Intonation in Swedish

Eva Gårding

1. BACKGROUND

Swedish, together with Danish, Norwegian, Icelandic and Faroese, belongs to the Nordic group of Germanic languages. It is spoken by 8 million people in Sweden and about 300,000 people in Finland.

Within this group the Scandinavian languages, Swedish (except Finland Swedish), Danish and Norwegian, are prosodically famous for having two distinctive patterns connected with stressed syllables: in Swedish Accent 1 (acute) and Accent 2 (grave), in Norwegian Toneme 1 and Toneme 2 and in Danish *stød* and non-*stød*. Historically the two patterns are linked with Old Norse words of different syllabic structure.

The immediate phonological factors determining Swedish intonation are word level accents and accentual and tonal features at the phrase and sentence level. These in turn are conditioned by syntax and pragmatics.

Intonation will be used as a general term for the fundamental frequency pattern of a stretch of speech. Defined in this way intonation covaries with a rhythmic pattern formed by the sequence of accented and unaccented syllables. The main points of coordination between intonation and segments are the accented syllables and the boundaries.

2. DESCRIPTION OF INTONATION PATTERNS

In my description of Swedish intonation patterns the presentation is divided into sections dealing with intonation at the word level (2.1), the phrase and sentence level (2.2) and the text level (2.3 and 2.4). Within sections the communicative functions of intonation serve as an ordering principle. These are the lexical-distinctive function, the grouping function with both demarcative and connective features, and the weighting, modal and expressive functions. Section 3 deals with dialectal variation. Behind my analysis is an

intonation model which can be applied to analysis as well as synthesis. It will be summed up in the final section (4).

2.1 Word level: Stress and accent. Rules and basic patterns

Stress and accent

Since every syllable with primary stress carries one of the two accents, the term stress is not necessary. I will use the term 'accent' for primary stress (A1, A2) and reduced accent for the secondary stress of compounds and derivatives which does not permit any accent contrast.

As in other Germanic languages, accent is used to express semantic weight and demarcation. Thus, as a general rule, root morphemes, the main carriers of information, are accented, whereas affixes are not. The accented syllable of the first root morpheme is primary and marks the beginning of the construction, e.g. `svensk-ar-na` 'the Swedes'. Reduced accent appears in compounds and derivatives in the accented syllable of the last lexical morpheme (roots and a handful of affixes) e.g. `smör-gås-,bordet` 'the smorgasbord'. The rest of the syllables have lower levels[1]. In contrast to German, a different location of a constituent boundary in such low-level syllables has no effect on the accent pattern. A pair of compounds like *(små)(landsvägar)* 'miniroads' and *(Smålands)(vägar)* 'Småland roads' is ambiguous in pronunciation (Elert 1981 p. 47).

In lexicalized phrases the accented syllable of the last lexical morpheme is primary and marks the end of the construction. One of the preceding syllables may now be the carrier of reduced accent, whereas other syllables have lower levels, e.g. *ett ,håll-i-´gång* 'a going on'. Low-level accents become for all categories of constructions a connective signal.

An accent pattern may also be influenced by rhythm, as is evidenced by polysyllabic loans which do not lend themselves to morphemic subdivision. Here the first heavy syllable is primary and the other syllables appear in rhythmic alternation between lower levels, e.g. *en ,ma-ri´mek-ko* 'a dress from Marimekko'.

The majority of Swedish words are accented on the first syllable. However, there is a considerable number of polysyllables accented on a non-initial syllable. French loans, particularly of recent origin, are oxytones. Only a few pairs of words are distinguished by accent location.

Accented syllables, including those with reduced accent, are heavy. This means that they have either a long vowel or a short vowel followed by consonant(s). Low-level accents may be light or heavy (see below under levels

of accentuation). In a sequence of such syllables, the principle of open syllabicity is adhered to.

The two accents

The two accents Accent 1 (A1, acute) and Accent 2 (A2, grave) are assigned to words according to the rules given below.

Phonological rules

A1 can occur in any accented syllable regardless of position. A2 never occurs in the last syllable of a word. From this it follows that only polysyllabic words can have an accent contrast.

Morphological rules

Monosyllabic roots and polysyllabic roots accented on the last syllable have A1. Bisyllabic roots have either of the two accents. A2 is the basic pattern for compounds. Most inflectional and derivational suffixes are unaccented and require A2 from the preceding root. Hence an A1 root will change to A2 when part of such a form. The definite-article suffix for nouns does not bring about any accent change.

The syllable is the natural domain for the assignment of accents. For the total effect of the accentual manifestation, however, also neighbouring syllables are involved (see below and Figure 1).

There are only about 350 pairs with distinctive accent patterns (Elert 1981). It follows from the predictability of the accents that they are not important in communication. The speakers of Swedish in Finland communicate easily without distinctive accents and a great number of immigrants in Sweden speak Swedish fluently without following the accent rules. The correct location of accent is by far more important for word recognition than the correct type of accent (Bannert 1986).

For a native listener the accent pattern gives information about the phonological and morphological structure of the word, at least when it is pronounced in a familiar dialect. Exposed to a sequence like *´tanken* 'the tank' or `tanken` 'the thought', a native listener can refer it to a monosyllabic or disyllabic stem guided by the accent pattern. In fact, only a small fraction of

the first syllable is needed for correct identification (Johansson 1970; for Norwegian, Jensen 1961).

The accent rules are highly productive. Speakers easily integrate new words into the language, compound them and inflect them by means of the old suffixes and their concomitant accent rules.

The present accent rules reflect the situation in Proto-Scandinavian when the accents were not distinctive and when cognates of words with A1 were monosyllabic and cognates of words with A2 were polysyllabic. At a later stage, in the 12th or 13th century, when the influence of Low German was at its peak, changes in word structure and reduction of stress in certain suffixes resulted in two pitch patterns for polysyllabic words. This development has been summed up by Haugen as follows (for 'tone' read A2): "In the basic native pattern 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/² and the intrusion of loan words, it would still be (as it was in Proto-Scandinavian) an automatic accompaniment of polysyllabicity." (Haugen 1967:201. For the origin of the accents see also Oftedal 1952. A summary is given in Gårding 1977, Chapter 7. The origin of the *stød* is treated by Fischer-Jørgensen 1989, Chapter 1.)

Representation
Almost every Swedish linguist or phonetician has been concerned with the accents and their place in the phonological system of Swedish[3].

Malmberg suggested the representation 'high' and 'low' for the two accents, since the distinguishing factor in experiments with synthetic speech had turned out to be pitch, and since one accent was physically high when the other one was low at a critical point in the accented syllable (Malmberg 1967).

Elert emphasized the connective function of the accents and compared the following now famous examples (1970:45):

(1) en ˋstormans ´dräkt   'the costume of a magnate'
(2) en ´stor ˋmansdräkt   'a large costume for men'
(3) en ˋstormansdräkt   'a costume of a magnate'
(4) en ´stor ´mans ´dräkt   'the costume of a big man'

In all these examples, Accent 2 shows that at least one syllable more than the stressed one belongs to the same word.

