common denominator of all Accent 2 manifestations is that it has a tonal peak in or near a posttonic syllable. I shall come back to this question in Section 6.

Table 3.2 Preliminary Scandinavian Accent Typology based on manifestation of accent distinction in bisyllables

Type	Map symbol	Accent distinction	Accent 1	Accent 2	Region
		None			
0	○				North of Norway Finland North of Sweden South of Denmark
		Tonal			
1		Timing of pitch peak	One peak	One peak	
1A	ˈ		Early in the stressed syllable	Late in the stressed syllable	South of Sweden West of Norway
1B	✡		Late in the stressed syllable	Early in the posttonic syllable	Gotland, Bergslagen (Sweden)
1C	❁		Late in the stressed syllable	Late in the posttonic syllable	South of Funen (Denmark)
2		Number of pitch peaks	One peak	Two peaks	
2A	ˇ		Late in the stressed or early in the posttonic syllable	One in each syllable	Central Sweden West Nyland (Finland) South West Norway
2Aa	ˆ		In the stressed syllable	In the stressed syllable (apocopation)	South of Jutland (Denmark) Norway, Sweden
2B	˂		In the post-stress syllable	One in each syllable	Göta dialect areas (Sweden) East Norway
		Stød			
S	◌̸		Stød	No Stød	Zealand, Funen
Sa	◌̸		Stød	No Stød (apocopation)	Jutland
Sa W	⊖		Stød	Stød before stops (apocopation)	West Jutland



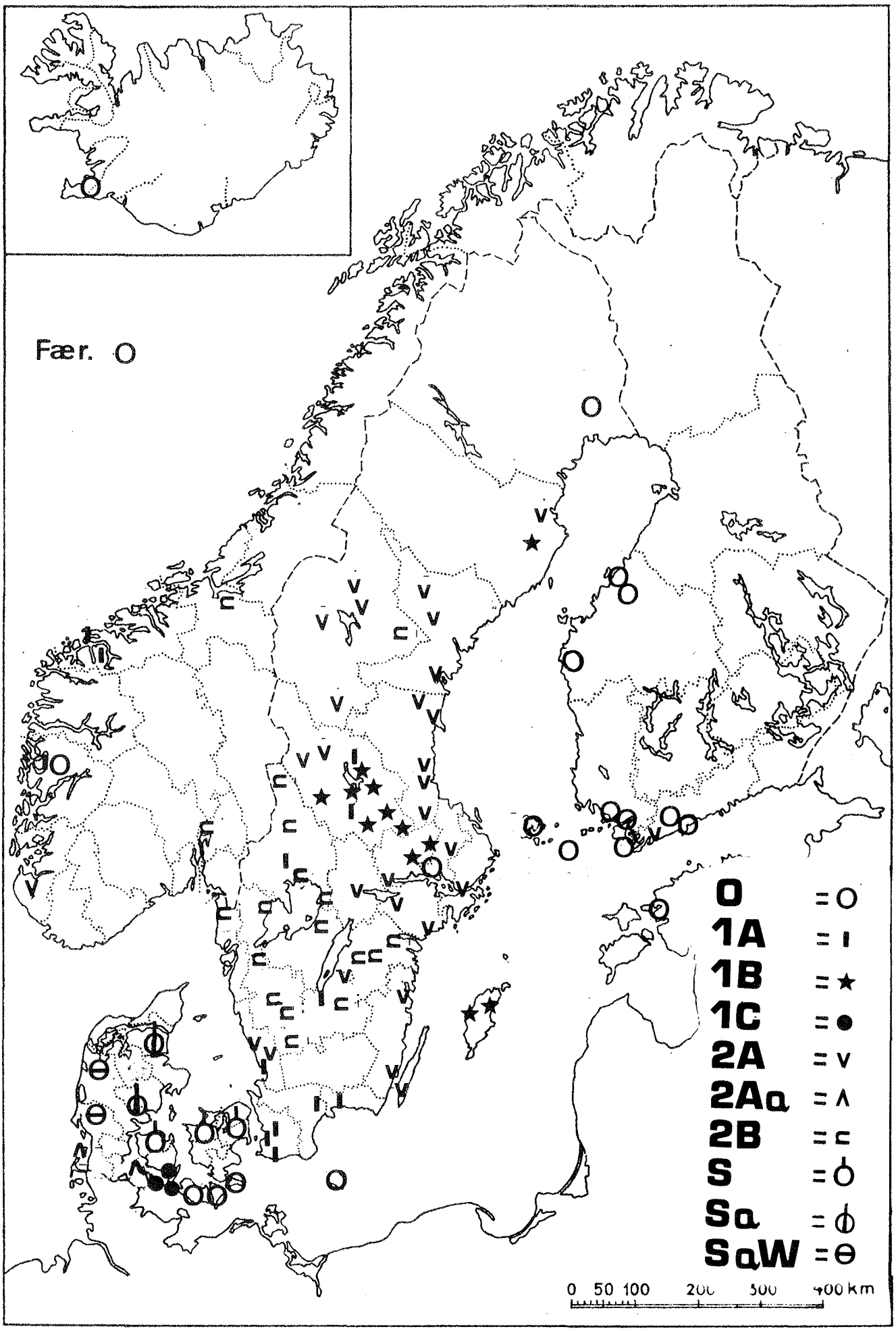


Figure 3.5:A. Geographical distribution of the accent types of Table 3.2. Data from various sources quoted in the text.

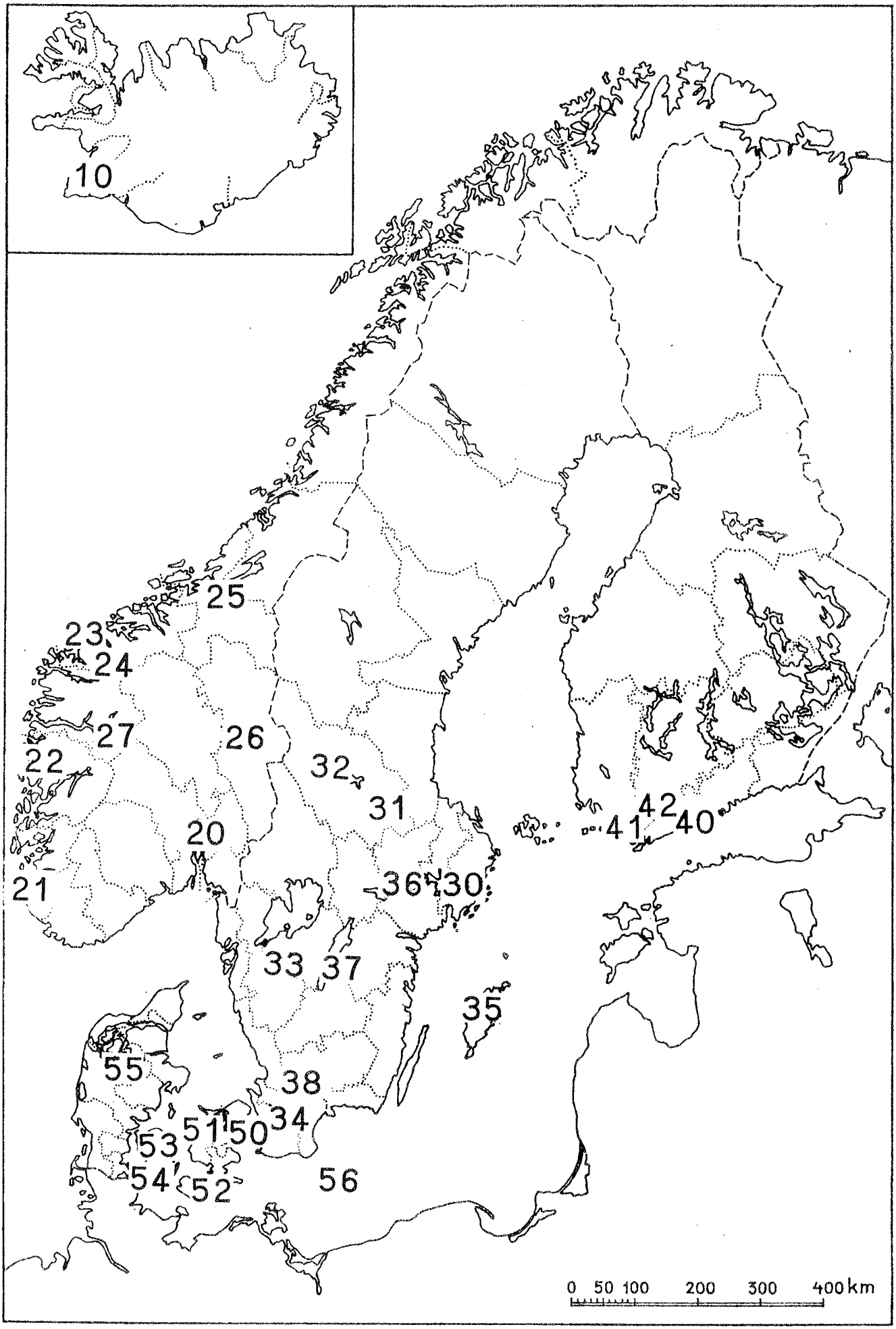


Figure 3.5:B. Guide to the preceding map. The number code is explained in Table 3.3.

Table 3.3 Code to Figure 3.5.8

Iceland	
Reykjavik	10
Norway	
Oslo	20
Stavanger	21
Bergen	22
Ålesund	23
Sunnmøre	24
Trondheim	25
East Norwegian dialect area	26
West Norwegian dialect area	27
Finland	
Helsinki	40
Turku	41
West Nyland	42
Sweden	
Stockholm	30
Bergslagen (Mining district)	31
Dalarna	32
Västergötland	33
Scania (Skåne)	34
Gotland	35
Svea dialect area (Central Sweden)	36
Göta dialect area	37
South Swedish dialect area	38
Denmark	
Copenhagen	50
Zealand	51
Islands south of Zealand	52
Funen	53
Islands south of Funen	54
Jutland	55
Bornholm	56

4. PERCEPTION

In the fifties electronic advances made it possible to synthesize speech and to manipulate recorded speech by filtering and segmentation. This opened the way to perceptual tests of systematically varied speech signals. Questions about acoustic correlates to linguistic elements and their relative importance to perception and recognition could be tested. For the accents the experimental work came to center around the following themes.

1. What acoustic parameters are important for the recognition of the accents? Are the accents dynamic or tonal? What role is played by other cues?
2. What pattern is essential for the recognition of a particular accent?
3. In view of the fact that the patterns differ from one dialect to another, how are the accents understood by people representing different dialects? Do the accents have any commpn characteristics which escape conventional acoustic analysis?
4. What role do the accents play in speech recognition?

Acoustic cues

The question about the tonal or dynamic character of the accents was tackled by Malmberg in 1956 at the Haskins Laboratories in New York. He made use of vocoder, spectrograph, and the Pattern playback. In a recorded material of Southern Swedish, Malmberg made measurements of various parameters that had appeared in discussions about the acoustic correlates to the accent distinction.

According to his measurements the location of a fundamental frequency maximum in the stressed syllable ('Tongipfel' in Meyer's terminology) seemed to vary more consistently with the two accents than intensity. In a series of

experiments, Malmberg then varied fundamental frequency and intensity in a systematic way. His results showed that the location of the fundamental frequency peak is a primary cue to the identification of accents in this dialect. If the peak was at the beginning of the stressed vowel, the word was heard as Accent 1, if it was placed towards the end, the impression was that of Accent 2.

