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THE ACOUSTIC MANIFESTATION OF STRESS IN DANISH WITH PARTICULAR REFERENCE TO THE REDUCTION OF STRESS IN COMPOUNDS*

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The present investigation of Danish stress is based on a rather extensive material from Standard Danish and from Jutlandish, Funish and North Zealandish dialects. It is found (1) that unstressed syllables are distinguished from stressed syllables by not being able to have stød or phonological vowel length, by shorter duration, by a different Fo pattern which can be described as a different placement on an undulating Fo wave (but Fo pattern differences are not the same in different dialects), and finally often by lower intensity, at least as far as the endings -e [ə] and -er [ɒ/ɔ] are concerned. (2) Syllables with secondary stress retain stød and phonological vowel length but are distinguished from stressed syllables by shortening (although not as much as unstressed syllables), by Fo, behaving in this respect like unstressed syllables, but hardly by intensity except for the dialects which have low Fo on unstressed syllables. (3) Syllables which are reduced by unit accentuation (in relation to a following stressed syllable) lose stød and (at least for monosyllabics) phonological vowel length; they are somewhat more reduced in duration and partly in intensity than syllables with secondary stress, and they behave, as do syllables with secondary stress, like unstressed syllables in the Fo pattern of the stress groups.

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*) *This report is a considerably enlarged - and in some details revised, version of Fischer-Jørgensen 1983.*

Content

I. INTRODUCTION

It is not my intention to enter into any general discussion of the phonology of stress in this paper, but it may be useful to start by stating what I mean by stress.

I use accent as a more general term covering stress and tone. Stress is used to indicate culminative accent, by which one syllable is made more prominent than other syllables in the given unit, whereas tone or tonal accent characterizes a syllable or part of a syllable or a word without giving special prominence to it. It is inherent in the idea of prominence that something stands out compared to the surroundings. Thus stress is a concept of relations in the speech chain. This makes it problematic to set up a definite number of absolute stress levels for a given language. Phonetically stress is a property of a syllable. Phonologically it may also belong to a syllable. This is the case in simplex words where one syllable is more prominent than the others. But it may also characterize a larger (meaningful) unit, e.g. a member of a compound or a phrase. Word stress may be called potential in the sense that it characterizes that syllable of a word which will be stressed if the word is stressed in the actual sentence. Stresses may be reduced in compounds or in certain phrasal structures. Stress reduction in compounds may be regarded as lexicalized syntactic reduction of stress (see, e.g., Martinet 1954). These reductions are rule governed. Moreover, the speaker is always free to give more or less prominence to words which he finds more or less important in a given sentence, and in the extreme case of explicit or implicit contrast the manifestation is normally conventionalized. This paper only deals with word stress and stress reduction by rule in neutral, declarative sentences. The main problem will be the acoustic manifestation of stress, more specifically the acoustic difference between main stress and reduced stress in compounds.

The search for acoustic differences raises some problems. Some phoneticians want to define stress from the point of view of speech production as increased effort on the part of the speaker. Fónagy (1958 and 1966) emphasizes that stress should be defined physiologically and that the acoustic consequences of the effort may be varied and shifting, and may even be conventionalized so that they are no longer effects of the effort but conventionalized signals, like e.g. the duration of vowels in Russian (compared to the much smaller lengthening in Hungarian which is really caused by more effort), and these conventions may be different in different languages. However, even if it may be true that stress can be defined in a simpler and more consistent way from the point of view of production (more evidence is still needed on this point), information on the physiological effort must be conveyed to the listener through the speech wave. A feature that functions in speech must be found at all stages of the speech communication act.

There is, however, another reservation to be made: Since stress is to a large extent rule governed, it is often predictable. Moreover, a syntactic construction may be sufficiently characterized by grammatical means so that the stress difference is redundant. Chomsky and Halle (1968, p. 25-26) emphasize that stress can be predicted to a large extent from semantic and syntactic facts, so that the listener expects stress to appear at certain points of the utterance and will perceive it even if there are no acoustic cues indicating it. It may be a perceptual fact without any physical basis. They go so far as to maintain that "there is no acoustic evidence to support the view that perceived stress contours correspond to a physically definable property of utterances". - This general formulation is exaggerated. But there is no doubt that it may happen, and it has even been proved by Berinstein (1979). She asked a number of English, K'ekchi and Spanish subjects to indicate the placement of stress in a sequence: *bibibibi* which was manipulated in different ways. In the control case, where all syllables were alike, 80% of the English subjects placed the stress on the initial syllable, and more than 40% of the K'ekchi subjects (who have final stress in their mother tongue) placed the stress on the last syllable. And there was still a certain bias when the syllables were different. But the importance of acoustic cues and the presence of acoustic differences in normal speech has been demonstrated in many experiments. And, as Katwijk (1974) remarks, stresses placed in a wrong position are easily noticed, and they are even very disturbing in normal speech situations. Thus, it may nevertheless be worth while looking for acoustic differences. One must, however, be prepared to find acoustic differences which are not normally used in the perception of stress and, on the other hand, one must also envisage the possibility that cues found in tests with synthetic sounds may not be used normally in the subject's mother tongue. He may know them from a different dialect or language.