In his dissertation *Swedish word accents in sentence perspective,* Bruce analysed the representation of the Stockholm Swedish accents as combinations of 'high' and 'low', HL, phonetically a fall with a different timing depending on the accent (Bruce 1977, 1983). A similar analysis was later applied to all dialectal categories (Bruce & Gårding 1978).

Comparisons with accentual phenomena in other dialects and langauges led us to believe, however, that a phonological representation ought to reflect what happens in the accented syllable. A small time shift of a fall-rise pitch movement starting in the preaccented syllable may shift the rise away from the accented syllable, replacing it by a fall, also in perception. From a perceptual point of view, then, the accents ought to have different representations in the dialects (Gårding & Bruce 1981:38).

The association of 'highs' and 'lows' with a particular syllable is similar to the autosegmental approach advocated by Goldsmith 1979. Following his method of analysis, the accented syllable of a southern dialect would be connected with HL for A1 and H for A2 followed by L for the postaccented syllable. In other dialects there would be more complications. For analyses along these lines of Norwegian accents, see Endresen 1983. The feature 'delayed peak' for accentual timing differences is discussed by Ladd 1983. For recent experiments with a shift of accent peaks for German see Kohler 1987.

Manifestation. Basic patterns
Differences in fundamental frequency, intensity and duration have been shown to accompany the two accents. Figure 1a is an example in which the accents have been pronounced in declarative intonation by one speaker from the south. To arrive at the accentual manifestation, let us first discount the features in the record which are caused by the articulation (for a comprehensive treatment of such phenomena see Di Cristo 1985). The gap produced by the voiceless consonants will be filled in since the pitch control proper is not essentially disturbed by the glottis opening for voiceless consonants (Sonesson 1968, Löfqvist et al. 1984). The steep fall caused by the glottis beginning to open for the following voiceless consonant *k* will be ignored. With these modifications, the accented syllables appear as similar humps added to a global slower movement, which is the manifestation of sentence intonation. Physiologically an accentual hump corresponds to a brief period of tension and relaxation in the pitch controlling muscles, in particular the cricothyroid (Gårding et al. 1970, 1975).
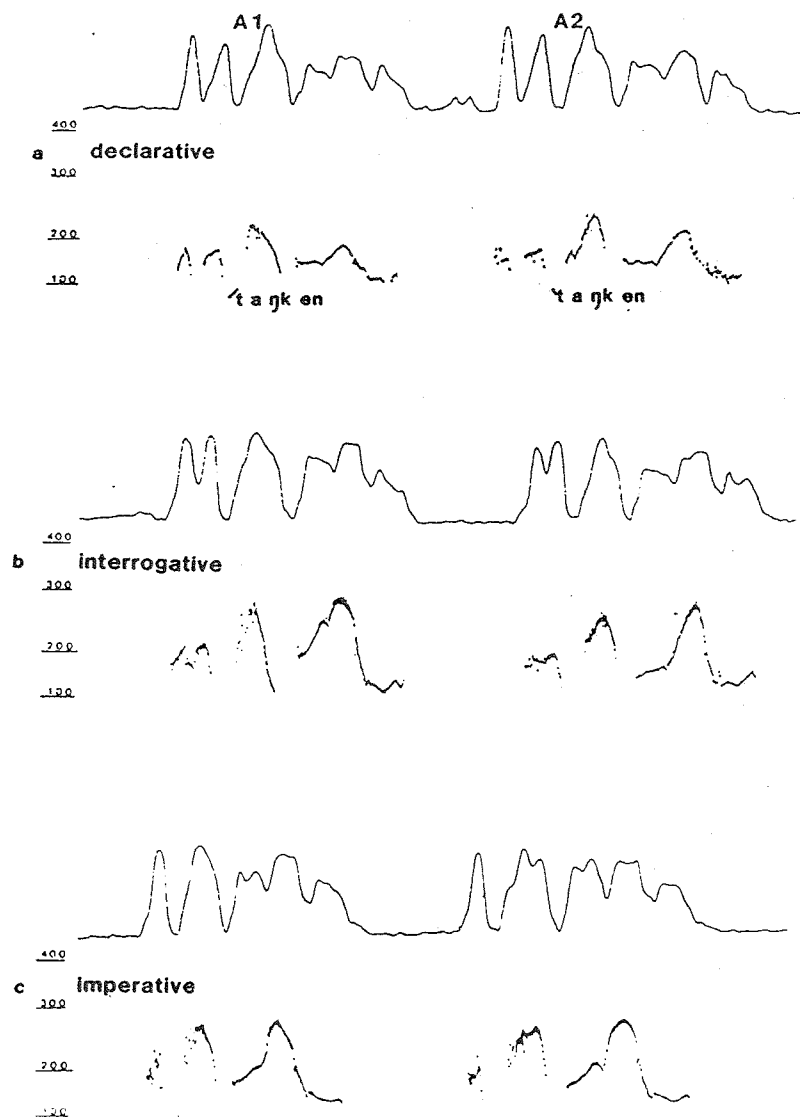
Figure 1. Lexical and modal function. Three sentences: (a) *Att ha tanken* (A1, A2) *redo* (A2) 'to have the tank (thought) ready' (b) *Har...* 'have you' (c) *Ha* ..'have'. Intonation and intensity curves according to mingograms. Southern dialect.

For A1 the hump is timed in such a way that there is a fall over the vocalic segment. For A2, on the other hand, the timing has produced a rise. The intensity envelope does not look very different for the two accents, but a close inspection will show that the intensity peak follows the early F_0 peak of A1 but precedes the late one of A2. This seems to be a regular phenomenon. The accents can often be identified in the acoustic record by the intensity curve. Like tones they can be recognized in whisper (Hadding-Koch 1961, Segerbäck 1966).

However, pitch is the most important perceptual cue to the accents, as was shown by Malmberg in a series of experiments with synthetic speech. His results showed that the location of the fundamental frequency peak is a primary cue to the identification of accents in the dialect exemplified in Figure 1 (Malmberg 1967).

2.2. Phrase and sentence level: Weighting, grouping, modality, expressivity

For accentuation at the phrase and sentence level the term focus occurs in the literature together with phrase and sentence accent. I shall make the following distinction. The term 'focalisation' will be used for the accentuation giving weight to a special part of the utterance and relating it to the message as a whole. It will therefore be treated in the following section (3). The terms 'sentence' and 'phrase accent' will be used when the accentuation is demarcative (nuclear stress) and has a grouping function.

Weighting
We have seen how accentuation is used at the word level to give special weight to a certain part of the word (root morphemes) and for demarcation. Similar phenomena occur at the phrase and sentence level. Words which are main carriers of information, i.e. content words (nouns, main verbs, adjectives etc.) are accented, while words which connect and relate them to each other, function words (prepositions, conjuctions etc.) are unaccented.