Variations of intensity did not affect the impression of the accents. Malmberg concluded in terms of the Prague school that the intensity variations were irrelevant and that pitch was the distinguishing factor in the accent opposition (at least for the dialect investigated). This investigation made Malmberg propose an analysis of prosodic features along structural lines. For the accents some abstract units were to be posited, for instance low and high. This amounts to saying in less abstract terms for this dialect that at a certain point on the time scale, the tone is high for one of the accents and low for the other. The rest of the configuration of the curve is then redundant. The analysis of this opposition can according to Malmberg be made more abstract by regarding one of the accents - Accent 2 - as marked in relation to the other (Malmberg 1955 and 1967).

In view of the fact that fundamental frequency variations have been shown to be sufficient to create impressions of stress (Fry 1955), Malmberg's finding of their importance for the accent distinction may not seem so surprising. But it was a refreshing contribution to a hundred year old discussion and his work introduced new research techniques of phonetics in Scandinavia.

Malmberg's results were later corroborated by Jassem (1963) and for Norwegian by Fintoft and Mártony (1964).

In his acoustical and perceptual analysis of Norwegian accents (1970), Fintoft described various experiments with manipulated speech which went to

show the overriding effect of fundamental frequency over intensity as a perceptual cue. In one set of stimuli, for instance, the peaks of intensity had been cut off, a distortion which did not have any effect on the recognition of the accents.

He also eliminated the possible effect of varying formant structure connected with the two accents by low pass filtering his accent stimuli. By this procedure the identification scores were in fact slightly improved.

Pattern recognition

Several scholars had claimed (e.g. Noreen 1907, Haugen 1956, Malmberg 1959, 1962) that the accents could be distinguished by the stressed syllable only. In Tonemicity (1951 p. 29) Kloster Jensen reported on an informal experiment in which subjects had been asked to identify isolated syllables from words with different accents. The accents were found to be recognizable both by their first and their second syllables although much less well in the latter case. He concludes (p. 28): 'In order to recognize the accent manifestation it is not necessary to have the full realisation any more than we need to see a whole cow to recognize one.'

In an attempt to explore systematically the intelligibility of the Norwegian accents, Efremova, Fintoft, and Ormestad (1959) presented listeners with fractions of different durations from words with one of the two accents. Their results showed that only small fractions of the words, approximately 200 msec or two thirds of a long vowel, were needed for a correct identification. As is shown by their figures (Fig. 4.1) the duration of these fractions is dependent of the segmental composition of the syllable. With an initial consonant the duration needed for the identification of the accent is longer. In other words, the acoustic cues to the accent distinction are located in

the vocalic segment. We notice in the figures that the vocalic segments have similar fundamental frequency contours (et and vik). In a similar test Johansson studied the intelligibility of Swedish accents (1970). It was found that for the Scanian accents only a small fraction of the first syllable was needed for correct identification. Similar results had been obtained by Westin et al. (1966). In a later experiment with synthetic speech Fintoft and Mårtony showed how the fundamental frequency information contained in the initial consonant is irrelevant to the accent identification. Only the fundamental frequency in the stressed syllable seems to count. In particular, for Accent 2 to be identified in East Norwegian, a fall is needed in the stressed syllable.

Interdialectal understanding

In connection with her investigation of the intonation of Southern Swedish, Hadding tested the recognition of word accents produced by speakers representing various dialects. A group of listeners of mixed dialectal background judged the accents which received scores ranging from 86 to 99 %. The test words spoken with the Scanian (southern) dialect or the Stockholm dialect had the best recognition scores (1961 p. 70).

The composition of the listener group made it natural to conclude that these dialects had been best known to the listeners. In her acoustic analysis of the test words, Hadding suggested that there might be acoustic dialect independent similarities in the words with Accent 2 (p. 72 ff.).

In a series of tests with manipulated stimuli, Johansson (1970) studied the intelligibility of Swedish accents in two different dialects (one from the south, Type 1A, Table 3.2, and one from the north Type 2A). In one test, isolated words differing in accent were presented to listeners whose

Figure 4.1. Intelligibility of accents. From Efremova, Fintoft and Ormestad 1963.

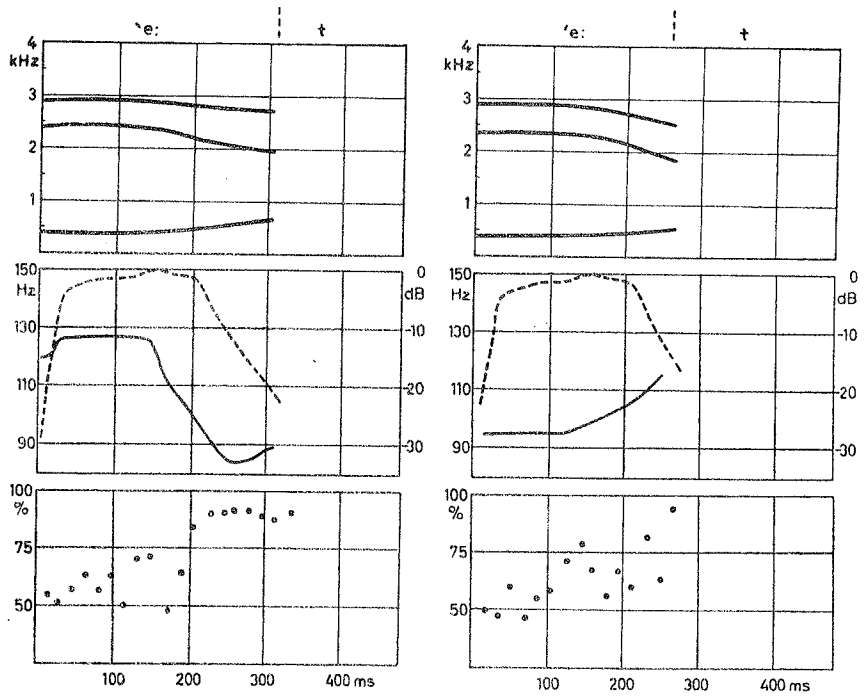


Fig. 2. Upper part: Tracings of the first three formants, F_1, F_2 and F_3, for *ete* (left) and *eter* (right), for our test speaker. Middle part: Fundamental frequency (solid line, scale on left side) and sound pressure level (broken line, scale on right side) for *ete* (left) and *eter* (right), for our test speaker. Lower part: Identification of accent in per cent as a function of fraction length.

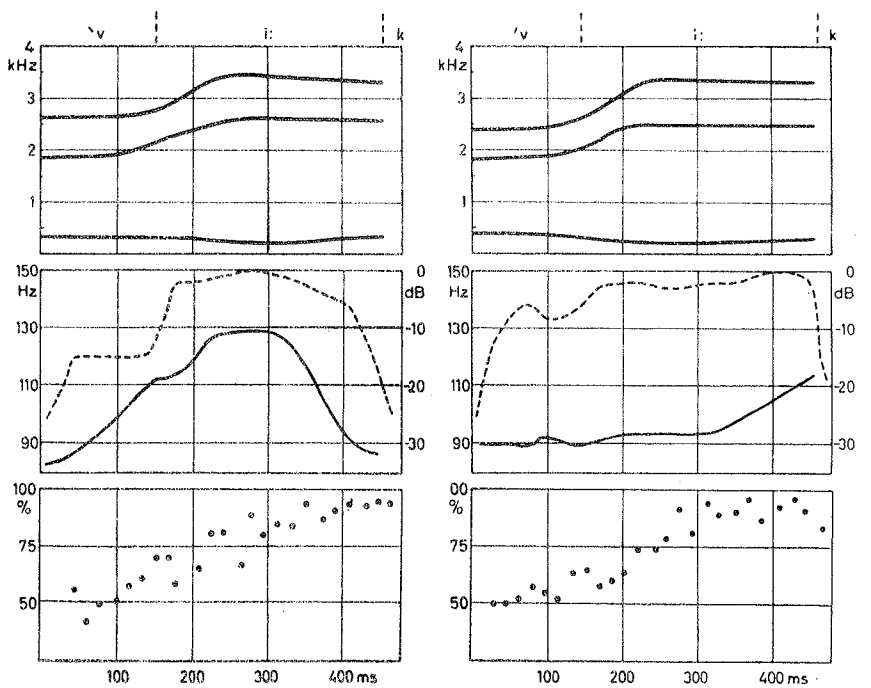


Fig. 3. Upper part: Tracings of the first formants for *vike* (left) and *viker* (right). Middle part: Fundamental frequency and sound pressure level for *vike* and *viker*. Lower part: Identification of accent.

judgements were correlated to the manifestations of their own accents. The results showed that the identification of accents was indeed dependent on the listener's dialect. Listeners from the south had almost perfect recognition of the test words from the southern dialect but could not recognize the accents of the northern dialect. A group of listeners from the north had similar reactions, i.e. they had difficulties with the isolated accents from the south.

In another test the listeners were asked to identify the first syllables of the test words. For listeners from the south, the first syllable of their own dialect was suffisient for a correct identification. The first syllable in the other dialect was misunderstood in a systematic fashion, that is the rising pitch of the northern Accent 1 was judged as Accent 2, which has rising pitch in Scania.

Isolated accents and fragments of accent then are compared to the listener's own patterns and judged accordingly. When the accents have reversed pitch values the reactions are also reversed. In a third test Johansson explored the importance of the second syllable. In the northern dialect the second syllable received scores around 70 % and the corresponding figure for the south was 60.

A set of stimuli consisting of the first syllables of test words with Accent 1 spliced together with the second syllables of the corresponding words with Accent 2 and vice versa were judged in such a way that it was possible to conclude that the first syllable had an overriding effect on perception in the southern dialect. The same is true of the second syllable in the northern dialect. (It probably is the pitch peak in the second syllable which is responsible for the weight of the second syllable in this dialect. The second syllable of the Scanian dialect has no such feature.)

Perception and interdialectal understanding are chief topics in Fintoft's analysis of the Norwegian accents (1970). As part of the material in this investigation, Fintoft used pairs of words differentiated by accent spoken by subjects representing five different dialects. The material was subjected to acoustic and perceptual analysis. For the perceptual analysis he used large groups of listeners from each of the five dialects. Each group of listeners then identified accents in five different dialects. The dialects were: Oslo and Trondheim which both belong to the East Norwegian dialect area (cf map, Fig. 3.5, and accent manifestations in Table 3.2). They have accent manifestations similar to the Swedish Göta dialects. Bergen and Ålesund in the west have accents which are principally the same as those in the south of Sweden (former Danish provinces). Stavanger finally in the south west has accents similar to the Svea dialects.

When a listener heard isolated words in his own dialect, the recognition score was about 90 %. As for the recognition of the accents of the other dialects, there was no straightforward correlation between the score and the similarity of the heard accents to the listener's accents. The accents of Oslo, Trondheim, and Bergen were easily identified by listeners of all the dialect groups which seemed to imply that the dialects of the large cities were familiar to the listeners.

Stavanger, which has an exceptional position in the Norwegian accent collection, received the lowest scores. It is interesting to note that the Ålesund contours, although very similar in pitch and intensity to those from Bergen had considerably less success in the tests (p. 98). Other factors must have been involved.

Do the accents then have any common dialect independent perceptual characteristics?