In spite of these reservations I think that it is possible through an acoustic analysis to find the properties which may be supposed to be most important in a given language. An acoustic analysis is the first step towards the goal of finding the perceptually relevant cues.

The acoustic properties which have most often been found to correlate with stress are (1) increased duration, (2) increased intensity, and (3) deviations in fundamental frequency (Fo). Another fairly frequent property is precise vowel quality versus schwa or at least a centralized quality; sometimes unstressed syllables are also characterized by lack of aspiration. A specific durational cue mentioned by Bolinger and Gerstman (1957) is "disjuncture", i.e. the distance between syllable centers. This distance may be shortened in compounds compared to a sequence of independent words.

The Fo deviation in stressed syllables need not be a movement upward, though high or rising pitch is the most common feature. It may also be a downward deviation (Bolinger 1958a). The de-

cisive thing often seems to be a relatively abrupt shift of level or direction. Cohen and 't Hart (1967), and 't Hart and Cohen (1973) found that in Dutch a rise-fall in the same syllable was the most prominence lending contour, but a simple rise or a fall (the latter only in the last accented syllable of the phrase) may be sufficient.

The timing may also be important. In Dutch a rise in the beginning of the syllable or a fall at the end have been found to be the most favourable placement for the perception of stress (Katwijk 1969 and 1974). (For a more detailed discussion of timing in Fo contours, see Thorsen 1982a.)

In quite a number of languages it has been found that Fo changes are perceptually most important, e.g. in English (Fry 1955 and 1958), Bolinger (1958a and b), Morton and Jassem (1965)), whereas intensity is the weakest cue. Fo has also been found to be important for the perception of stress in German (Isačenko and Schädlich 1964, and Bleakley 1973) and in Dutch (Katwijk 1974), in Polish (Jassem 1959), and in French (Rigault 1962)). In French there are also obvious differences in duration (Benguerel 1971), but hardly in intensity (Spang-Thomsen 1963).

There is not complete agreement about English. Scholes (1971) found intensity to be the most important cue between syntactically conditioned stress differences as *the good flies quickly past* and *the good flies quickly passed*, at least in natural speech (in synthetic speech the temporal differences turned out to be more important), and Lieberman (1960) found intensity differences to be dominant compared to duration in English pairs like *cónduct - conduct*.

However, both for English and for most other languages the hierarchy which is most frequently set up is (1) change in Fo, (2) increased duration, (3) increased intensity. Hyman (1977) considers this to be a universal hierarchy. But that can hardly be upheld. Berinstein (1979) proposes instead to consider this hierarchy to be the unmarked one, which is valid only for languages without phonemic contrast in tone or vowel length. If one of these properties is phonemic it will be superseded by the other cues in the hierarchy. She finds confirmation of this hypothesis in the fact that in K'ekchi, which has phonemic vowel length, duration is the weakest cue for stress, whereas it is used for this purpose in Cakchiquel, which does not have phonemic vowel length. Similarly, Janota (1967 and 1979) found intensity to be more important than duration in Czech, which has phonemic vowel length, whereas Polish which does not have phonemic vowel length has the unmarked hierarchy (Jassem 1959). Fónagy (1958) also draws attention to the extensive and conventionalized increase of duration of stressed syllables in Russian (which does not have phonemic vowel length) compared to the small differences in Hungarian (which does have phonemic vowel length). But even without interference from the phonemic factor there may be deviations from the unmarked hierarchy. Botinis (1982) thus finds duration and intensity to be more consistent cues than Fo in Greek, and Bertinetto (1980) finds

duration to be the most important cue in Italian. He takes the difference limen for the various cues into account, which has not always been done.

