

LEXICAL STRESS, EMPHASIS FOR CONTRAST, AND SENTENCE INTONATION
IN ADVANCED STANDARD COPENHAGEN DANISH

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Due to lack of space, no references will be made to the very considerable literature on intonation in other languages, nor will any extensive documentation be given.

1. A model of Danish intonation

Intonation in short sentences in Advanced Standard Copenhagen (ASC) Danish may be presented as in fig. 1, which is but a model, with the advantages and shortcomings that modeling almost always entails in terms of simplicity and inaccuracy, respectively. It is based on recordings by six subjects, three males and three females, of a rather elaborate material (Thorsen 1978a, 1979b). The qualitative statements which can be read off the figure are perfectly representative of all the subjects, but the quantifications involved are, of course, averages, and no one subject behaves as mathematically neatly as the model would have you believe.

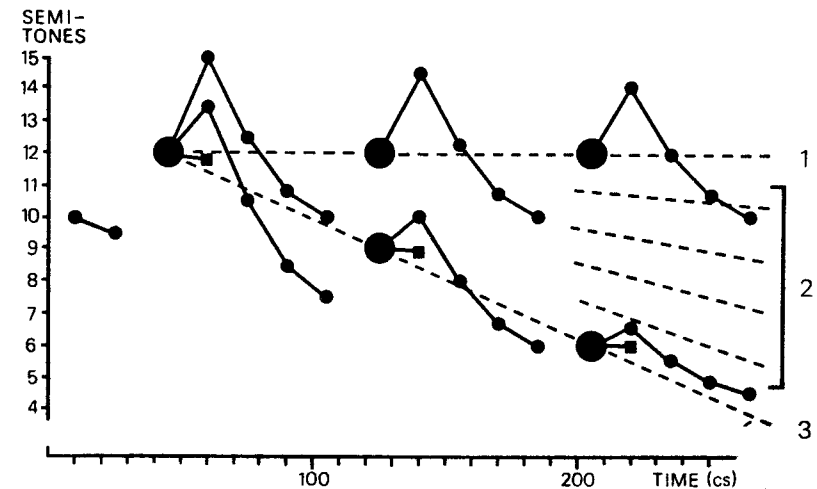


Figure 1

A model for the course of F_0 in short sentences in ASC Danish. 1: statement questions, 2: interrogative sentences with word order inversion and/or interrogative particle, and non-final periods (variable), 3: declarative sentences. The large dots represent stressed syllables, the small dots unstressed ones, and the small squares represent an unstressed syllable being the only one between two stressed ones (see further the text). The full lines represent the F_0 pattern associated with stress groups, and the broken lines denote the intonation contours.

A basic assumption underlying fig. 1 is that the complex course of fundamental frequency (F_0) in an utterance is the outcome of a superposition of several components: (1) A sentence component which supplies the INTONATION CONTOUR (broken lines). (2) On the contour is superposed a stress group component which furnishes the STRESS GROUP PATTERNS (full lines). (3) To the resultant of those two components is added, in words containing $st\ddot{o}d$, a $st\ddot{o}d$ component, rendering $ST\ddot{O}D$ MOVEMENTS. However, as $st\ddot{o}d$ words had been excluded from the material, the model does not include this particular feature. These first three components are language specific and thus "speaker controlled". (4) Finally, intrinsic F_0 level differences between segments, and coarticulatory variations at segment boundaries supply a MICROPROSODIC COMPONENT, which is not consciously controlled by the speaker, but due to inherent properties of the speech production apparatus and which, therefore, is superfluous in the model from the point of view of the human speaker. - This concept of "layers" in intonation is anything but original; the triviality of the statement does not, however, deprive it of its validity or its relevance: firstly, it is tremendously useful in the interpretation of F_0 tracings (Thorsen forthcoming) and, secondly, it has a very direct bearing on the theme of this symposium, 'The relation between sentence prosody and word prosody (stress and tone)':

The relation between word stress and sentence prosody (i.e. sentence intonation: duration and intensity are not considered) is physically a very close-knit and intricate one, but on the higher and more abstract levels we may hypothesize that very little of the mutual influence which is customary in a relationship takes place, as long as we are dealing with neutral lexical stresses.