Fintoft tackled this question by presenting his listeners with synthetic stimuli consisting of sine tones with varying fundamental frequency. One set of stimuli simulated the stressed vowel of the accents. The responses were very uniform for all the dialect groups except Stavanger. A rising tone was interpreted as Accent 1 and a falling tone as Accent 2. The Stavanger listeners (with their untypical Norwegian accents) behaved differently. Another set of stimuli consisted of sine tones put in a bisyllabic arrangement. The listeners now reacted in accordance with the patterns of their own accents. Fintoft's and Johansson's results suggest that there cannot possibly be a uniform pitch pattern which signals accents unequivocally, independently of dialect and context.

In a discussion of interdialectal understanding (1959), Malmberg stresses the importance of functional rather than phonetical similarity. After pointing out the small communicative value of the accents (there are, as has been mentioned earlier, dialects which do not have the accent contrast), Malmberg makes an impressionistic description of what happens when representatives of two dialects with different accent manifestations talk to each other. In current speech only a few sentences are needed for a native Swedish listeners to grasp the accent manifestations in the foreign dialect. One of the manifestations is compared and identified with the listener's functional type 1, that is, the accent he uses in for instance the definite form of monosyllables and the other is identified with his functional type 2, that is, the "connective" accent of his polysyllabic stems. As soon as this equivalence is established, which of course is unconscious and automatic, there are no accentual disturbances in communication.

I should like to add a probably commonly shared experience. An interdialectal difference in the rules for accent assignment arouses more attention

than a difference in manifestation. For instance, a word like blåbär 'blueberry' which has Accent 2 in the south and Accent 1 in most dialects further up in Sweden, is apt to create surprise in the south when pronounced with Accent 1 although the Accent 1 of the north in its tonal appearance is quite similar to the Accent 2 of the south. This can be explained along Malmberg's functional lines but there may be additional factors as well. One such possible factor is that the accents, in certain contexts at least, are perceived as stress patterns rather than tonal patterns. The Central Swedish accentuation of ´blåbär would then to a Scanian represent a pattern with strong stress on the first and reduced stress on the second element of the compound. This pronunciation sounds odd to him since as a Scanian he is used to `blåbär with Accent 2, felt as a combination of two stressed elements. Another example which creates surprise is saker 'things' which for a Scanian has Accent 2 but in Central Swedish dialects may have Accent 1.

Accents and speech recognition

In recent research of perception the earlier insistence on isolated words and segmental cues has partly been superseded by an interest in the speech recognition process proper. Experiments have been designed to find out how information at various levels of speech, grammar, prosody, and segments is retrieved and what roles the different kinds of linguistic information should have in a model of speech recognition.

Experiments in this direction with some bearing on the accents have been reported by S.G. Svensson (1971). In a series of tests, listeners were presented with stimuli representing the 12 possible prosodic patterns of Swedish bi- and trisyllables. The stimuli consisted of hummed "words" pronounced by a trained phonetician who simulated the prosodic characteristics of Swedish

words. Listeners were asked to interpret a hummed stimulus by writing down a Swedish utterance with a comparable prosodic pattern. An answer was judged as correct if the suggested word had the same prosodic pattern as the stimulus. The average "recognition" score was 83 % but the syllables that were involved in Accent 2 had scores of 95 %. (The explanation may be that Accent 2 in one syllable restricts the prosodic possibilities of the next stressed syllable while Accent 1 does not have this property.)

Further exploration of the role of the accents in speech recognition of Swedish has been reported by Lindblom and Svensson (1973). They recall the well known fact that spectrograms are very hard to read even for trained phoneticians and suggest that some additional prosodic and grammatical information might be helpful for a more successful decoding. The prosodic features chosen were stress and accents for every syllable. A suitable decoding strategy was devised and tested and turned out to be successful. In their discussion of the outcome, the authors weigh the relative importance of the spectrographic, prosodic and grammatical information. They conclude among other things that the prosodic features are highly informative about the grammatical structure.

Whispered accents

In an experiment with whispered accents, Kloster Jensen (1958) found that the recognition of whispered accents largely depended on the whisperer's technique. Whispered accents whose recognition scores were 100 % were performed as follows: Accent 1 had one marked stress and Accent 2 had an additional marked stress on the second syllable.

Hadding (1961) tested the intelligibility of whispered accents from five different dialects. The average recognition score was 71 %. Spectrograms of

her material showed that successful Accent 2 whispers had a prominent second syllable, whereas well understood Accent 1 whispers had a strong first syllable followed by a weak second syllable.

In a study dealing exclusively with whispered accents, Segerbäck (1966) found that a difference in the distribution of intensity was the most important distinction between the accents.

5. PRODUCTION

Research on the physiology of the accents has centered on the following themes:

1. Collection and first interpretation of physiological data.
2. Neurophysiological models for pitch control.
3. Timing and coordination of pitch with other speech signals.

The first theme will be illustrated by a summary of Svend Smith's pioneering study of the Danish stød (1944). With the appearance of the spectrograph after the war and various other electronic equipment, acoustic phonetics came to dominate over speech physiology for many years to come. The second theme above was initiated in the mid sixties by Öhman's and Lindqvist's analysis of the pitch contours of Swedish accents as smoothed out responses to neural step commands (Öhman and Lindqvist 1965, Öhman 1967). The testing of various hypotheses in this analysis using recent advances in electromyography has given new experimental data. Some of the results will be reported below. The third theme is closely connected with the second. The data are here acoustic and kinematic but the design of the experiment and the analysis aim at tracing physiological processes and neurological events.

Physiological data

The stød

The Danish stød was studied at various stages of its production in a treatise by Svend Smith (1944). Smith made electromyographical recordings of respiratory muscles, measured subglottal pressure, inspected vocal cord vibration, measured airflow at the mouth and made various kymographic and acoustic recordings. Using surface electrodes (located between the omphalos and trigo-

num scarpae), Smith found different innervation types in pairs of words contrasted by stød. The words with stød had a brief and intense, suddenly decreasing innervation, whereas words without stød had a more evenly distributed innervation. In Wachholder's terminology (1928) these two patterns were described as thrusting and controlled movements respectively. According to Smith only the stød and not the other type could be a manifestation of a "ballistic stroke", which according to Stetson's theory should occur in every syllable.

Smith distinguishes three physiological phases in the stød, the first phase (the stød proper, when the agonists are active), the second (braking by antagonists), and the third phase (the rebound).

The stød has but little effect on the pitch envelope. The great difference in the two accents is to be found in the intensity curve. There is a decrease of intensity during the second phase, but the oscillations never cease completely.

Smith's results can be summed up in his general characterization of the stød: "a stress accent, a special marking movement made by a thrust-like emphasizing of sounds".

The activities of some laryngeal muscles in the production of the stød were studied in an EMG investigation at Haskins Laboratories by Fischer-Jørgensen and Hirose (1972). When this material has been analysed it should make a valuable contribution to the understanding of the stød.

Swedish accents

According to Öhman's model, which will be treated in more detail in Section 6, the Scandinavian accents should be regarded as variously timed glottal stops, "only softer than the Danish one", i.e. the stød (1967 p. 29).

Meyer's curves in Figure 3.1 give a good illustration of this point of view. Any double-peaked Accent 2 (look for instance at numbers 1 through 9) is indeed similar to the Accent 1 of e.g. Aarhus, Denmark (number 99). The curves suggest that some pitch inhibiting or pitch lowering force is at work towards the middle of the accents, that is for Danish in Accent 1 and for Central Swedish in Accent 2.

To give the model a physiological basis, Öhman (et al. 1967) looked for a pitch lowering mechanism that could be correlated to the lows in the pitch curves. Departing from Smith's results, Öhman expected to find a special activity pattern in the vocalis and cricothyroid muscles at the time of the lows, namely, high activity in the vocalis muscle combined with low or no activity in the cricothyroid muscle. An EMG investigation (Öhman et al. 1967) with probes into these muscles did not give any conclusive results however. (For a closer discussion, see Gårding 1970).

A parallel EMG experiment was conducted at the Institute of Logopedics and Phoniatrics in Tokyo (Gårding et al. 1970). Apart from the vocalis and cricothyroid muscles, the sternohyoid muscle was investigated as a possible candidate for the pitch lowering effect. There were two subjects with different accent types. Several parameters were varied, such as phonetic shape of the test words, stress, and tempo. Some of the results are shown in Figure 5.2. In the upper EMG tracings from the subject speaking a Central Swedish dialect with double-peaked Accents 2, there is coactivity in the vocalis and cricothyroid muscles for peaks in fundamental frequency and a decrease of activity in these muscles prior to the lows. Peaks of activity in the vocalis and cricothyroid muscles correspond to a peak in the pitch curve. In the lower tracings derived from the South Swedish speaker, who has an early peak for Accent 1 and a late one for Accent 2, there is a similar

but less striking correlation between fundamental frequency and muscular activity. The sternohyoid activity could not be correlated to the accents.

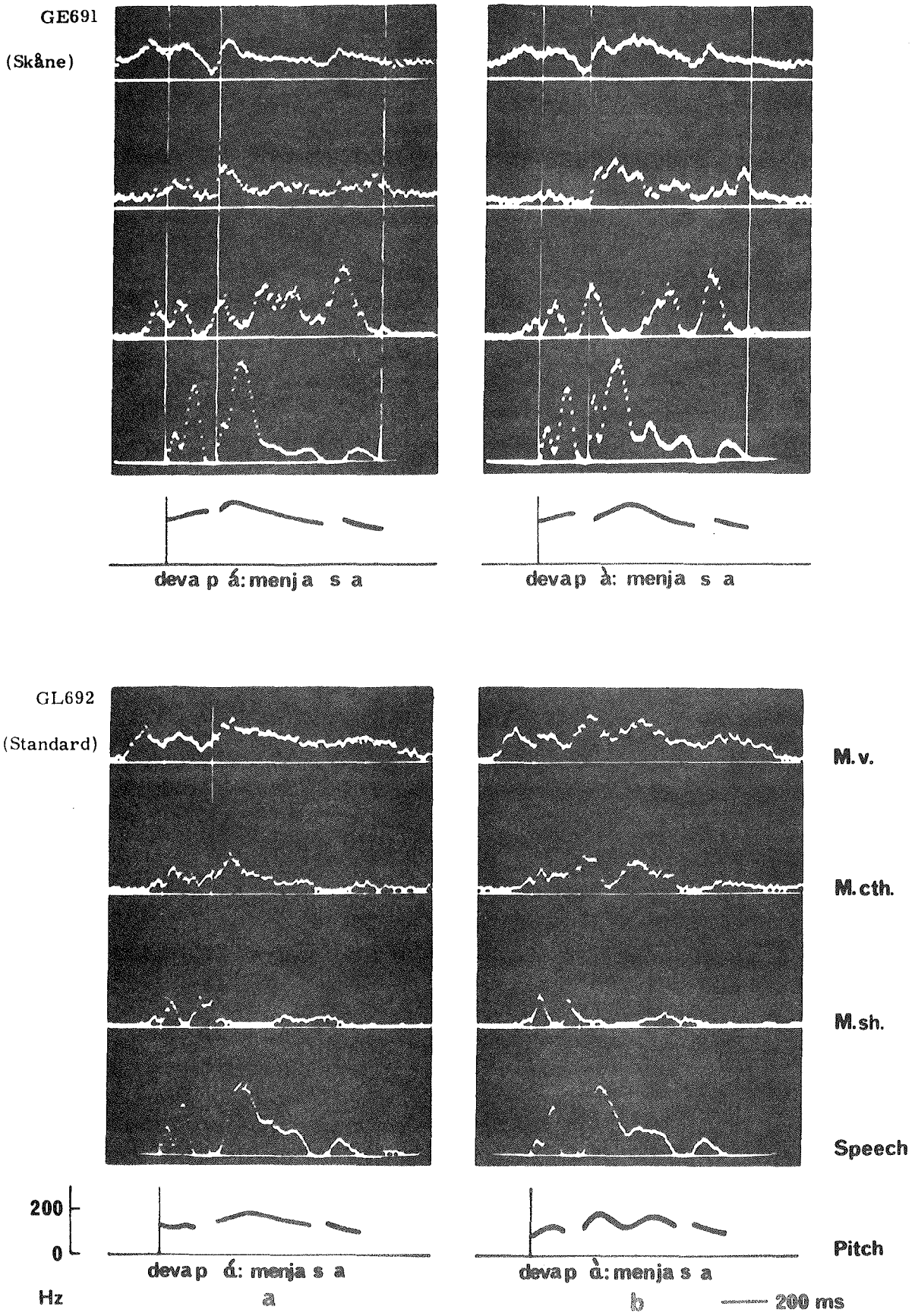
By means of fiberoptic techniques, Lindqvist studied laryngeal activity during various speech gestures (1972). Special attention was paid to the accents. Lindqvist's observations of laryngeal behaviour in connection with low fundamental frequency made him advance the theory that the aryepiglottic sphincters are active for lowering the pitch and that these muscles work in antagonism to the cricothyroid muscle. (Contraction at a higher level in the larynx for the West Jutland stød had already been demonstrated by Ringgaard. Compare Section 3.) This activity pattern was present in connection with the stressed syllable of Accent 2 which has falling pitch in the dialect of the subject.