It is usually assumed that four levels of accentuation may be used in a phrase. These levels can be analysed as in the matrix of Table 1 below.

A syllable is considered to be heavy (+) when it contains a long vowel or a short vowel followed by consonant(s). Otherwise it is light (-). A pitch movement over an accented syllable is (+) if it is large enough to carry an accent contrast. Otherwise it is (-). The movement is expanded (+) when it dominates a large pitch movement of the same phrase. The abbreviations FA, SA, PA, WA, A, -A stand for focal accent, sentence accent, phrase accent,

Table 1. Levels of accentuation

level	syllabic weight	pitch movement	expansion	functional carrier
1	+	+	+	FA,SA,PA
2	+	+	-	FA,SA,PA,WA
3	+	-		A
4	-	-		-A

word accent, reduced accent (deaccentuation) and no accent respectively. All accents of levels 1 and 2 are either A1 or A2.

We notice that there is no unique correspondence between the functional carrier and the level of accentuation. An accent in a monosyllabic utterance normally receives level 2 while a higher level under the same circumstances creates an impression of contrast or emphasis. On the other hand, if the phrase accent occurs in an utterance with more than one accent, it receives level 1 in order to stand out. The same situation reoccurs in a sentence with many phrases. Here the sentence accent (or focal accent) may receive a level higher than 1 or else level 1 while the remaining accents are subdued to a lower level. Behind the assignment of accentuation level in a particular syllable there is, apart from the phonological, syntactic and pragmatic factors, a principle of economy relative to the message.

Grouping

As a general rule, a demarcative accent is assigned to the last accented syllable of a phrase or sentence when no other place is marked for focus. Focal and demarcative accent may coexist in this syllable, but in any other place the focal function overrules the demarcative one.

The assignment of a demarcative accent to the last accented syllable of the phrase is often combined with a weakening of preceding accents. There is also a rhythmical rule at this level, comparable to the one demonstrated at the lexical level, which works against the encounter of two main accents (Bruce 1984).

Manifestation of grouping. Figure 2 illustrates groups of numbers produced by speakers representing two different dialects. The goal of the corresponding experiment was to force speakers to peform groupings by
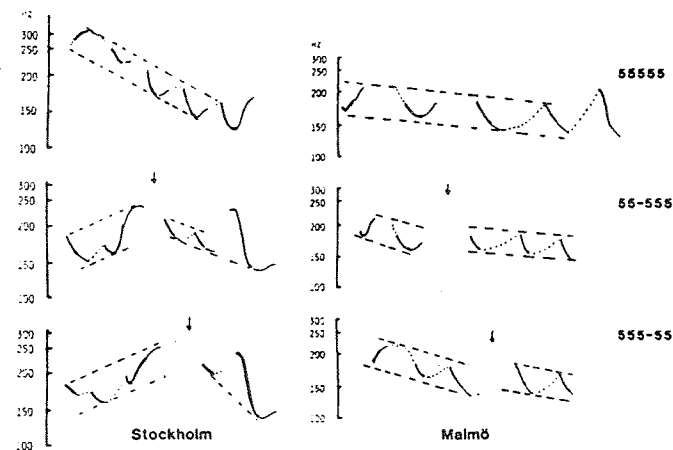
Figure 2. The grouping function. Groupings of *fem* 'five' in two dialects. Broken lines denote grids, arrows denote pivots. *From Gårding & House 1987.*

means of intonation only, without any influence of syntax and semantics. The numbers, here a sequence of the number *fem* 'five', were uttered as an ungrouped series or as groups of 2+3 and 3+2, all in declarative intonation. The speakers were asked to think of the series as a telephone number, to give equal weight to the numbers and to avoid pauses.

One conclusion we can draw from this investigation is that speakers use both dialect-dependent and dialect-independent features apart from universal ones. The dialectal difference in accent manifestation is responsible for the most conspicuous part of the variation.

The devices used for grouping will be summed up below. Most of them apply to other languages as well.

> *Demarcative features:* Pauses, pause-like gaps, large-range pitch movements in terminal syllables (accented or unaccented), changes of direction and/or range of intonation.

The term 'pivot' is used to cover the demarcative features.

Connective features: Reduction of accents with concomitant reduction of pitch movements so as to create special patterns. Similarity of elements of a group.

Perceptual tests with equidistant synthetic stimuli of the same duration have shown that all the intonational features mentioned above are efficient markers of groups (Gårding & House 1986; for continued work along this line, see House 1990). The results also indicate that linguistic rules apart from auditory processes influence the grouping decisions. Swedish listeners, for instance, interpreted large-range pitch movements as group-final markers in accordance with the final demarcative accent rule. Another result of our investigation was that we could define a prosodic phrase as a stretch of speech surrounded by pivots.

In analysis of natural speech, one has to distinguish between precise boundaries and boundary regions. Precise boundaries are possible to detect in the acoustic record only when two accented syllables meet with an internal juncture between them (Gårding 1967a, Ch. 9; for English, see Lehiste 1960). In other cases we have the same situation as in compounds; namely, that precise boundaries are replaced by boundary zones consisting of low-accented syllables, some of which may be enclitic and others proclitic. I shall give one example. In the two sentences *(Anders)(tankar på gården)* 'Anders gets gas in the yard' and *(Anders tankar på gården)* 'Anders's thoughts of the yard' with main accents on *Anders* and *gården,* the different syntactic structure is often left unmarked by prosody, which, if there is no support from the context, results in ambiguity. In such cases the intonation forms a bridge over the boundary zone between the two accented syllables which is constructed according to a principle of economy: the shortest way. The implication is that a precise boundary cannot be detected by acoustic criteria. What listeners do, then, if they are asked to segment into phrases, is to let syntactic and semantic criteria be their guide (Gårding 1967b,53 ff.).

The stretch of speech between one accented syllable and the next in connected speech is an important unit in most analyses of intonation and rhythm. It has been given various terms: stress group (Thorsen 1978), foot (Fretheim & Nilsen 1988), speech tact (Strangert 1985), accent domain (Gårding & Lindblad 1988).

Patterns of accentuation and their intonation are important cues in speech recognition, as has been shown by Lindblom & Svensson 1973, Svensson 1974, and Risberg 1974. Risberg studied the combined effect of intonation and lip-reading on hard-of-hearing listeners. The result was improved understanding.

Automatic recognition of prosodic features is the object of a joint Lund-Stockholm project (House et al. 1988).

Modality
The preceding parts of section 2 have shown how intonation is used to group words into phrases. In the remaining parts we will consider how intonation turns such phrases into speech acts, conveying the speaker's attitude, emotion and selected center of the message (focus, see next section). In such acts there are contributions also from lexicon and syntax. However, the modal and expressive signals of intonation are so strong that they tend to override other cues.