On the whole, there is some uncertainty in comparing the relative importance of properties measured in different units, except in the cases where a cue is less frequently used, or not used at all. Finally, it should be mentioned that some phoneticians prefer to measure the energy integral, not the peak intensity as most have done. In this way duration and intensity are combined into one feature, which for short vowels is justified by the integration time of the ear. Lieberman (1960) finds this to be the best measure for English stress (cp. also Lea 1977). Rossi (1970) and Rossi et al. (1981) do not use intensity but a calculated loudness value, based on compensation for intrinsic vowel intensity and the integration time of the ear. In principle this is, of course, a correct procedure for arriving at the loudness value. But in this way physical duration is reckoned twice (as part of loudness and on its own,as is also the case when the energy integral is used). It is probably safer to avoid these problems by keeping vowel quality, Fo, and duration constant when investigating the perceptual importance of intensity by means of synthetic sounds (which has also been done by various experimentors). In measurements of natural speech one may at least stick to comparisons between vowels of the same quality, or one may compare relations or differences between similar pairs of vowels instead of absolute values.

Most investigators have compared full stress and weak stress. But one cannot be sure that the same cues are used for the distinction between full stress and reduced stress, as found, e.g. in compounds in Germanic languages. It would no doubt have been methodologically preferable to start this study of Danish stress by a study of full stress vs. weak stress (stressed vs. unstressed syllables) and from there go on to the more complicated problems of reduced stress in compounds. But I had a 20 years old material on compounds which had never been utilized. I thought it only needed a few supplements, which then grew into a rather large corpus. I have, however, used this material and some other recordings made for a different purpose to give some necessary information on weak stress (section V.A). The Fo differences between stressed and unstressed syllables in Danish have been thoroughly investigated by Nina Thorsen, but there are hardly any published results for intensity and duration measurements in Danish stressed and unstressed syllables.

As stress in Danish compounds has not been investigated instrumentally before, this is a preliminary pilot study. For such a first study you may (1) choose a well delimited material, perhaps consisting in nonsense words, read by speakers of the same dialect, as a safe starting point for later enlargements of the field, or (2) you may wish to get a wider, but more superficial overview, e.g. using various types of compounds in natural sentences spoken by subjects with different dialectal

background, in order to get an impression of the main problems and find the points which would be worth a more detailed investigation. I have chosen the latter approach. But this, of course, implies that not all complicating factors can be kept apart, and the conclusions must therefore necessarily be preliminary.

II. THE DANISH PROSODIC SYSTEM

A. VOWEL LENGTH AND STØD

Danish has distinctive vowel quantity, which has quite a considerable functional load in words of two or three syllables (e.g. /mi:lə milə/). There is hardly any concomitant difference in vowel quality except for /a/, /o/ and /ɔ/. Postvocalic consonants do not show any consistent difference in duration after long and short vowels (Fischer-Jørgensen 1964, and Petersen 1973).

Almost all monosyllabic words, as well as final stressed syllables of polysyllabic words, with long vowel have "stød". The same is true of the great majority of monosyllabic words and final stressed syllables with short vowel plus sonorant consonant. "Stød" is a specific accent (transcribed [ʔ]), which in its typical form is characterized acoustically by a drop in intensity and Fo, often ending in creaky voice in the latter half of the long vowel or the beginning of the sonorant consonant after the short vowel. But the creaky voice may be practically absent, and there is, on the whole, a rather large variation in the manifestation of the stød. Its presence is to a large extent rule governed (it corresponds historically to accent 1 in Swedish and Norwegian), but there is a number of minimal pairs, mainly disyllabic words with the endings *-en*, *-el*, *-er* where one member of the pair is an old monosyllable, (e.g. *løber* [lø:ʔbɒ] 'runs' vs. *løber* [lø:bɒ] 'runner') and also some monosyllables with short vowel plus sonorant consonant (e.g. *ven* [vɛn] 'friend' vs. *vend* [vɛnʔ] 'turn!'). (For the rules governing the presence of stød see, e.g., Aage Hansen (1943), Hjelmslev (1951 (~~1983~~)), and Basbøll (1972 and 1971-1973); for its manifestation see Smith (1944) and Petersen (1973).

B. STRESS

1. GENERAL (TRADITIONAL) DESCRIPTION

Stress is traditionally described on an auditory basis, and a language may be characterized by its distribution of stresses in simplex words, compounds, phrases, and utterances. (In the following the accent marks ˊ and ˋ are used to indicate main and secondary stress, respectively, in orthographic examples, whereas ˈ and ˌ are used in phonetic transcriptions, weak stress (= unstressed syllable) being left unmarked.)