Timing and coordination

Time relations between the acoustic segments and the fundamental frequency contour of bisyllabic Accent 2 nonsense words (of shape Ca:Ca and CaCa where C stands for a voiced or voiceless obstruent) were studied by Öhman in 1965. When all the utterances were lined up with the end as a common time reference, the superimposed fundamental frequency curves looked as if the phonatory activity determined the duration of the acoustic segments of the consonants. Or, in other words, the articulatory gestures seemed to be adjusted to the phonatory time scale according to certain rules.

The study of time relations between acoustic segments and fundamental frequency contours in connection with accents has been pursued by Rapp (1971) and Eriksson and Alstermark (1972). In a study of syllable timing, Rapp used Accent 1 sequences of the type [a'C_1^3:ad] where the medial consonants were represented by various dentals and dental clusters. All these words had very

Figure 5.1. Averaged EMG signals of the vocalis, cricothyroid and sternohyoid muscles. Central Swedish above and South Swedish below. Accent 1 to the left and Accent 2 to the right. From Gårding, Fujimura, Hirose 1970.



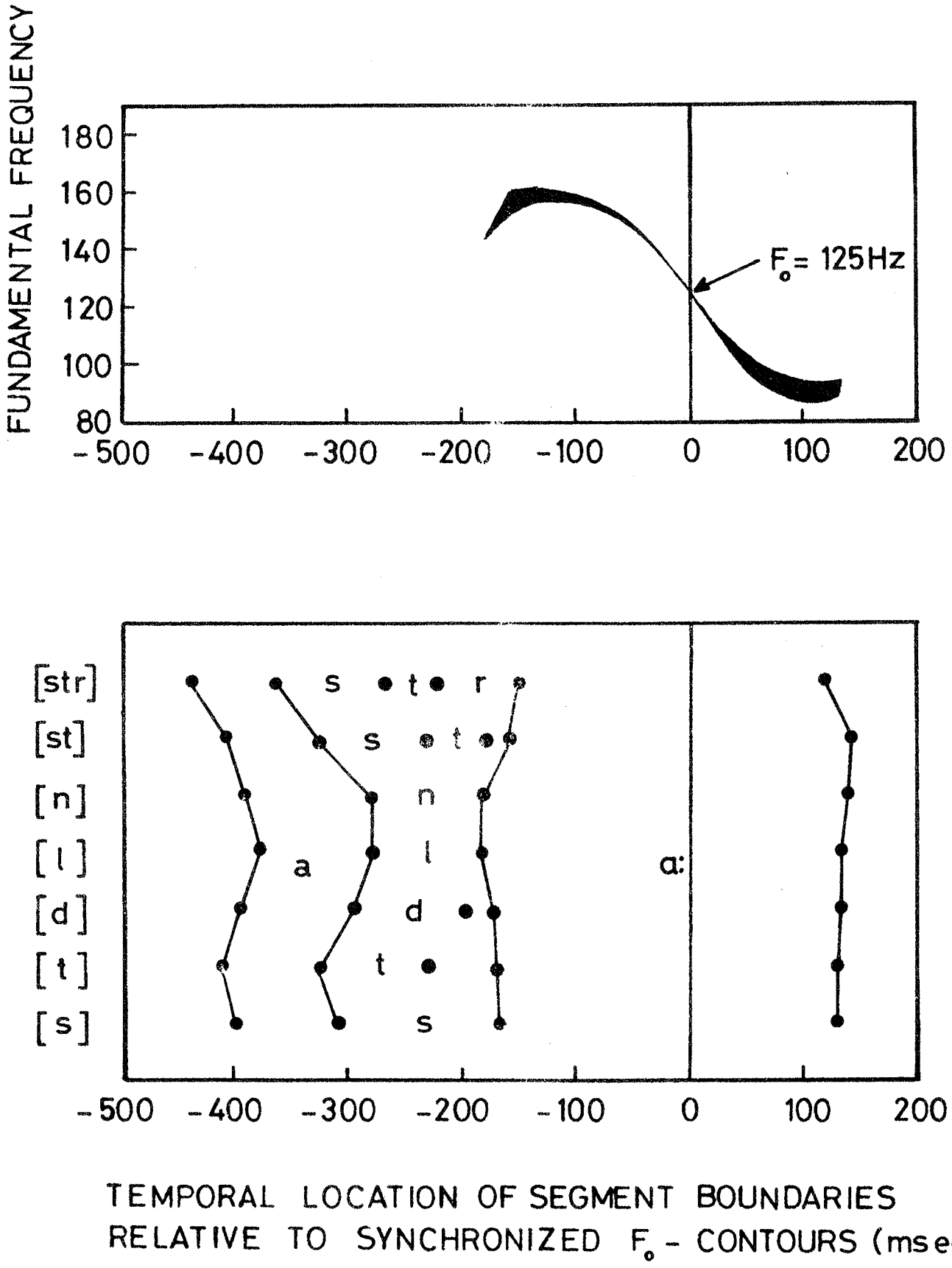


Figure 5.2. Temporal location of segment boundaries relative to synchronized Accent 1 F_0 contours. From Rapp 1971.

similar pitch contours. As can be seen from Figure 5.2, where the contours have been lined up with a certain fundamental frequency value in the stressed vowel as a reference point, the high of the contour is rather uniformly related to the beginning of the vocalic segment regardless of the number of medial consonants.

In a material consisting of Accent 2 compounds with long or short vowel in the stressed syllable, Eriksson and Alstermark (1972) looked for the constant part of the pitch curve in the stressed syllable. The question asked was as follows: Will a shortening of the long stressed vowel - as in [ˋdatta:d] compared to [ˋda:ta:d] - bring about some kind of reorganisation of the timing of the gestures or will it simply cut off the corresponding part of the pitch curve. The result favours the second alternative. The voiceless consonants seem to mask the low. This shows that the stable portion of the pitch of the stressed syllable of Accent 2 is the early part when the curve is still at a high level. It also implies that it is this part which is important to perception.

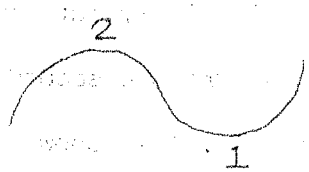
6. MODELS AND SYNTHESIS

Models

In their article Tone and Intonation in East Norwegian (1954), Haugen and Joos presented a spectrographic, auditory, and structural analysis of a text, read by a Norwegian actor.

Haugen observes that there is an up and down melody in the speech and that the accents cannot be detected unless it is known where the stressed syllables are.

I shall illustrate Haugen's analysis by the following schematized pitch curve



The accents are described as stresses that are timed differently in relation to this carrier. For Accent 1 in this dialect, the stress sets in near the minimum marked 1 in the curve. Accent 2 starts near the maximum marked 2. The common feature of the two accents is minimum 1, which in Haugen's structural analysis makes Accent 2 the marked form of the opposition. What happens after the minimum (defined as the contour) is common to both accents and therefore Accent 2 is described as a displacement of the tonal curve of Accent 1 (e.g. 1967 p. 189).

With Selmer's schematic figures of accents in various dialects and his own data, Haugen arrives at the first common "model" for all Scandinavian dialects (Fig. 3.2. The figure was presented in connection with my account of Selmer's work.). Accent 1 for all dialects is interpreted as a short syllable. Accent 2 has a long nucleus and its relevant tonal movement runs over into the next syllable. I interpret nucleus as referring to the duration of the build up of intensity.

Öhman used a general model for intonation to analyse and explain dialectal variety of accents (1967). The components of his model are step functions which represent the on and offset of nerve signals (approximately neural commands). Generally speaking, the model transforms these step functions into pitch curves by a physically and physiologically motivated smoothing procedure.

When applying his model to the accents, Öhman uses two kinds of step functions, the "positive step" which raises pitch in the stressed syllable and represents sentence intonation and the "negative pulse" which, as the term indicates, lowers pitch. The negative pulse is thought of as representing the word accent. By combining the pulse and the step in various ways in relation to time, Öhman could generate pitch curves that simulated accents in different dialects. According to Öhman's model dialectal variation is the result of a difference in timing between the pulse and the step. To give one example, the pitch envelope of Stockholm Accent 1 is rather similar to South Swedish Accent 2. In terms of the model the step and the pulse come at the same time for Stockholm Accent 1 and for Stockholm Accent 2 the pulse comes later. In the Skåne dialect the situation is the opposite (see Fig. 6.1).

Öhman tried to find some neurological evidence for his negative pulse but the experiment was inconclusive. This together with the fact that he allows the step and the pulse to compensate each other (see fig. 6.1) leaves his model without a physiological foundation. This criticism was advanced by Gårding (1970) who also proposed a revised model.

According to the revised model the pitch curve of a Swedish utterance is the combined result of responses to sentence intonation, stress and Accent 2. The generation of accents requires positive pulses only. To fit an actual

pitch curve these pulses should have appropriate amplitudes, onset times, and durations, and be exposed to a suitable smoothing procedure. Each pulse consists of a rise and a fall correlated to activation and relaxation of the main pitch raising muscles. (This does not exclude the existence of pitch lowering mechanisms.) Whether a syllable has rising or falling pitch depends on how it is timed relative to the pulse.

In terms of this model, a South Swedish Accent 2 should be explained as a pulse of long duration (or two pulses close together) whereas the Stockholm Accent 2 can be interpreted as consisting of two separate pulses.

One observation in Meyer's curves motivated further criticism of Öhman's model. As can be seen from Figure 3.1, there is a stable relation between the two accents in all the dialects which is independent of accent type. Whatever the shape of the pitch curve for Accent 1, the latter part of the corresponding Accent 2 is similar to it. This regularity was expressed as an informal recipe for the synthesis of grave accents (op.cit. p. 41): "Squeeze in the acute accent into the latter part of the grave word (Accent 2). Then extrapolate the curve to the earlier part of the word." The accuracy of the relation for the Stockholm dialect is demonstrated in Figure 6.2, taken from Alstermark and Eriksson (1971). The two curves are observed pitch curves for a trisyllabic Accent 1 nonsense word bababab with stress pattern 401 and a tetrasyllabic Accent 2 nonsense word babababab with stress pattern 3200 (4 is the highest degree of stress).[1] By timing the pulse and the step in an ad hoc manner Öhman's model fails to bring out this dialect independent relation between the accents.