The modal function will be studied in three categories: the declarative, interrogative and imperative modes. Their effect on intonation is shown in Figure 1. For the illustrations, short utterances without focus have been used.

Declarative mode. Figure 1 illustrates how the accent pattern can be seen as added to a slower movement, in this case a falling baseline expressing declarative mode. Also the topline, defined as a line connecting the peaks of the accents, is falling. The slope of the declination is dependent on the length of the sentence. The declination has a physiological background but at the same time a communicative value. If the falling line is levelled out, the intonation seems to reflect an uncertain attitude.

Interrogative mode is most often expressed by word order with the finite verb preceding the subject or by lexical means, and one of these arrangements is enough to make the sentence function as a question. Intonation is also sufficient to convey the interrogative mode in an otherwise declarative sentence. This way of asking questions is not unusual in Swedish. It is found in casual questions for which the answer is expected, e.g. *Du har inte sett Kalle?* 'You haven't seen Kalle?'. An added speech-act adverbial *händelsevis* 'by any chance' would bring out the casualness of this speech act even more clearly.

An investigation of syntactically marked and unmarked questions shows that for question intonation the topline is raised and the total range of the curve is widened by focus (Gårding 1979). The widening is timed differently in relation to the intonation curve, depending on the rules that govern the manifestation of sentence accent in the particular dialect. As in the analysis of

statements, the modal intonation could be separated from the word accents for which the manifestation rules remain unchanged. Acoustically a question can be signalled by a bundle of features, global as well as local, a shifting up of the whole pattern combined with an optional terminal rise (Bredvad-Jensen 1984).

The presence or absence of focus splits up interrogative intonation into two basic rising types with different semantic connotations. With focus, the rise starts from the focussed word and continues to the end. The slope of the rise is determined by the length of the part following after focus. This is the ordinary pattern of a yes-no question and is used when the speaker expects the interlocutor to ponder the answer.

The other pattern occurs in focus-free questions and is characterized by a continuous rise. It is used in questions when the speaker expects a quick answer (e.g. echo-questions). Figure 1b is a case in point. The rise is most clearly expressed by the topline of the accent humps in combination with the unaccented syllables.

Imperative mode. Like the other categories, the imperative mode can be expressed by lexical, syntactic and intonational means. Figure 1c illustrates the imperative mode expressed by intonation.

It is clear from the figure that the interrogative and imperative modes are distinguished from the declarative one by the overall direction of the curve, noticeable mainly in the topline and in the unaccented syllables. Only with added voice-quality and intensity features is a Swedish imperative clearly distinct from a question.

An overall impression of Figure 1 is that the modes deform the accentual patterns in characteristic ways and that in this process the turning points of the accents remain fixed to the segments according to certain rules.

Expressivity

Intonation gives the speaker the possibility of expressing emotion and attitude. Such effects can be achieved by using an intonation pattern or a voice quality which deviates from a neutral standard. The terms 'emphatic' or 'contrastive' are often used in connection with such patterns.

Some examples of expressive function are given in Figure 3 where a four-digit number, *2510*, is the carrier sentence. The intonations have expressed reactions labelled neutral, angry and happy, to different situations. The neutral case has a falling statement intonation with a small range. The angry

intonation is almost level and has a much larger range up to the end. In the happy expression a large range is given only to the beginning, actually to the part corresponding to 'two thousand'. Experiments have shown that the emotional attitudes are not well-established and that an angry reaction cannot be distinguished from a happy one by means of intonation alone. Voice quality features are needed (Gårding & House 1986).

To conclude this section let me underline some important observations connected with the examples of Figure 3. As for modality, the neutral case can be regarded as the pitch part of a basic accentuation pattern which is deformed in various ways by the sentence intonation. In spite of these deformations, however, the highs and the lows of the accents, the turning points, are similarly located in the vocalic segments in all cases. These observations, the fixed positions of the turning points and the deformations of the accentual pattern due to sentence intonation, are two of the cornerstones of the intonation model to which I will come back in section 4.

2.3 Sentence and text level: Focalisation

Focalisation is used to give weight to the most important parts of a message. It makes these parts stand out above the rest and connects them by a similarity of their accentuation levels. The essence of a text is shown by its focussed parts.

Special weight can be given to a part of an utterance by using lexical, syntactic and intonational means. When syntactic and lexical means are used, there is no need for a special accentuation. However, a focal accent can highlight any part of the sentence without the assistance of syntax or lexicon. The effect is enhanced when this accent is combined with reduced and compressed patterns of the surrounding accents. It should be remembered that focal accent, as it is used here, is a functional term and need not be phonetically different from sentence accent or phrase accent. Its level of accentuation follows the economy principle mentioned earlier.

As in other languages, the position of phrase and sentence accent in a sentence is mainly determined by syntax and can be predicted with some degree of certainty. In contrast to this, the occurrence and position of focus is determined by the speaker's intentions; for instance of giving weight to new information (informative focus) or to a word acting as an intensifier (expressive focus). In a broad context informative focus expresses semantic relations between discourse referents (Halliday 1967, Gussenhoven 1983, Rossi 1985, Horne 1987).
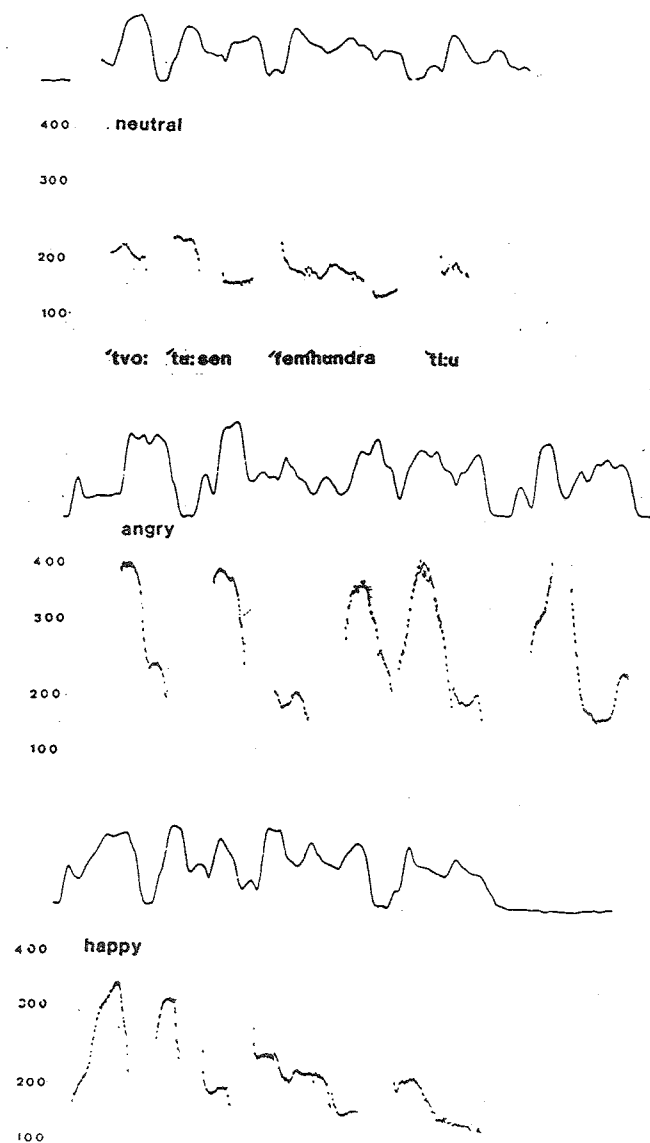
Figure 3. The expressive function. The sentence *Tvåtusen femhundra tio* '2510' in different moods. Southern dialect.