The Danish stress system is very similar to that of German or Dutch. Simplex native words consist (with very few exceptions) of an initial stressed syllable with full vowel, followed by 0-2 (rarely 3) unstressed syllables with schwa. Foreign words may, however, have stress on any syllable and full vowels in unstressed syllables. Unstressed syllables do not have stød and have only short vowels.

Compounds and derivatives have only one main stress in the standard language with the exception of a very specific type, in which the first member is an intensifying prefix, e.g. *bómbesíkker* 'absolutely sure' compared to *bómbesikker* 'protected against bombs'. I should prefer to regard this as a lexicalized emotional accent. Nina Thorsen has called my attention to the type *júləáften* 'Christmas Eve' and *påskemórgen* 'Easter morning', which I should be inclined to regard as sequences of two words completely parallel to *Søndag mórgen* 'Sunday morning', but often written as one word because of their specific meaning.

In some West Jutlandish dialects a large number of compounds are described as having two main stresses (cp., e.g., Ejskjær 1954). It remains to be investigated whether this type is phonetically different from a syntactic combination of two words and how it is perceived by the dialect speakers. In a number of cases it will be signalled as a compound by means of other features, e.g. lack of stød in the first member, and the identification as a compound will be supported by the relatively large individual variation, some speakers using two main stresses and others stress reduction in the same words.

The majority of compounds and many derivatives in Standard Danish are characterized by having main stress on the first member and secondary stress on the second member, e.g. *en sórtmèjse* 'a coal tit' vs. *en sórt méjse* 'a black tit'. (Only a few derivative suffixes have weak stress, viz. *-ig*, *-lig*, and probably *-ing* and *-isk*, and several, particularly foreign, suffixes have main stress.)

In more complex compounds and derivatives there may be a graduation of secondary stresses depending on the construction, e.g. *(dýrskùe)plàds* 'cattle showground' vs. *krígs(skùeplàds)* 'theatre of war' (where the stronger secondary stress is indicated by "). There is, however, mainly for rhythmical reasons, a tendency to shift the strongest stress to the last member, particularly after monosyllabic first members, thus ˊ ˋ to ˋ ˊ, and this pattern has been lexicalized in several cases.

A limited number of complex compounds and derivatives have main stress on the second member, e.g. *Langfrédag* 'Good Friday', particularly certain types of derived compound adjectives: *barnágtig* 'childish', *sandsýnlig* 'probable' (more often than in German, but less often than in Dutch).

The second member of a compound with main stress on the first member retains stød and vowel length; and in quite a number of cases a second member which has no stød as a simplex word even acquires a stød (e.g. *sende* [sɛnə] 'send', but *opsende* ['ɔbsɛn?ə] 'send up'); and the first member of the compound, when it is monosyllabic, normally loses its vowel length and stød, e.g. *hus* [hu:?s] 'house', but *husmand* ['hus,man?] 'smallholder'. But when the main stress is on the second member of the compound, the first member has not only reduced stress but loses its stød and, at least when it is monosyllabic, also its vowel length, e.g. *løs* [lø:?s] 'loose' *løsagtig* [løs'agdi] 'prostitute'.

Prefixes are often unstressed, e.g. always *be-*, *er-*, whereas *u-* is vacillating. As the root morpheme *for* has stress and the prefix *for-* is unstressed, we get minimal pairs like *fórbènet* 'the foreleg' and *forbénet* 'ossified, pigheaded'.

Danish phrasal stress differs from e.g. German or English, in that in a neutral Danish utterance all main stresses are of the same weight. Danish has no obligatory "sentence accent" or "focus", and there is no tendency to have a heavier stress in the last stress group. Nor is there any general tendency to stress the second member of a noun or verb group more than the first. On the other hand, a number of special close-knit constructions have reduction of stress on the first member and are clearly distinguished from the above mentioned sequences of equal stresses. These two factors are obviously connected. Examples of stress reduction, "unitary stress" (or "unit accentuation", to use Rischel's terminology (1982)) are *et glas øl* 'a glass of beer', *fru Hánsen* 'Mrs. Hansen', *gå i vándet* 'go swimming' in contradistinction to *gå i vándet* 'walk in the water', *læse románer* 'read novels' in contradistinction to *læse románen* 'read the novel', *stå óp* 'get up' but *stå óp* 'stand'. These latter distinctions are characteristic of Danish, and a large number of minimal distinctions could be quoted. Some rules are given by Jespersen (1922) and a thorough discussion with formulation of new rules is found in Rischel 1980 and 1982. By this reduction the reduced member loses stød and, at least when it is monosyllabic, also vowel length, i.e. it is treated in the same way as the first part of compounds with main stress on the second member. Rischel uses the term "unit accentuation" in both cases (for compounds: "intra-word unit accentuation").