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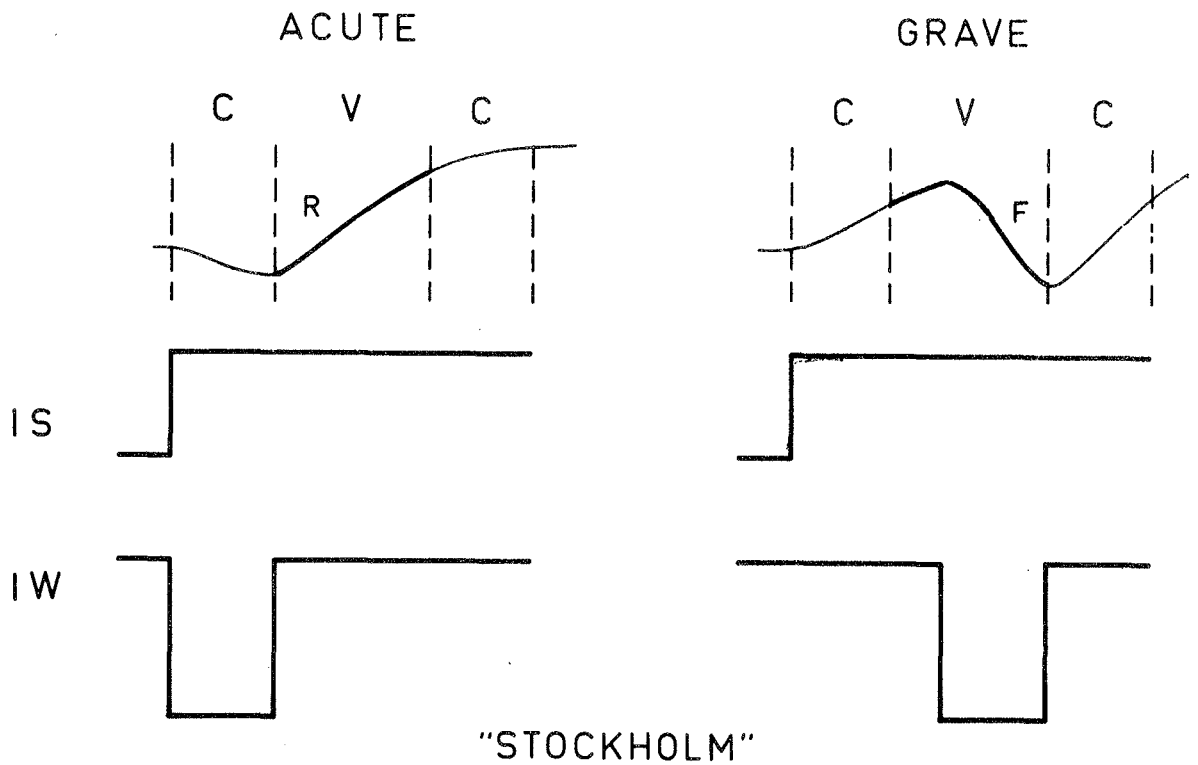
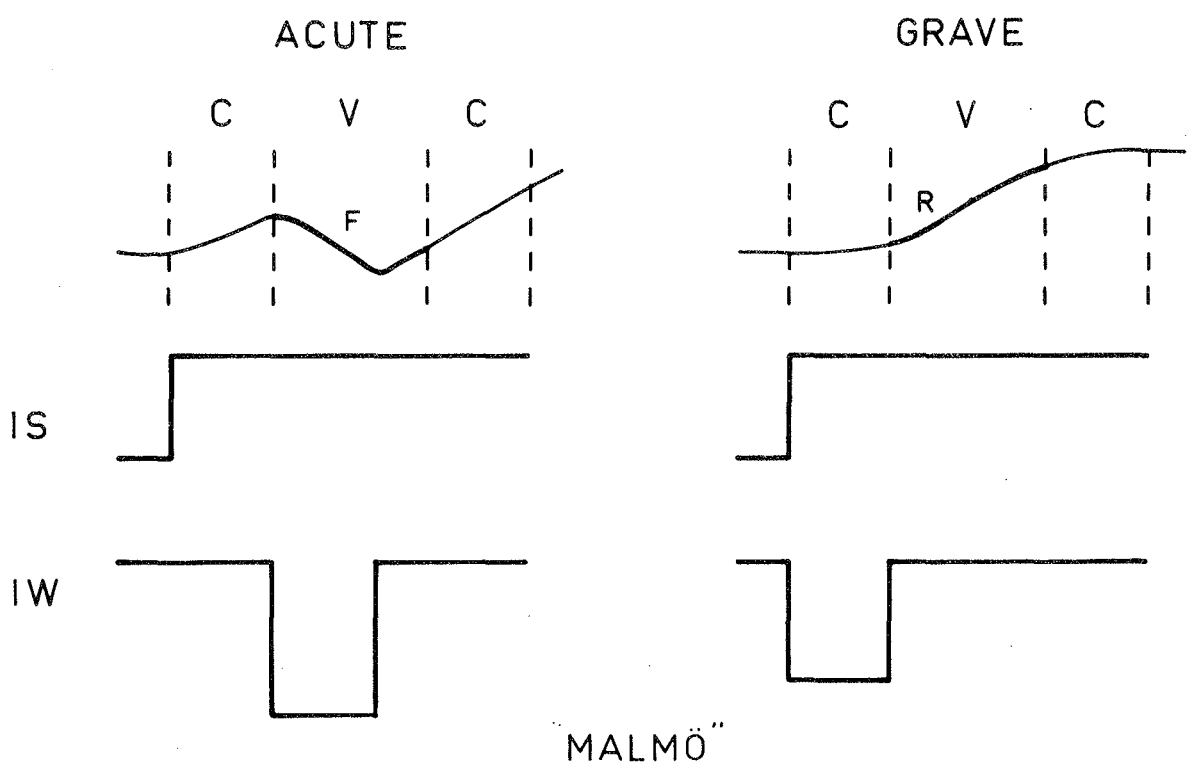
1. The authors follow the trancription system used in the Dictionary of the Swedish Academy according to which the accents represent different phonetic stress patterns; for instance, Accent 1: anden[4] and Accent 2: anden[3].

Figure 6.1. Input commands suitable for Stockholm and Malmö (South Swedish) accents. The pitch contour has been drawn with thick lines in the vowel segments. From Öhman 1967.





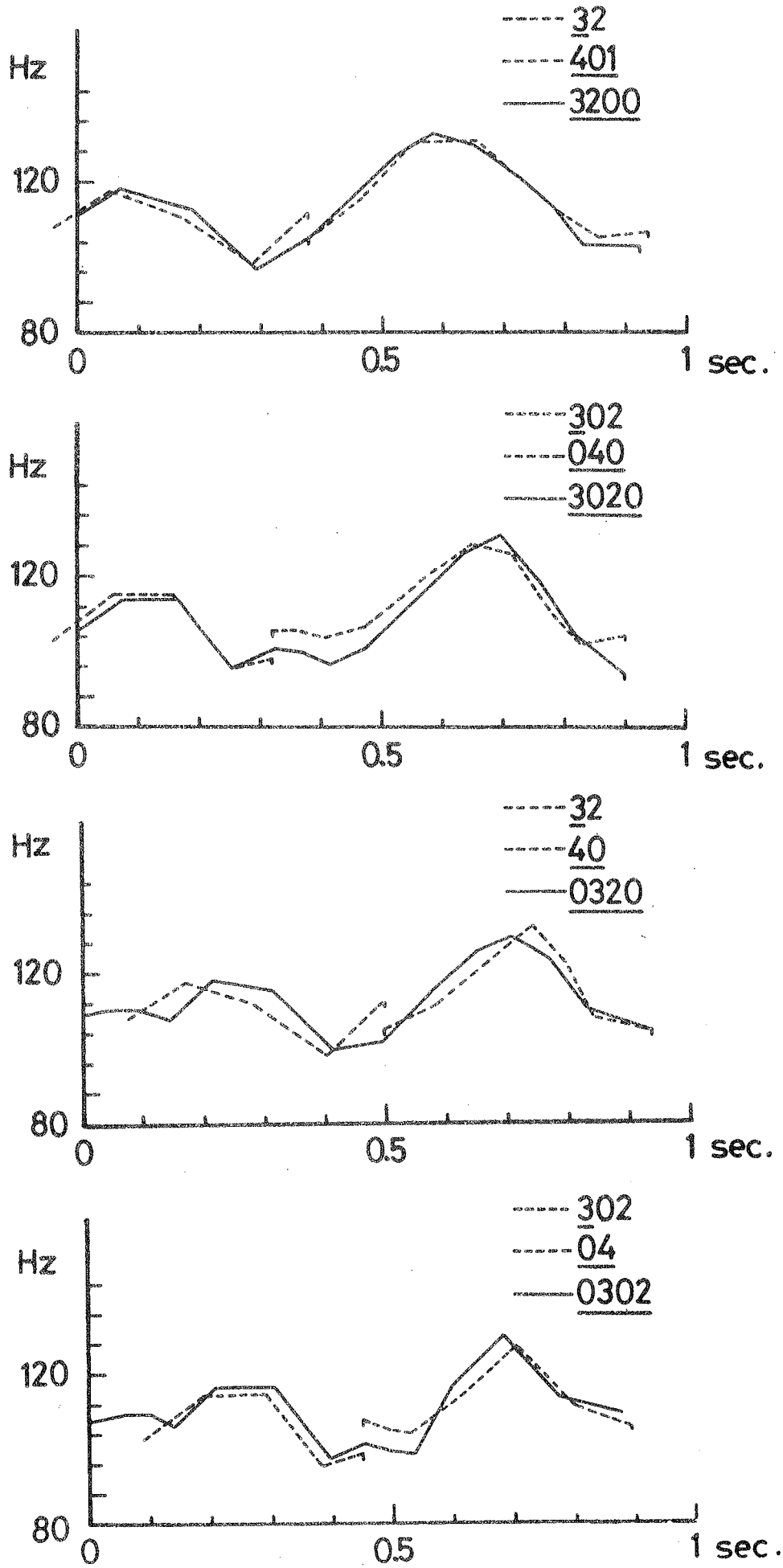


Figure 6.2. Synthesis of compound F_0 Accent 2 (32) patterns from pieces of Accent 1. Top graph: The first syllable of an Accent 2 compound combined with an Accent 1 trisyllabic to form a tetrasyllabic Accent 2, etc. From Alstermark and Erikson 1971.

A natural interpretation of the similarity in the two accents is that it represents the laryngeal response to sentence intonation which of course must be shared by both accents.

In order to test the revised model for accents in other types of sentence intonation, new material was collected (Gårding and Lindblad 1973). The dialects represented in Meyer's material had been divided into four types (Gårding 1970) and representatives of these dialects were selected for recordings. The speech material consisted of mono-, bi-, tri-, and tetra-syllabic words with contrastive accents in the polysyllables. The words were uttered as neutral and emphatic statements and as neutral and emphatic yes/no questions. Figures 6.3 and 6.6 are taken from this data collection.