Manifestation

The phonetic manifestation of focus in different positions in the sentence and its effect on the surrounding accents was the main topic of Bruce's thesis (1977). Test sentences were constructed in such a way that focus could occur in any one of three different positions. The manifestation of focus in the Stockholm dialect was analysed as a rise after the fall of the preceding accent, differently timed depending on the accent (p. 49). Thus, according to Bruce's theory, the accent distinction is in all cases a question of timing of a pertinent part of the pitch curve, a fall for the word accents and a subsequent rise for the sentence accent.

Bruce's method of analysis made it possible to isolate with great precision the contribution of focal accent from that of the word accents. The focal accent had little effect on the preceding accents, but after focus the accent manifestations were reduced in relation to distance from focus. A closer study of declination effects on accents after focus in declarative intonation showed that there are constant frequency ranges in the rises of neighbouring accents but varying ranges in the falls (Bruce 1982a).

Manifestation of focal and other accents

Figure 4 illustrates my interpretation of word accent, phrase accent, sentence accent and focal accent in the sentence *Madame Marianne Mallarmé har en mandolin från Madrid* 'M.M.M has a mandolin from Madrid', produced without and with focus on *Mallarmé* by a speaker from the south. In the focus-free production (a), the subject and predicate are delimited from each other by a light turn from rising to falling intonation in connection with the first phrase accent. The predicate phrase has a second phrase accent in *mandolin* and the whole sentence concludes with a sentence accent. Together with the unaccented syllables there are four accentuation levels in this sentence.

In (b), which has three levels, there is a sharper division of the two main constituents effected by a focal accent on *Mallarmé,* falling from a high pitch level. The first accent of the second constituent starts from the same high level as the focal accent and the phrase has neither phrase nor sentence accent. Yet, in contrast to what happens in many other languages after focus, the accented syllables retain their pitch manifestations. Note the phonetic similarity of the sentence accent of (a) and the focal accent of (b).
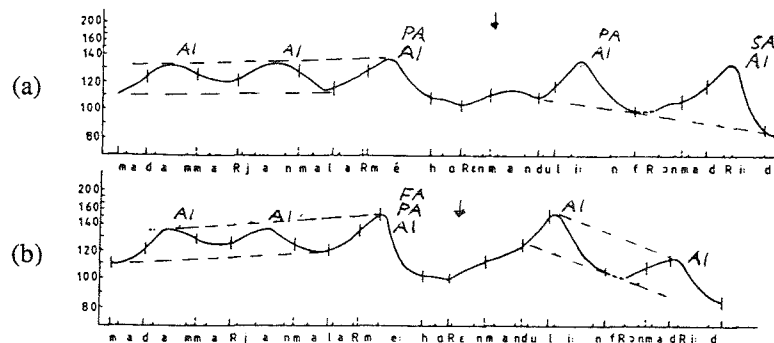
Figure 4. The weighting function. *Madame Marianne Mallarmé har en mandolin från Madrid* 'M. M. M. has a mandolin from Madrid' (a) focus-free (b) focus on *Mallarmé*. All accented syllables have A1. The abbreviations WA, PA, SA, FA stand for word, phrase, sentence, focal accent respectively. Southern dialect. *From Gårding 1981.*

2.4. Sentence and text level: Textual organization

Intonation is used to group and arrange sentences into text units with a variety of semantic implications. When two sentences separated by a tonal, local juncture are given a global unidirectional intonation, the second sentence is heard as an added comment. The intonational arrangement has a function corresponding to the text-linguistic category 'additive'. When the second sentence is uttered with a reset of intonation and a subsequent fall, the impression is extra weight and a new topic (Bruce 1982b). This puts it on a par with the first sentence, an arrangement which may correspond to the text-linguistic category 'equivalence'. Thus, not only local accentuation but also intonation over a stretch of an utterance contributes to the weighting of different parts of the message.

A study of such phenomena showed that there is a limited number of possibilities for intonation to behave in a major syntactic splice (Gårding 1982a). One possibility is the encounter of a falling intonation with a rising-falling one. This arrangement expresses contrast to what can be expected in the context given by the first sentence. The corresponding text-linguistic concept is 'adversative'. A parenthetical effect is achieved by a compressed range for the part of the utterance which is deemphasized.
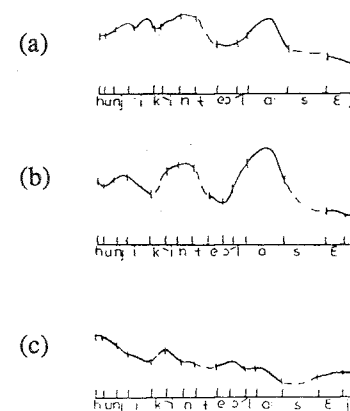
Figure 5. Text-level connections. *Hon gick inte o(ch) la sej* 'She did not go to bed' as a follow-up sentence of different contexts (a) equivalence (b) adversative (c) deemphasis. Southern dialect. *From Gårding 1982a.*

Similar effects can be obtained by lexical and syntactic means, such as a subordinating conjunction like 'since' in the first additive case above, coordination by 'and' in the second case and by 'but' or 'on the other hand' in the third case, and a subordinate relative clause in the fourth case.The semantic implications of such intonational arrangements are recognized by speakers as well as listeners (Gårding 1982a. For French cf. Fonagy 1981. For the text-linguistic aspects of newscasting see Enkvist and Nordström 1978).

Figure 5 shows the sentence *Hon gick inte o(ch) la sej* 'She didn't go to bed', uttered as a follow-up sentence in three contexts elicited by different preceding sentences. The falling intonation of (a) is an example of equivalence, syntactical coordination. Intonation (b), with its rising topline up to the sentence accent, is typical of adversative (superordination), and the compressed range of (c) is an expression of deemphasis (subordination).