2. NUMBER OF STRESS DEGREES (VARIOUS PHONOLOGICAL DESCRIPTIONS)

It has been discussed how many degrees of stress should be set up on the basis of the above mentioned facts. Jespersen (1897-99 and 1922) sets up four degrees (apart from emphasis), but at the same time he remarks that this is arbitrary. And if it is done on a purely auditory basis, he is right that it is arbitrary.

Andersen (1954) sets up four degrees of what he calls "weight" (he uses "stress" in a somewhat different sense): "levissimus", "levis", "semifortis" and "fortis". They are mainly defined by their segmental structure and their possibility of having distinctive vowel length and stød. Levissimus syllables only contain the vowel [ə]; levis syllables may contain all vowel qualities, but do not distinguish long and short vowels and cannot have stød. This covers weak syllables in foreign words (e.g. *veránda*), weak suffixes (*-ig*, *-lig*, *-ing*), syllables reduced by unit accentuation, and a few particularly weak second members of compounds (e.g. *móndag* [man?da] 'Monday'). Both semifortis and fortis may distinguish long and short vowels and may have stød, but the fortis syllable is perceived as dominating the semifortis syllable. Fortis thus covers what was called main stress in compounds above, and semifortis covers reduced stress on second members of compounds. Other Danish dialectologists have taken over these four degrees and their definitions (although they generally allow levissimus syllables to contain the vowel *i* (e.g. Ella Jensen 1944 and Inger Ejskjær 1954), but they call them degrees of stress, not of weight.

A surface phonological description may combine the criterion of syllable structure with the commutation criterion.

"Fortis" and "semifortis" are evidently commutable, cp. the example *en sórt méjse* 'a black tit' and *en sórtmèjse* 'a coal tit' above. There are many examples of this type. It may also be possible, at least for a very distinct style of speech, to set up two degrees of secondary stress based on examples of the type *dýrskùepl̀ds* vs. *krĭgsskùepl̀ds*, mentioned above.

The distinction between levis and levissimus is more problematic. If [ə] is described as a variant of /e/ and /ɛ/ as done by Hjelmslev (1951), there must be a separate very weak stress level conditioning this reduction of vowel quality. I would, however, find it simpler to regard [ə] as a separate phoneme which may sometimes be in free variation with other phonemes. In this case the syllables with [ə] need not constitute a separate stress level.

If, for the time being we consider syllables with weak suffixes like *-ig*, *-lig* and weak syllables in foreign words, like *veránda melodĭ*, etc. as constituting phonologically unstressed syllables, it can be stated that there is commutation between this level and the level of main stress, although there are very few minimal pairs, e.g. *plástik* 'PCV' vs. *plastík* 'plastic gymnastics', and *bílligst* ['bilisd] 'cheapest' vs. *bilíst* [bi'lisd] 'motorist'. Rischel (1970) succeeded in giving rules for the stress placement in Danish morphemes, including most foreign words, but there were some exceptions, e.g. *Áugust* (name) vs. *augúst* 'August', so that stress is not completely predictable.

Syllables with reduced stress due to unit accentuation create difficulties. There is no perceptible difference between pre-

tonic syllables in foreign words and the first part of compounds or phrases with unit accentuation, e.g. *sandálen* 'the sandal' vs. *sandsýnlig* 'probable', or *en banderóle* 'a revenue label' and *en bande røvere* 'a gang of robbers' (and in this paper they are not provided with any stress marks). On the other hand, the distinction between this type of stress reduction and secondary stress is not clear. There are no commutation examples since the syntactic surroundings are always different. The distinction must therefore be based on the possibilities of distinctive vowel length and stød. This criterion is, however, not always quite reliable. In complex compounds there may be loss of stød in syllables with second degree reduction in medial position, e.g. in *vánd* [van?] 'water' in *úndervàndsbåd* 'submarine'; on the other hand, it happens in very distinct speech that a disyllabic word reduced by unit accentuation retains a weak stød, e.g. *han springer óp* 'he jumps up', and a long vowel in a disyllabic word is rarely so strongly reduced in duration that it merges with a phonologically short vowel, e.g. there is a small difference of duration between *læse óp* 'to read aloud' and *læsse óp* 'to load'. Finally, in syllables with short vowel plus obstruent where neither vowel length nor stød are involved, it is a real problem whether there is any difference of prominence, and the syllables must then be assigned to different degrees of stress by generalization from the clear cases. But this may be considered a rather dubious procedure.