The results show that the interdialectal relation between the two accents which holds for Meyer's material of neutral statements persists for other intonation and stress patterns as well. For a given intonation and stress pattern (prosody for short) the pitch curve of Accent 1 recurs towards the end of Accent 2. This relation is independent of dialect. Figure 6.7 shows examples of pitch curves derived from accents uttered as statements and questions. For each sequence and prosody utterances contrasted by accent have been superimposed with the end as a common time reference. The figure illustrates in addition that sentence intonation affects the entire pitch curve of words with Accent 1. Notice for instance in the Skåne dialect how the rise-fall of a/ statement turns into a fall-rise in a question. On the other hand, the pitch of the stressed syllable of words with Accent 2 is very stable. A shift of prosody has practically no effect here. It does change pitch over the remaining part of the word, however, and there the changes are similar to those occurring in the corresponding words with Accent 1. This is particularly striking in the double-peaked Accents 2. A question

gives the same pitch value to the second peak as to the single peak in Accent 1.

In view of these facts, Accent 1 may be regarded as the basic prosodic unit and Accent 2 as consisting of a stable precontour followed by a delayed and time compressed basic Accent 1.

A comparison of the curves for Accent 2 in different dialects shows that the shape of the precontour is dependent on the shape of Accent 1. With a dominant rise in the stressed syllable of Accent 1, as in Stockholm, the precontour of Accent 2 will be falling. With a predominant fall in Accent 1, as in Skåne, the precontour will be rising. The time compression needed for Accent 1 to fit the pitch curve of a corresponding Accent 2 may be dependent on dialect. The Stockholm Accent 1 apparently needs less shrinking than the Skåne Accent 1 (see preceding figures).

This amounts to saying that the precontour and hence all of Accent 2 in a particular dialect can be deduced from its sentence intonation. (The historical aspects of this observation will be treated in Section 7.) There are four kinds of statement intonation in the dialects studied: rising-level-falling for Stockholm, rising-falling for Gotland, rising for Västergötland and falling for Skåne.

Synthesis

Öhman's model for the accents had an actual synthesis program attached to it (Liljencrants 1971). In the report just mentioned, Alstermark and Eriksson synthesize the pitch contours of Accent 2 polysyllabic compounds by piecing together shorter units from suitable Accent 1 and Accent 2 curves.

Rules for generating pitch contours of either accent under various prosodies and in different dialects were sketched by Gårding and Lindblad (1973).

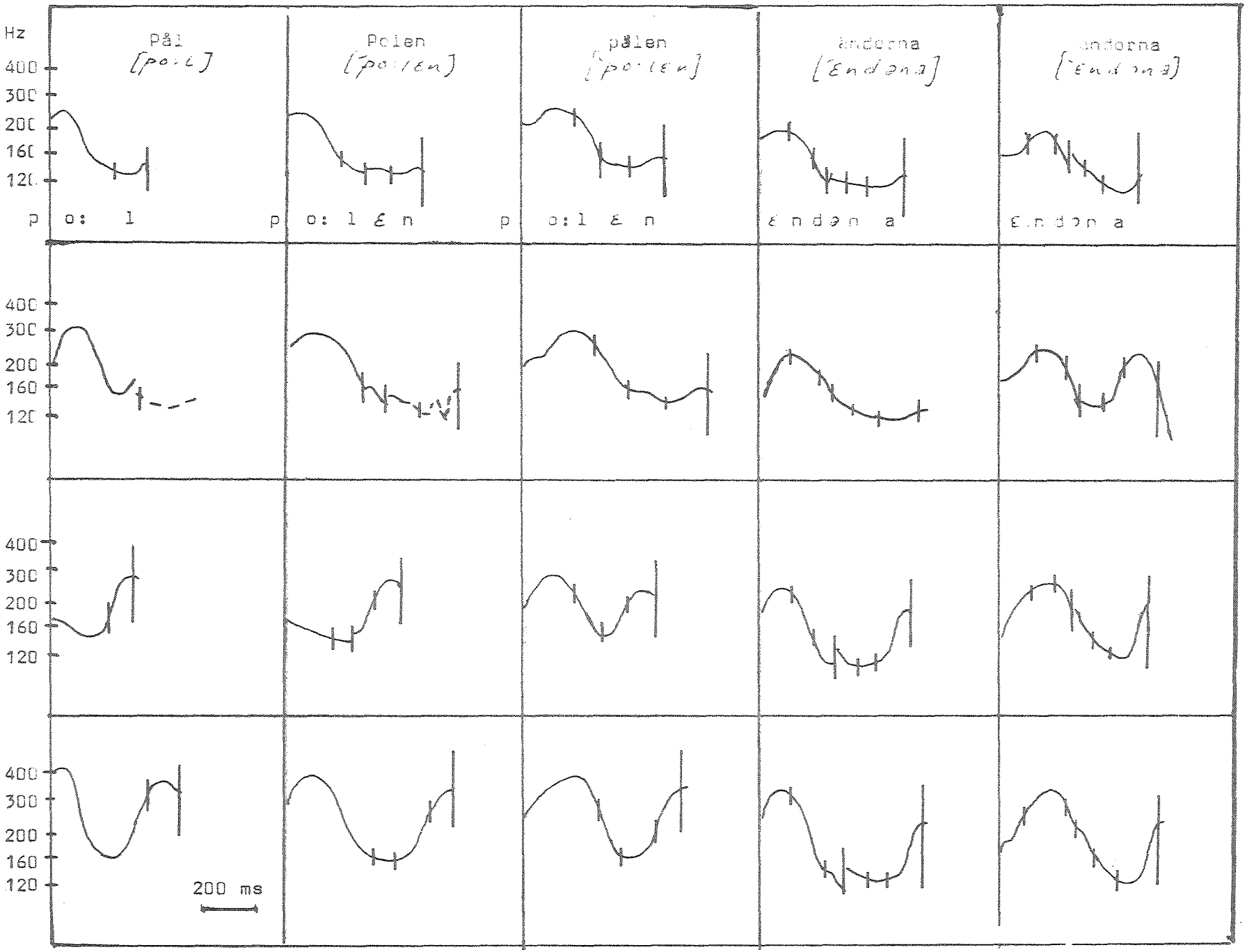


Figure 6.3. Accent 1 and Accent 2 under various prosodies. Type 1 A. From Gårding and Lindblad 1973.

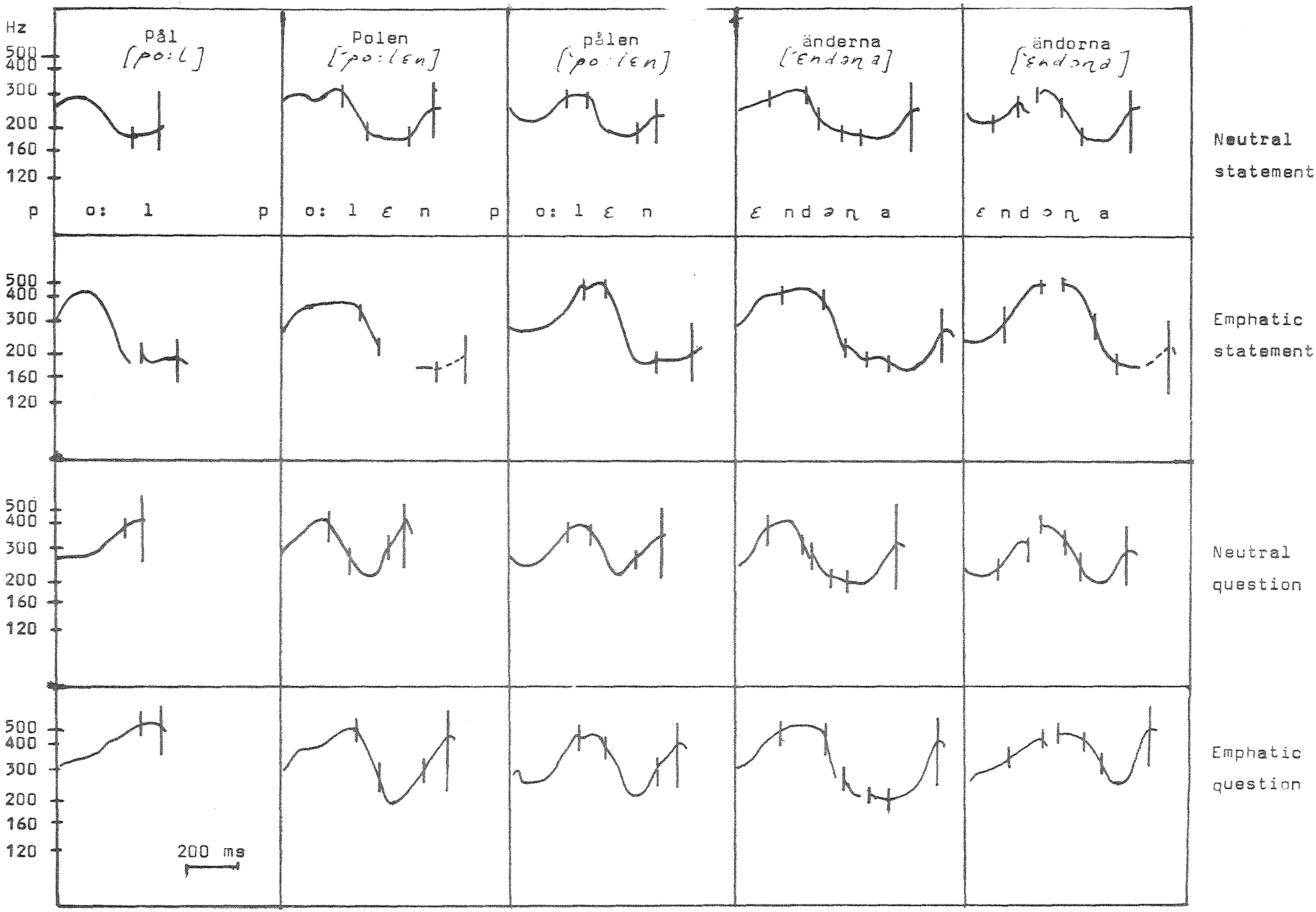


Figure 6.4. Accent 1 and Accent 2 under various prosodies. Type 1B. From Gårding and Lindblad 1973.