1.1 Stress group patterns

As can be seen from the full lines of fig. 1, the stress group pattern can be described as a (relatively) low stressed syllable followed by a high-falling tail of unstressed syllables. This pattern is a predictable and recurrent entity, though allowing for contextual variation in the magnitude of the rise from stressed to unstressed syllable and in the slope of the fall through the unstressed ones. It was this observation which gave rise to the definition of the STRESS GROUP in ASC Danish as A STRESSED SYLLABLE PLUS ALL SUCCEEDING UNSTRESSED SYLLABLES (within the same, non-compound sentence), irrespective of intervening word or morpheme boundaries, and, as a consequence of this predictability and recurrency, it al-

so brought about the definition of the INTONATION CONTOUR as THE COURSE DESCRIBED BY THE STRESSED SYLLABLES ALONE.

1.2 Intonation contours

The intonation contours tend to vary systematically with sentence type, declarative sentences having the most steeply falling contours, at one extreme, and statement questions (i.e. questions with statement syntax where only the intonation contour signals their interrogative function) having "flat" contours, at the other extreme. In between these two are found other types of questions as well as non-final periods. For a further account of these contours and their perception, see Thorsen 1978b, 1979a.

2. Implications of the model

2.1 F_0 movements in syllables

The model does not specify the F_0 movements of syllables: the tonal composition of the stress group pattern as one of LOW plus HIGH FALLING allows for a very simple account of F_0 movements in vowels and consonants: segments do not carry specific movements (except when $st\ddot{o}d$ is involved) but simply float on the F_0 pattern, and slight variations in F_0 movement would be due then to the fact that segments do not always hit the patterns at exactly the same place.

2.2 The course of the intonation contour

(a) When the number of stress groups changes, everything else being equal, so does the slope of a given contour, leaving only the "flat" ones intact; the constancy presumably lies in the interval between the first and the last stressed syllable, with intervening stressed syllables evenly distributed between them, and not in a certain rate of change (this point needs further verification which I hope to present orally in August).

(b) When the number of unstressed syllables varies in the stress groups, the stressed syllables will not be equidistantly spaced in time, and the straight lines of fig. 1 break up into a succession of shorter ones with unequal slopes.

Combining the effects of changes of both types leaves us with an infinity of physically different intonation contour configurations. On a higher level in production these variations may not exist, and perceptually they may be obliterated, turning the contours into smoothly slanting slopes, (1) if what we aim at producing and what we perceive are equal intervals between stressed syllables and not the actual slope of the contour, and (2) if we assume that isochrony, be it not a physical reality, is a psycho-

logical reality with the speaker/listener.

2.3 Fo patterns of stress groups

2.3.1 Stress groups with more than one unstressed syllable

(a) In statements, the rise from stressed to unstressed syllable is, on the average $1\frac{1}{2}$, 1, and $\frac{1}{2}$ semitone, respectively, in the first, second, and third stress group. In statement questions, the rises amount to 3, $2\frac{1}{2}$, and 2 semitones, respectively. The difference in magnitude of this rise, between patterns riding on different contours is very likely a direct consequence of differences in the level of the following stressed syllable.

(b) The decrease with time in the rise from stressed to unstressed syllable is the same in statement questions and statements, one semitone. This decrease, which is independent of the particular contour, may be seen as a consequence of either of two distinct processes, or of a combination of them. It may be a "voluntary" decrease, i.e. a signal of finality, and/or it may be a physiological phenomenon: the closer you get to the end of the utterance, the less "energy" is expended and the less complete the gestures will be; either or both phenomena may also account for the less and less steep falls through the unstressed syllables.