3. COMPARISONS

3.1. Dialectal variation

Intonation is a strong dialect marker in Scandinavian dialects. Ernst A. Meyer was the first to make instrumental analyses of the accents pronounced by speakers of different Scandinavian dialects (1936 and 1954). Based on his

material a prosodic dialect map was set up with four categories apart from the Swedish dialects in Finland and in the north which do not possess any distinctive accents (Gårding 1970). The patterns were divided into two groups, each with two subgroups depending on the number and locations of the pitch peaks in relation to the syllable. The map showed that the geographical distribution of the manifestation types cooccur with well-known dialect areas, established mainly on lexical and morphological criteria. There are single-peaked A2 in the south (formerly Danish provinces), in Bergslagen and Gotland, and double-peaked A2 in central dialects.

A new investigation of accents in different dialects and sentence intonations corroborated Meyer's data. The results were presented in a scheme which generated the observed patterns with phonologically motivated rules (Gårding & Lindblad 1973).

A similar analysis of intonation in which rules for word accents and global intonation were separated was carried out in a material representing the five dialectal categories established earlier. The dialectal variation could be referred to the different manifestations of sentence accent. A two-peaked A2 is found in dialects in which sentence accent is separated from the word accent manifestation and in the southern dialects with one-peaked A2 there is an overlap of word accent and sentence accent (Bruce & Gårding 1978, Gårding 1982b).

3.2. Swedish and some related languages
To conclude this section, I shall sum up what I find characteristic of Swedish intonation. (As before I disregard the rhythmic pattern).

1. Typical of Swedish are the word accents. They cause the intonation to go up and down more often than it does in an intonational system like the one in English, for instance, which gives the language and its dialects some of their most striking melodic characteristics.

2. It follows from the distinctiveness of the accents that their turning points are fixed to the intonation curve in a regular way. A high remains a high and a low remains a low in relation to the accented syllables and the tonal grid which the model uses to express intonation over a stretch of an utterance. This is not the case in English or German, where rising accents are preferred in a rising intonation and falling in a falling one.

3. In many West Swedish dialects, as in East Norwegian ones, the main accent is followed by a rise extending to the next accent or to the end of the sentence. The impression is one of rising intonation for both statements and

questions, a feature which is very striking to foreigners. The difference between the two speech acts is that for questions the intonation goes to a still higher level than it does for statements.

Although all these characteristics basically have to do with the word level, they seem to dominate the total impression of Swedish intonation. Our analysis of various languages suggests that if the accents are disregarded, the communicative functions of intonation and their expressions on the other levels are of a very general nature.

4. CONCLUSION. THEORETICAL IMPLICATIONS
4.1. The model
In the background of my analysis of Swedish intonation is a general model which has been described earlier (Bruce & Gårding 1978, Gårding 1979, Gårding & Bruce 1981, Gårding 1983, 1985). The basic principle is that global intonation stretching over a phrase or a sentence is separable from local intonation bearing on accents (and tones). This principle becomes clear in analysis of material in which prosodic features are varied systematically. As was shown in Figure 1, the accent humps can be analysed as being added to or superimposed on a global phrase intonation component. The timing of the accent humps is crucial for the separation of accents from sentence intonation, for the accents from each other, and for the distinction of different dialects. Another effect of superposition is that the deformation of accent shapes in a given accentual pattern can be explained as due to sentence intonation (Gårding 1984). (For the use of superposition in intonation analysis see Öhman 1967 where it was introduced, Carlsson and Granström 1973, Gårding 1986. For Danish see Thorsen 1978.)

A very important observation is that some of the turning points have rather fixed positions relative to specified acoustic segments. It follows from this that certain falls and rises are also relatively fixed. As a result, an intonation curve can be economically described by giving the time and frequency positions of some specified turning points. This is the main principle for the generative part of the model.

Another principle is to base the global analysis of phrase and sentence intonation on the notions of 'tonal grid' and 'pivot'. A grid is obtained by fitting two nearly parallel lines to the local maxima and minima of the curve in such a way that they enclose the main part of the tonal movements derived from normal-sized accents. That part of the grid where the direction or width

is changed is a pivot. A pivot marks the boundary between two prosodic phrases.

These concepts, grid and pivot, can be seen as descriptive tools which can be used to analyse intonation in any language. They are illustrated in Figure 2. The pivots are marked by arrows and the grid by broken lines.

The model can also be used to generate intonation for an input sentence equipped with markings expressing lexical accent for the content words, for phrase and text-level accents, and markings for speech act and dialect area. The input is first treated by a rhythmic component which operates on the same markings as the pitch component and gives the syllables the durations that fit the pitch pattern[4].

Characteristic of the intonation-generating scheme is that sentence and phrase intonation are generated first from the speech act markings and the boundaries in the form of a grid. The grid lines move within the outer bounds of the normal register, which is about one octave. The direction of the movement is determined by speech act and the position of the phrase in the sentence. The slope of the movement is conditioned by the length of the phrase. Highs and lows are given their proper positions relative to the accented syllables and relative to the grid from specifications for the dialect. Accents with a high level of accentuation reach the outer bounds. Finally, the curve is obtained by interpolation over the voiced segments through the points generated earlier in the program.

Attempts to quantify the accentuation levels relative to the grid have been made by Shi Bo for a Chinese text-to-speech system and by Merle Horne for English (Shi 1989, Horne 1987)[5].

4.2. Hierarchy

In my analysis of Swedish, intonation appears as a hierarchical structure in the following sense. Phonetic features and their functions observed at the lexical level appear also at the phrase and sentence level. Take the turns of the intonation pattern, for instance. They are first observed at the lexical level, and their proper timing in relation to the syllable is decisive for marking different groupings of morphemes and giving them different weights and meanings. At the phrase and sentence level, we encounter turns of the larger phrase-like pattern, the pivots, which again are associated with different groupings and meanings.

Also the range and direction of the intonation movements are used at different levels to bring out relations between parts of the message. The large

range of a sentence accent for instance makes it possible for it to dominate over a phrase accent which by the same token dominates over the word accents. Furthermore, the direction of pitch over a syllable may have a certain connotation at the word level (for instance, terminality versus non-terminality) which is repeated at the phrase and sentence level.

The hierarchical structure of intonation has been recognized by many linguists and phoneticians (e.g. Bolinger 1986, Thorsen 1978 and later work). The model presented here can handle such a structure. It has been applied with some success to other prosodic systems such as French and Greek (Gårding, Botinis & Touati 1982, Touati 1987), Chinese (Gårding, Zhang & Svantesson 1983) and Hausa (Lindau 1986).

NOTES

[1]Acute / ´ / and grave / ` / accent symbols at the beginning of the stressed syllable mark primary stress expressed as A1 and A2 respectively. Secondary stress is marked by a vertical subscript stroke / ˌ /. Note that accents are only marked by orthography if the location deviates from the basic rules, as it may do in new family names such as *Bylén* or in French loans such as *armé, café*.

[2]This /e/ developed in monosyllabic roots ending in an obstruent followed by a sonorant consonant, e.g. *vatn > vatten*.