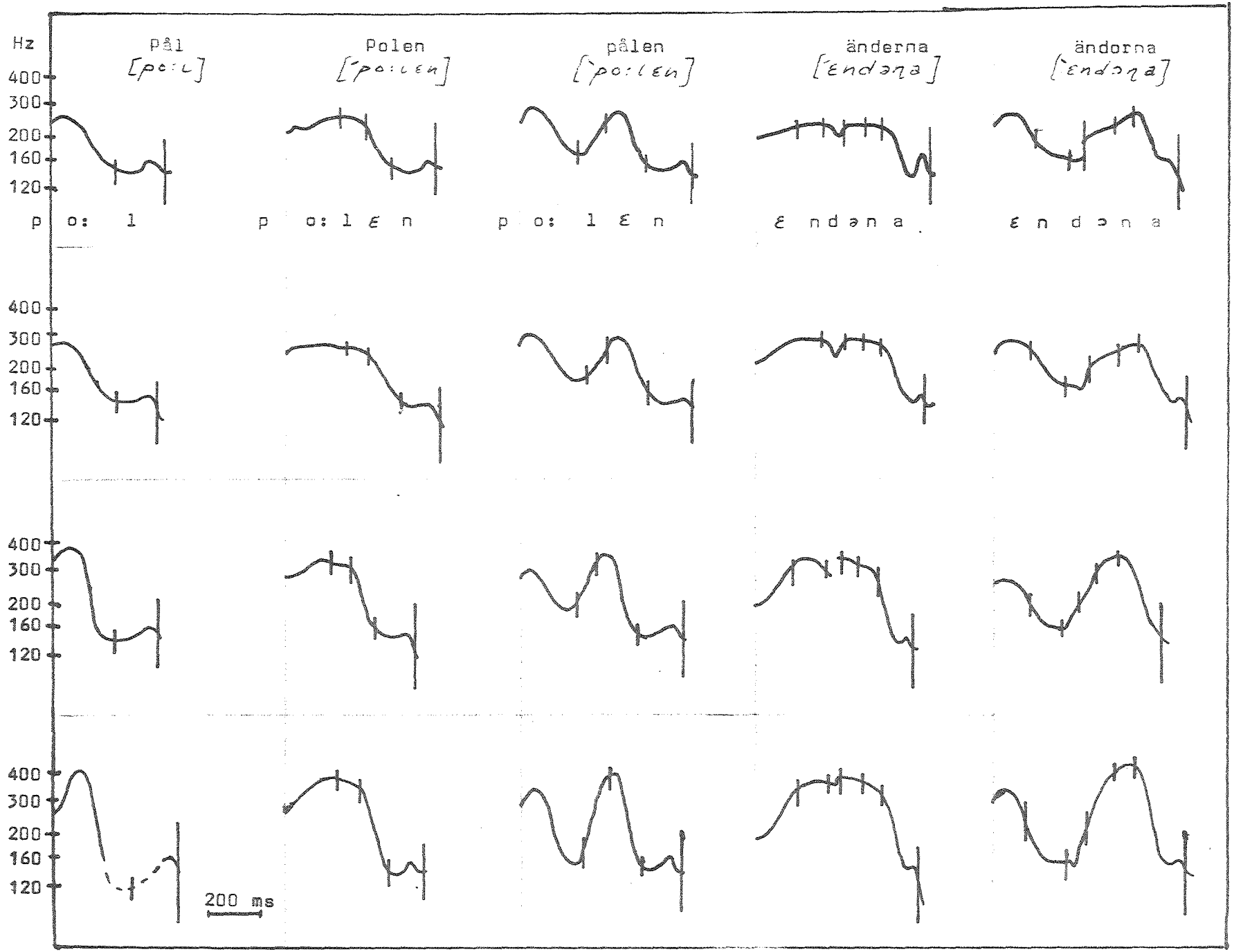


Figure 6.5. Accent 1 and Accent 2 under various prosodies. Type 2 A. From Gårding and Lindblad 1973.

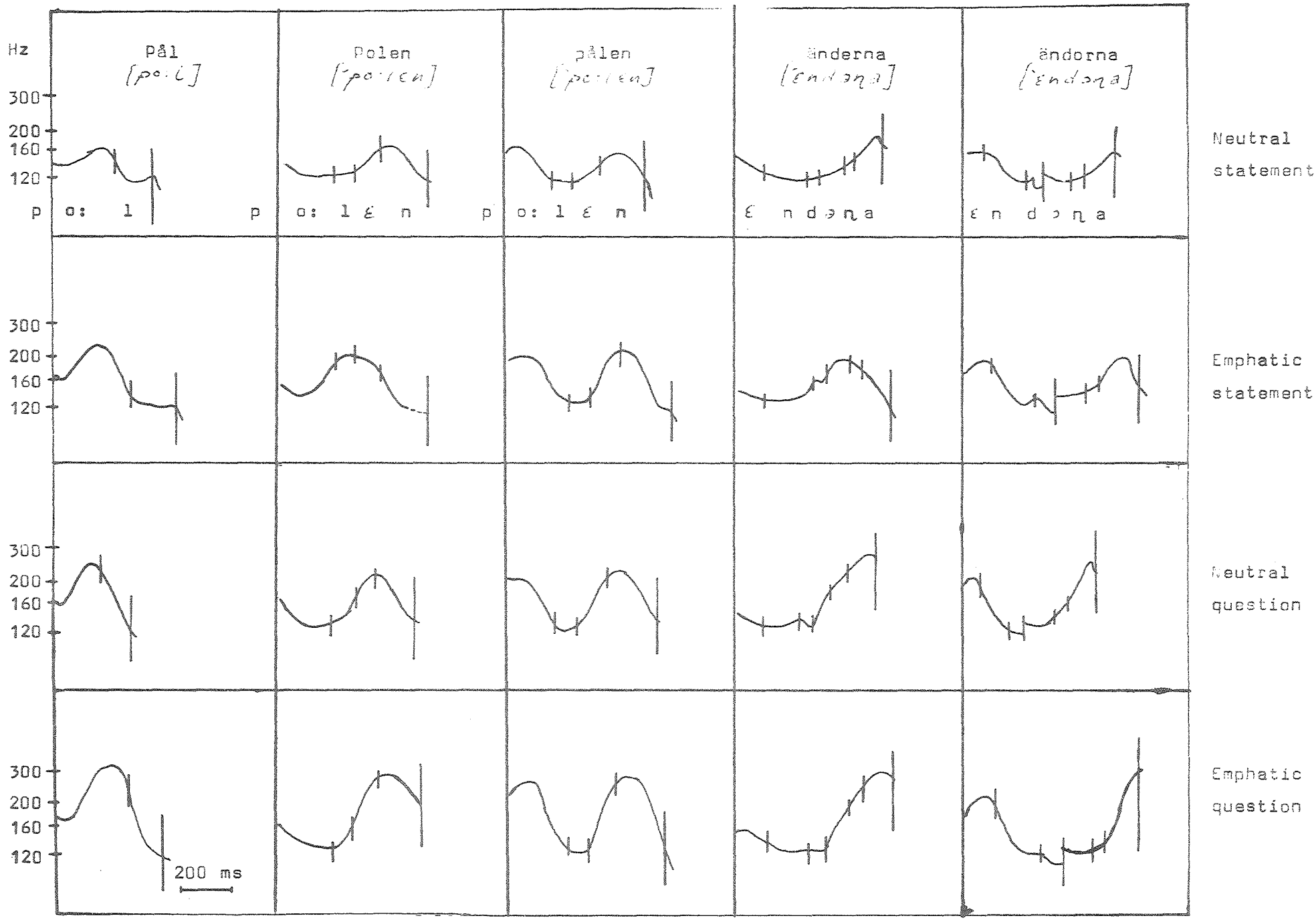


Figure 6.6. Accent 1 and Accent 2 under various prosodies. Type 2 C. From Gårding and Lindblad 1973.

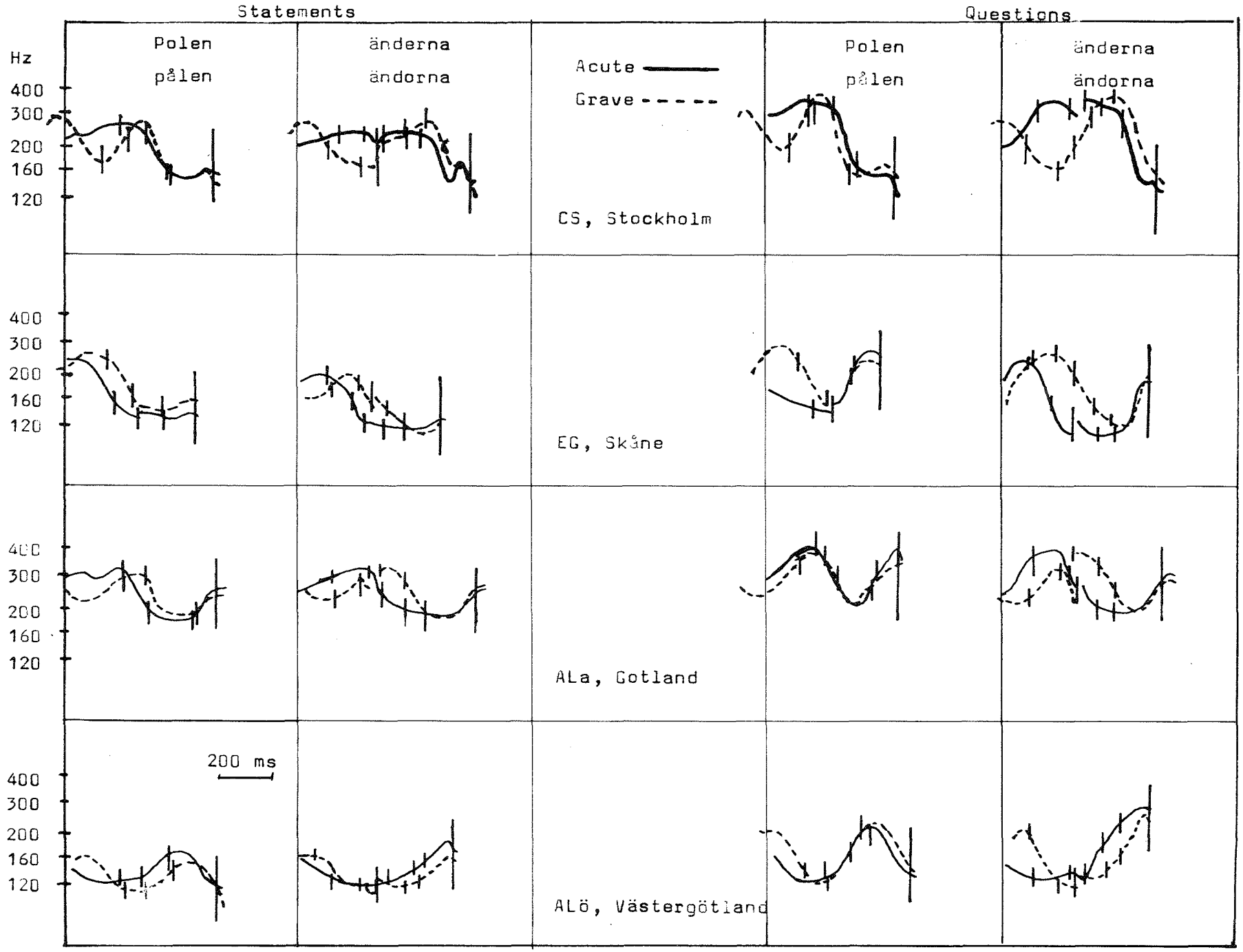


Figure 6.7. Accent 2 superimposed on Accent 1 in different dialects and prosodies. From Gårding and Lindblad 1973.

The input to these rules are phrases of one to four syllables with one primary stress. The specifications are syllabic shape, location and type of stress (emphasis or not), sentence intonation (question or not) and accent (Accent 2 or not). The rules make use of four relative pitch levels (low, neutral, mid, high) and prescribe the pitch movements for utterance final and stressed syllables. They specify where in the syllable the pitch turns (early, middle, late) and the range of the movement (from mid to low etc.).

For all dialects and prosodies the rules proceed in the following three stages:

1. Pitch of the utterance final syllable
2. Pitch of the stressed syllable
3. A join rule for the rest of the contour

The join rule makes the program applicable to phrases with any number of unstressed syllables. The input Accent 2 affects only Stage 2, i.e. the stressed syllable and indirectly the join rule.

The rules can also be formulated in such a way that the input Accent 2 generates a dialect dependent and intonation independent delay of the basic intonation unit generated without this input. The precontour is then taken care of by the join rule, with a neutral beginning.