If the variation in the Fo patterns with intonation contour and time is physiologically determined, the speaker may be unconscious of it, and the listener may neglect or compensate for it.

2.3.2 Stress groups with only one unstressed syllable

Stress groups with one unstressed syllable will of course be shorter than those with several, a feature which is not reflected in fig. 1. - A single unstressed syllable does not accomplish a full rise-fall when the following stressed syllable is considerably lower than the preceding one, as is the case in statements. Instead it lands on very nearly the same level or slightly below the preceding stressed syllable and, accordingly, the rise-fall is amputated. A full rise-fall may be intended by the speaker and the amputation be due to a shortcoming in the peripheral speech production mechanism. Accordingly, the listener may well re-introduce a rise-fall (this is, indeed, my own subjective impression). But we have here an indication that time (rhythm) overrides Fo when the two are in conflict. On the other hand, there is definitely a tendency towards as complete rise-falls as possible. Two unstressed syllables will traverse more than half the fall exhibited by four, everything else being equal. - These two facts together are

another reminder that speech is not a card-board structure but a smooth and dynamic process.

2.4 Conclusion

If the assumptions made about production and perception of Fo courses hold water, we are left with two components which physically are highly interactive but on more abstract levels may be invariant, apart from the fact that contours change with sentence type.

3. Emphasis for contrast

By emphasis for contrast is meant the extra prominence on one of the syllables in the utterance, used to denote a contrast which may be implicit or may be explicitly stated in the context. I have deliberately avoided terms like 'focus', 'sentence accent', or 'nucleus' because these terms are used, in a number of languages, to describe a phenomenon different from emphasis for contrast: one of the lexically stressed syllables in the utterance will always have slightly greater prominence (realized, very roughly speaking, as a more elaborate Fo movement within that syllable), and if nothing else is specified by the context, it will fall on the last stressed syllable. - A similar phenomenon does not exist in ASC Danish as a thing apart from emphasis for contrast. Whenever and wherever such a slightly heavier stress is introduced, it invariably invokes the impression of contrast. Insofar as we are not faced with incomplete evidence or with a false dichotomy, i.e. one due to differences in concepts, Danish seems to be markedly different from e.g. English, German, and Swedish.

3.1 Contrastive stress and Fo

The following account is based on a material of sentences, uttered in dialogues, where the contrasts were all explicitly stated in the context (but I strongly believe that they would have looked no different had they been implicit). - When emphasis for contrast occurs, it affects the intonation contour as well as Fo patterns.

Fig. 2 compares the neutral edition with three statements where the emphasis lay on the first, second, and third lexically stressed syllable. (Durational differences between the neutral and emphatic editions are very slight and there is no doubt that Fo is the prime cue to contrast, as it is to neutral lexical stress.) The obvious changes introduced in the Fo course by emphasis for contrast is a raising of the syllable in question (represented by a star), a drastic fall from first to second unstressed syllable, plus a not inconsiderable shrinking of the surrounding Fo patterns:

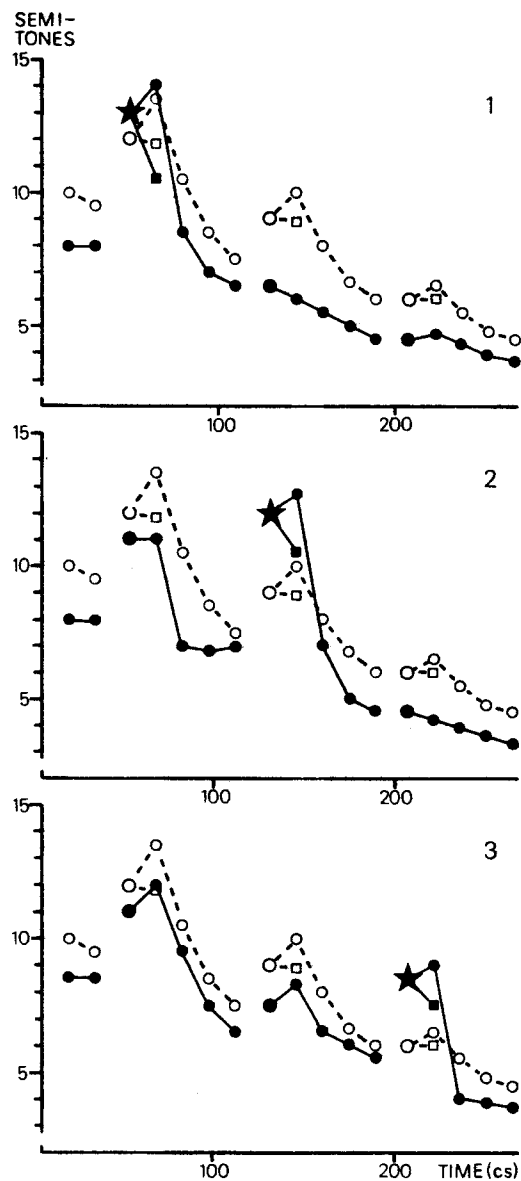


Figure 2

Models for statements with emphasis for contrast on (1) the first, (2) the second, and (3) the last stressed syllable, compared to the neutral edition (broken lines and empty dots).

(1) when emphasis is on the first stressed syllable, it is higher, the rise to the first unstressed syllable is smaller, and the fall through the following unstressed syllables is steeper than for the neutral case. The levels of the second and third stressed syllables are considerably lowered and the LOW+HIGH FALLING pattern is annihilated in the second and shrunk in the third stress group. The syllables of the second and third stress groups look, tonally, more like a series of unstressed syllables continuing the fall in the first one.

(2): emphasis on the second stressed syllable repeats the pattern of (1), and we also get a certain reduction of the first stress group with a very steep fall from first to second unstressed syllable.

(3) the pattern repeats itself in the last stress group, with a shrinking of the preceding ones as well.

Again we note that a single unstressed syllable does not accomplish a full rise-fall but instead drops well below the preceding emphatic one.

The feature common to

the three cases seems to be that the syllable on which the emphasis for contrast occurs must stand out clearly from the surroundings, which is brought about by a raising of that syllable as well as by a lowering of the immediate surroundings, except for the first of several post-tonic syllables. The change is slightly greater in the succeeding than in the preceding F_0 course. During some informal experiments performed with the ILS-system for analysis and synthesis at the Institute of Linguistics, Uppsala University, it appeared that shrinking the F_0 course in the surroundings is sufficient to create the impression of emphasis for contrast. To get emphasis on the word 'sidste' in the statement 'Det er sidste bus til Tiflis.' (It's the last bus for Tiflis.) it is sufficient to change the rise from 'bus' to 'til' to a level or a slight fall, whereas just raising the stressed syllable of 'sidste' will not do the trick. Likewise, to get emphasis on 'bus', lowering the unstressed syllable of 'sidste' will do and just raising 'bus' does not accomplish anything.

The three F_0 courses in fig. 2 look widely different and only vaguely resemble fig. 1 "3" although the utterances still sound declarative. What constitutes the intonation contour in utterances with emphasis for contrast, I hesitate to say at present. They may resemble one-word utterances in that the difference between statement and question lies in the level of and movement within the emphatically stressed syllable as well as in the course of the succeeding unstressed ones (Thorsen, 1978a), or the intonation contour may be extrapolated from, and thus still be definable in terms of, the lexically stressed syllables surrounding the emphatic one. The first solution would be interesting, because it implies that in utterances with emphasis, word prosody takes precedence over sentence prosody, whereas the second solution would make the definition of intonation contour apply to a wider range of utterances.

- References** (ARIPUC = Ann. Rep. Inst. Phonetics, Univ. Copenhagen)
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