[3]The classical treatment of the accents is Axel Kock's dissertation (1878). For a survey of accent research in Scandinavia, see Gårding 1977. A comprehensive phonetic study of the *stød* is given by Fischer-Jørgensen 1989. For recent investigations of intonation see also *Nordic Prosody* 1-4 and Jahr & Lorentz 1983.

[4]The interaction of tonal and temporal features has been the object of a lot of research. See e.g. *Nordic Prosody* 1-4. Rhythmic patterns are efficiently illustrated by Bannert 1979.

[5]Merle Horne showed how accentuation levels can be assigned to words in an English discourse according to a rule system in which grammatical function interacts with coreference relations (1987). The same model will be applied to Swedish.

REFERENCES

Bannert, R. 1979. *Ordprosodi i invandrarundervisningen*. Praktisk lingvistik 3. Dept. of Linguistics, Lund University.

Bannert, R. 1986. 'From prominent syllables to a skeleton of meaning: a model of prosodically guided speech recognition'. *Working Papers* 29, 1-31. Dept. of Linguistics, Lund University.

Bolinger, D. L. 1986. *Intonation and its parts. Melody in spoken English.* London: E. Arnold.

Bredvad-Jensen, A-C. 1984. 'Tonal geography. Geographical variation in declarative and interrogative intonation along the west coast of Sweden'. *Nordic Prosody III*, eds. C-C. Elert, I. Johansson, E. Strangert, 31-41. University of Umeå.

Bruce, G. 1977. *Swedish word accents in sentence perspective.* Lund: Gleerup.

Bruce, G. 1982a. 'Developing the Swedish intonation model'. *Working Papers* 22, 51-117. Dept. of Linguistics, Lund University.

Bruce, G. 1982b. 'Textual aspects of prosody in Swedish'. *Phonetica* 39, 274-88.

Bruce, G. 1983. 'Accentuation and timing in Swedish'. *Folia Linguistica* 17, 221-38.

Bruce, G. 1984. 'Rhythmic alternation in Swedish'. *Nordic Prosody III*, ed. C-C. Elert, I. Johansson & E. Strangert, 31-41. University of Umeå.

Bruce, G. & E. Gårding. 1978. 'A prosodic typology for Swedish dialects'. *Nordic Prosody*, ed. E. Gårding, G. Bruce & R. Bannert, 219-28. Dept. of Linguistics, Lund University.

Carlsson, R. & B. Granström 1973. 'Word accent, emphatic stress and syntax in a synthesis by rule scheme for Swedish'. *Speech Transmission Lab QPSR* 1973:2-3, 31-35. Stockholm.

Di Cristo, A. 1985. *De la microprosodie a l'intonosyntaxe.* Université de Provence.

Elert, C-C. 1970. *Ljud och ord i svenskan.* Stockholm: Almqvist & Wiksell.

Elert, C-C. 1981. *Ljud och ord i svenskan 2.* Universitetet i Umeå.

Elert, C-C., I. Johansson & E. Strangert, eds. 1984. *Nordic Prosody III.* University of Umeå.

Endresen, R.T. 1983. 'An alternative theory of stress and tonemes in Eastern Norwegian'. *Prosodi/Prosody, Studies in Norwegian Linguistics 2*, ed. E.H. Jahr & O. Lorentz, 362-87. Oslo: Novus Forlag.

Enkvist, N. E. & H. Nordström. 1978. 'On textual aspects of intonation in Finland-Swedish newscasts'. *Studia Linguistica* 32, 63-79.

Fischer-Jørgensen, E. 1989. *A phonetic study of the stød in standard Danish.* University of Turku, Phonetics.

Fonagy, I. 1981. 'Fonction prédictive de l'intonation'. *Problèmes de prosodie*, eds. P. Léon & M. Rossi, 113-20. Paris.

Fretheim, T., ed. 1980. *Nordic Prosody II.* Trondheim: Tapir.

Fretheim, T. & R.A. Nilsen. 1988. *Romsdal intonation: where east and west Norwegian pitch contours meet.* Manuscript.

Gårding, E. 1967a. *Internal juncture in Swedish.* Lund: Gleerup.

Gårding, E. 1967b. 'Prosodiska drag i spontant och uppläst tal'. *Svenskt talspråk*, ed. G. Holm, 40-85. Uppsala: Almqvist & Wiksell.

Gårding, E. 1970. 'Word tones and larynx muscles'.*Working Papers* 3, 20-46. Dept. of Linguistics, Lund University.

Gårding, E. 1977. *The Scandinavian word accents.* Lund: Gleerup.

Gårding, E. 1979. 'Sentence intonation in Swedish'. *Phonetica* 36, 207-15.

Gårding, E. 1981. 'Contrastive prosody: a model and its application'. *Studia linguistica* 35, 146-65.

Gårding, E. 1982a. 'Prosodic expressions and pragmatic categories'. *Textstrategier i tal och skrift*, ed. W. Koch, 117-35. Stockholm: Almqvist & Wiksell.

Gårding, E. 1982b. 'Swedish prosody. Summary of a project'. *Phonetica* 39, 288-301.

Gårding, E. 1983. 'A generative model of intonation'. *Prosody, Models and Measurements*, eds. A. Cutler & D.R. Ladd, 11-21. Springer Verlag.

Gårding, E. 1984. 'Comparing intonation'. *Working Papers* 27, 75-99. Dept. of Linguistics, Lund University.

Gårding, E. 1985. 'In defence of a phrase-based model of intonation'. *Working Papers* 28, 1-18. Dept. of Linguistics, Lund University.

Gårding, E. 1986. 'Superposition as an invariant feature of intonation'. *Invariance and variability in speech processes*, ed. J.S. Perkell & D.H. Klatt, 292-99. L. Erlbaum Associates. N.J. and London: Hillsdale.

Gårding, E., A. Botinis & P. Touati. 1982. 'A comparative study of Swedish, Greek and French intonation'. *Working Papers* 22, 137-52. Dept. of Linguistics, Lund University.

Gårding, E. & G. Bruce. 1981. 'A presentation of the Lund model for Swedish intonation'. *Nordic Prosody II*, ed. T. Fretheim, 33-40.

Gårding, E., G. Bruce & R. Bannert, eds. 1978. *Nordic Prosody.* Dept. of Linguistics, Lund University.

Gårding, E., O. Fujimura & H. Hirose. 1970. 'Laryngeal control of word tones'. *Annual Bulletin of the Research Institute of Logopedics & Phoniatrics* 4, 45-53. University of Tokyo.

Gårding, E., O. Fujimura, H. Hirose & Z. Simada. 1975. 'Laryngeal control of Swedish word accents'. *Working Papers 10*. Dept. of Linguistics, Lund University.

Gårding, E. & D. House. 1986. 'Emotion and intonation'. Unpublished paper.