7. ORIGIN AND DEVELOPMENT OF THE ACCENTS

What is the origin of the accents? When did the present distinction arise? Why did it occur in Norwegian, Swedish, and Danish and not in the other Nordic or Germanic languages? Various speculations about these questions can be found in the literature. Some recent contributions have been made by Oftedal (1952), Öhman (1968), and Katsnelson (1966).

In his comparative study of Germanic accentuation, Katsnelson (1968) brings together data on accents and phonology derived from descriptions of dialects in four different language areas, Norway and Sweden (treated together as North Scandinavian), Denmark, and the Rhine district of Germany. This comparison makes him connect Scandinavian and West Germanic accentuation, and trace their accentual systems back to Proto-Germanic. According to Katsnelson, Proto-Germanic long-syllable words, which were trimoric, could have four accents combining two features of tone and two of stress. The tonal features are one central peak located in the second mora, as opposed to two peripheral peaks in the first and third mora. Each of these two tonal contours could occur with one of two different intensity contours (called smooth and abrupt dynamic accents). The accents of modern languages and dialects are interpreted as simplifications of this original system. Some dialects, however, have retained traces of the full system (e.g. East Funen, Denmark). The development of the Germanic accents is closely tied up with changes in the rest of the sound system for which Katsnelson sometimes offers new interpretations (e.g. Verner's law). In Katsnelson's opinion accents originally served to differentiate morphemes and the rule according to which monosyllables have Accent 1 and polysyllables Accent 2 is of recent origin (after free apocope).

In one section of his dissertation (1967) Öhman discusses the development of the accents in terms of his intonation model. He starts out considering the possible effects on the pitch curve of syncopation, the suffixation of the definite article, and the leveling of the quantity system. These changes may have resulted in two different pitch contours for polysyllabic sequences. Öhman interprets the accents as a sharpening of this difference which could be achieved in different ways depending on the dialect. In terms of the earlier described model (Section 6), Öhman regards the dialectal variety of accent manifestations as variously timed negative pulses. His interpretation permits him to arrange the dialectal accent manifestations in a scheme called the Scandinavian Accent Orbit. This arrangement for which he used Meyer's data suggests a stepwise displacement of the negative accent pulses as one passes from one dialect to another.

In his article On the origin of the Scandinavian tone distinction, Oftedal reviewed the competing theories in the classical literature. After a systematic inspection of the present-day accent distribution in forms with a syncopated medial syllable, he sided with the view given in the standard handbooks: Accent 1 is the reflex of an *Accent 1 of forms that were monosyllabic in the post-syncopation period. Accent 2 is the reflex of an *Accent 2 characteristic of the polysyllables of the same period. Oftedal is mainly concerned with the genesis of the distinctive function of the accents and he reinforces the view that the accent distinction arose when the enclitic article lost status as a free morpheme (i.e. around 1200 A.D.). The postposition of the definite article resulted in pairs like Sw. and-inn>and-en 'the duck' and andi-nn>ande-n 'the spirit' with different accents. The same view was advanced by Haugen (1968). Before the suffixation of the definite article, Oftedal argues, the different accents were Grenzsignale 'boundary signals',

showing the boundaries of words with different syllabic structures.

I should like to add some observations that might strengthen Oftedal's hypothesis.

Members of pairs like and–inn and andi–nn are both nouns in the definite form and can appear in the same syntactic and prosodic context. An inspection of Elert's list of minimal pairs for Swedish Accents 1 and 2 (1972) shows that the majority of cases with grammatically similar members are precisely monosyllabic and bisyllabic nouns in the definite form. There are of course in addition numerous examples of rhyming bisyllables with different accents. Given the same syntactic and prosodic frame, the accent difference becomes manifest and the speakers of the language may have found it important to keep the definite form of the monosyllables prosodically distinct from that of the bisyllables. Note that the definite form of monosyllables and bisyllables in languages with a preposed article also gives two prosodic patterns, as for instance in English the duck (∪ –), and the spirit (∪ – ∪).

The fact that Icelandic and Faroese did not develop accents does not clash with this point of view. Since these languages retained the old case endings and the definite article was added to these, the different prosodic patterns did not acquire the same importance.

Haugen (1970) ascribes the absence of an accent distinction in some Nordic languages and dialects to contact with other languages. Early Icelanders for instance were in contact with speakers of Gaelic and English, the Swedes in Finland with speakers of Finnish and the Danes in the South with speakers of German. Except perhaps for Icelandic and Faroese (see above) this is certainly a reasonable explanation. As has been mentioned earlier the functional load of the accents is small. The accentless Swedish dialects spoken in Finland are as easily understood as the other dialects which have preserved the accents.

M. Bjerrum (1948 p. 9) reports that in the bilingual areas in the south of Denmark the tonal accents disappear quickly.

The phonetic analysis in Section 6 of Swedish accent manifestations in different prosodic patterns and dialects may now be put in a long historical perspective. It was observed there that the pitch contour of Accent 2 can be analysed as Accent 1, the basic prosodic unit, and a stable precontour. The shape of the precontour can be deduced from the basic unit. This interdependence probably has a historic significance. It indicates that Accent 2 in simple words may be the fundamental frequency remainder of an *Accent 2 applied to compounds or derivatives whose second member lost semantic and grammatical importance - and therefore stress.

Finally I should like to return to the opening example and Nicander's warning against rhymes with different accents. It has in fact often been disregarded. As an example I quote some artful rhyming by the Swedish poet Harriet Löwenhjelm:

O, I eunucker,
som blomstergårdarne i Stambul ansen!
Bak bärstolsluckor
en hög gesandt förs bort av ambulansen
Se, purpurfanan sänks på bambulansen.

The underlined words, ˊStambul 'Istanbul' + ˋansen 2d pl. of ansa 'weed', ambuˊlansen 'the ambulance', ˋbambuˊlansen 'the bamboo-lance', are three tetrasyllabic rhymes on the vowel sequence a - u - a - e. Their different prosodic patterns are perhaps part of the artistic effect.

SUMMARY

Introduction. There are contrastive accents, Accent 1 and Accent 2, in polysyllabic words with the same primary stress location in Danish, Swedish, and Norwegian. The accent is connected with the stressed syllable. It is not marked by the orthography.

1. History. Accent 1 is a reflex of *Accent 1, the accent of the monosyllables of Old Norse after syncopation. Accent 2 is a reflex of *Accent 2, the accent of the polysyllables.

2. Distribution in the vocabulary. In Old Norse the accents were determined by the number of syllables within word boundaries. Later - after 1200 - due to the suffixation of the definite article and the development of svarabhakti vowels in certain clusters - there were two new categories of bisyllables. These categories retained *Accent 1. The result was two accents for bisyllables. Reduction of stress and retention of pitch in the old bisyllables resulted in two tonal patterns for Norwegian and Swedish. Various morphological and lexical changes obscured the earlier simple relation between accents and grammar.

For Danish the difference between the accents was reinforced by the stød in Accent 1 words with stødbasis (cf. p. 19).

The following principles govern the assignment of accent in the modern Scandinavian languages. Words with stress on the last syllable (and hence all monosyllables) have Accent 1. (There is a small group of Danish monosyllables which lack the stød in spite of stødbasis.) Accent 1 can occur on any stressed syllable. Accent 2 frequently starts on the first. Bisyllabic native roots are stressed on the first syllable and have either Accent 1 or

Accent 2. Foreign polysyllabic roots can have stress on any syllable and either of the two accents(but not Accent 2 on the last).

A great number of unstressed, inflexional suffixes require a shift of accent from 1 to 2 in the resulting complex. The statistically highly important definite article and some other suffixes do not call for such a shift. If two or more stressed items are compounded in Swedish and Norwegian the resulting complex will receive Accent 2.

Generative rules have to cope with the problematic category of bisyllabic monomorphemic words which can have either of the two accents.

The accent rules are highly productive. New roots will be given one of the accents. When inflected, the roots are subject to the accent shifts required by the suffixes. In Norwegian and Swedish new compounds receive Accent 2.

3. Acoustic manifestations. The number and the position of the pitch peaks of the bisyllables in different dialects make it possible to set up a tentative accent typology. There are dialects on the outskirts of Scandinavia without any accent contrast. As for the dialects which have a contrast, there are four types in Sweden. Three of these recur in Norway and two in the few Danish dialects which are tonal. The predominant accent contrast in Danish is stød vs. no stød. The following is the interdialectal relation among the tonal accent types. If Accent 1 and Accent 2 have one peak each, the peak of Accent 1 comes earlier. If one of the accents has two peaks while the other has one, it is always Accent 2 that has two peaks. Durational differences and intensity differences which accompany the accents are mainly correlated to the existing pitch differences.

4. Perception. Fundamental frequency is an all important cue to the accent

in Norwegian and Swedish/
distinction/. Accents are recognized in low pass filtered speech and in speech in which the intensity peaks have been cut off. A small portion of the beginning of the pitch pattern is sufficient for a listener to recognise the accents of his own dialect. There is no tonal contour (high or low) which is interpretd as Accent 1 or Accent 2 by listeners of all dialects. The accents play a minor role in communication. Different accent manifestations do not hamper interdialectal understanding. Accent contrasts can be brought out in whispered speech.

5. Production. The stød is only rarely performed with a total glottal closure. It is still an open question whether the closure is an active laryngeal speech gesture or a reflexive response to a sudden change in the aerodynamic conditions at the glottis. A contraction of the aryepiglottic sphincter muscles is often found in connection with lowered pitch, as for Accent 2 in the Stockholm dialect. Similar behaviour is observed for the Jutland stød which is a concomitant feature of certain stop consonants. Coactivity in the vocalis and cricothyroid muscles is correlated to pitch peaks and decrease of activity in these muscles to pitch lows. The timing of the pitch peaks (dialect of Stockholm) seems to be related to the beginning of the vocalic segment.

6. Models for the interdependence of accents. When the pitch contours of the accents are studied in various prosodies (intonation and stress patterns) and dialects, it is observed that Accent 2 repeats the behaviour of Accent 1 in the latter part of its contour. The pitch of the stressed syllable of Accent 2 words is unperturbed by the prosody. Accent 1 may be regarded as the basic prosodic unit and Accent 2 as composed of a stable precontour and a delayed and time compressed Accent 1. Different dialects have different

manifestations of sentence intonation. Some of them have rising and others falling statement intonation. The Accent 2 precontour depends on the dialect but may be deduced from its sentence intonation. A precontour is falling before rising sentence intonation and vice versa.

7. Development of accents. The distinctive function of the accents probably arose as a consequence of the suffixation of the definite article. The absence of an accent contrast in the outer area of Scandinavia may be due to bilingualism.

For Icelandic and Faroese another explanation is possible. Here the retention of the old case endings, to which the definite suffix was added, made the different accentuations in the definite form of nouns statistically less important.

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Abbreviations:

ANF =	Arkiv för nordisk filologi
Arch. Néerl. Phon. Exp. =	Archives Néerlandaises de Phonétique Experimentale
ARIPUC =	Annual Report of the Institute of Phonetics, University of Copenhagen
SLSF =	Svenska Litteratursällskapet i Finland
STL-QPSR =	Speech Transmission Laboratory Quarterly Progress and Status Report
Sv.lm. =	Svenska landsmål och svenskt folkliv, or, before 1904, Bidrag till kännedom om de svenska landsmålen och svenskt folkliv
Trans. Philol. Soc. =	Transactions of the Philological Society
Z. Phonetik =	Qeitschrift für Phonetik und allgemeine Sprachwissenschaft