Gårding, E. & D. House. 1987. 'Production and perception of phrases in some Nordic dialects'. *The Nordic languages and modern linguistics 6*, eds. P. Lilius & M. Saari, 163-77. Helsinki: University Press.

Gårding, E. & P. Lindblad. 1973. 'Constancy and variation in Swedish word accent patterns'. *Working Papers 7*, 36-110. Dept. of Linguistics, Lund University.

Gårding, E. & P. Lindblad. 1988. 'Eastern Norwegian and Western Swedish intonation in a common descriptive framework'. *Working Papers 34*, 50-55. Dept. of Linguistics, Lund University.

Gårding, E., J. Zhang & J-O. Svantesson. 1983. 'A generative model for tone and intonation in Standard Chinese'. *Working Papers 25*, 53-65. Dept. of Linguistics, Lund University.

Goldsmith, J.A. 1979. *Autosegmental phonology*. New York: Garland.

Gussenhoven, C. 1983. 'Focus, mode and nucleus'. *Journal of Linguistics 19*, 377-417.

Hadding-Koch, K. 1961. *Acoustico-phonetic studies in the intonation of southern Swedish*. Lund: Gleerup.

Halliday, M. 1967. 'Notes on transitivity and theme in English. Part 2'. *Journal of Linguistics 3*, 177-274.

Haugen, E. 1967. 'On the rules of Norwegian tonality'. *Language 43*, 185-202.

Horne, M. 1987. *Towards a discourse-based model of English sentence intonation.* (=*Working Papers 32*). Dept. of Linguistics, Lund University.

House, D. 1990. *Perception of tonal movement in speech*. To be published in Travaux de l'Institut de Linguistique de Lund.

House, D., G. Bruce, L. Eriksson & F. Lacerda. 1988. 'Recognition of prosodic categories in Swedish: rule implementation'. *Working Papers 34*, 62-66. Dept. of Linguistics, Lund University.

Jahr, E.H. & O. Lorentz, eds. 1983. *Prosodi/Prosody*. Oslo: Novus forlag.

Jensen, M.K. 1961. *Tonemicity*. Acta Univ. Bergensis, Hum. Serie No 1.

Johansson, K. 1970. 'Perceptual experiments with Swedish disyllabic accent 1 and accent 2 words'. *Working Papers 3*, 47-74. Dept. of Linguistics, Lund University.

Kock, A. 1878. *Språkhistoriska undersökningar om svensk akcent I-II*. Lund: Gleerup.

Kohler, K. 1987. 'Categorical pitch perception'. *Proc. XIth ICPhS*, Vol.5, 331-333.

Ladd, D.R. 1983. 'Phonological features and intonational peaks'. *Language 59*, 721-759.

Lehiste, I. 1960. 'An acoustic-phonetic study of internal open juncture'. *Phonetica 5*, Suppl.

Lindau, M. 1986. 'Testing a model of intonation in a tone language'. *JASA 80*, 757-764.

Lindblom, B. & Svensson, S.G. 1973. 'Interaction between segmental and non-segmental factors in speech recognition'. *IEEE Trans. on Audio and Electroacoustics* Vol. AU 21, No 6, 536-545.

Löfqvist, A., N. McGarr & H. Kiyoshi. 1984. 'Laryngeal muscles and articulatory control'. *JASA 76*, 951-954.

Malmberg, B. 1967. *Structural linguistics and human communication*. Berlin: Springer.

Malmberg, B., ed. 1968. *Manual of phonetics*. Amsterdam: North Holland.

Meyer, E.A. 1937. *Die Intonation im Schwedischen, I: Die Sveamundarten*. Studies Scand. Philol. 10. University of Stockholm.

Meyer, E.A. 1954. *Die Intonation im Schwedischen, II: Die norrländischen Mundarten*. Studies Scand. Philol. 11. University of Stockholm.

Oftedal, M. 1952. 'On the origin of the Scandinavian tone distinction'. *Norsk Tidsskrift for Sprogvidenskap 16*, 201-225.

Öhman, S. 1967. 'Word and sentence intonation: a quantitative model'. *Speech Transmission Laboratory QPSR* 2-3, 20-54.

Risberg, A. 1974. 'The importance of prosodic speech elements for the lip reader'. *Scand. Audiol. Suppl.* 4, 153-64.

Rossi, M. 1985. 'L'intonation et l'organisation de l'énoncé'. *Phonetica 42*, 135-53.

Segerbäck, B. 1966. *La réalisation d'une opposition de tonèmes dans des syllabes chuchotés*. Lund: Gleerup.

Shi Bo 1989. 'A Chinese speech synthesis by rule system'. *Speech, hearing, language*. UCL Vol. 3, 217-236.

Sonesson, B. 1968. 'The functional anatomy of speech organs'. *Manual of phonetics*, ed. B. Malmberg, 45-75. Amsterdam: North Holland.

Strangert, E. 1985. *Swedish speech rhythm in a cross-language perspective*. Stockholm: Almqvist & Wiksell.

Svensson, S.G. 1974. *Prosody and grammar in speech perception*. Monograph from the Institute of Linguistics 2, University of Stockholm.

Thorsen, N. 1978. 'Aspects of Danish intonation'. *Nordic Prosody*, ed. E. Gårding, R. Bannert & G. Bruce, 23-32.

Touati, P. 1987. *Structures prosodiques du suédois et du français. Profils temporels et configurations tonales*. Lund: Lund University Press.

Bodily Behaviour in Emotive Expressions

Gisela Håkansson

INTRODUCTION

When we hear an utterance like *He raised his eyebrows* or *He shook his fist against his brother*, we interpret the behaviours as signs of certain inner emotions, and the metaphors are quite transparent. But few of us come to think of the relationship between bodily behaviour and adjectives such as *rädd* 'afraid'. In this paper I will investigate the etymological origin of some basic emotional words and relate them to the corresponding bodily behaviour.

BACKGROUND

Since Darwin's *The expression of emotions in man and animal* (1872), the nonverbal 'language of the emotions' has been a vital research area. In fact, emotions and attitudes are mainly expressed by the use of the nonverbal channel. These functions are not as easily expressed by means of the verbal language. Eibl-Eibesfeldt 1970:462 states that "To communicate emotions we do not necessarily require language even today, because our innate expressive behaviour repertoire is quite sufficient."

The verbal language, in contrast, has its main function in communicating events and thoughts, i.e. the referential function. One of the characteristics of human verbal language is that it allows the communication of events outside the immediate context of the 'here and now'. Emotions are evoked by some sort of stimulus. Emotions typically occur in social situations, where humans interact and/or react on stimuli. In social interaction, 'body language' (facial expression, gestures, posture, touching etc.) and vocal signs (tone quality, prosody, cries, laughter etc.) are important means of communication for humans as well as for other social species.

One example of the inferiority of the verbal channel in communicating emotions is that when the verbal content conflicts with the nonverbal message the verbal message is ignored, and people trust the nonverbal signal (see