In normal conversation - and particularly in allegro speech - there may be what Rischel (1982) calls "loss of ranking difference" or "shrinkage of structure", so that all stresses below main stress are reduced to weak stress. In that case secondary stress in compounds may coincide with weak stress, e.g. with the stress of weak suffixes, as *-ig* and *-lig*, or posttonic syllables in foreign words. Rischel assumes that this happens. In an oral communication Rischel has given the example *útŷske* 'monster' vs. *emfátìske* 'emphatic'. In this case the position after the main stress is the same, so that one might in principle apply the commutation test, but it is hardly possible to find minimal pairs. Personally I am inclined to believe that there is a small difference in syllables immediately after the main stress, e.g. in *býbùs* 'town bus' vs. *rébus* 'rebus', or in *natúrgàs* 'natural gas' vs. *Dálgas* (name), or *úlìge* 'unequal' vs. *mílige* 'possible', but not if there is an intervening weak syllable, in which case the weak derivative ending receives a certain rhythmically conditioned prominence, e.g. *péngegrìsk* 'avaricious' = *málerisk* 'picturesque', or *fláskegàs* 'bottled gas' = *ánanas* 'pineapple' (foreign words may even get stød in this case, e.g. *Páradis* ['pʰɑɑˌdi:ʔs] 'Paradise').

In a more abstract phonological analysis it is evidently possible to reduce the number of stress degrees considerably, deriving most of the differences from the syntactic structure including the relations within compounds. I have argued briefly for this point of view in an old paper (1961 (1948)), maintaining that it is completely arbitrary to set up 3 or 4 degrees

of reduced stress in a language. It is only a way of stating its syntactical possibilities. The important thing is always a comparison between two members and two members only, but this comparison may take place on different levels. It is not possible to identify the degree of stress from one syntactic group to another. Hjelmslev (1951) sets up two degrees of stress in Danish, and Rischel (1972) has discussed these problems in much more detail. He states that it is possible to describe the facts by means of cyclical rules, but that it is simpler to derive the prominences in one operation directly from the syntactical tree structures. Basbøll (1978) finds it still simpler to base the rules on boundaries of different degrees. One thus comes down to a distinction of only two phonological stresses (cf. also Liberman and Prince (1977)).

3. THE PROBLEMS OF PHONETIC MANIFESTATION

Reducing the stresses to two on an abstract phonological level does not, of course, make it superfluous to look for acoustic and physiological manifestations not only of strong and weak stress, but also of stress reductions. They still have a function in distinguishing different constructions.

Some of the questions that may be raised are: What are the acoustic properties (if any) distinguishing different degrees of stress and different types of stress reduction (apart from stød, vowel length and specific vowel quality ([ə]))? Is it duration, Fo, or intensity, or a combination of two or all of them, and are these combinations different in different types of reduction? In the first place one might compare main stress and weak stress. The material used in the present investigation was, however, not intended specifically for this purpose, and it is rather limited what can be said about duration and intensity, whereas the Fo contours were so regular in spite of segmental differences that they have been treated in more detail. The main purpose was a comparison between main stress and secondary stress (of the first degree), e.g. *mále bøtten* and *málebøtten*, and between secondary stress and stress reduced by unit accentuation. Although they do not occur in the same syntactic surroundings, they may contain the same segments and occur in the same prosodic surroundings, e.g. *Ótto tog málebøtten frém* 'Otto took out the painting box' and *Ótto vil mále bøtte fém* 'Otto will paint box number five'. As for the difference between secondary stress and weak posttonic stress, I have only (at the last moment) analysed one pair: *útỳske* vs. *Herrenhútiske* (or *polítiske*).

4. STRESS GROUPS

On the preceding pages the Danish prosodic system has been seen in relation to the grammatical structure, to simplex and complex words and phrases. This is useful for a comparison with other languages, and as a background for the description of the acoustic manifestation. But when describing this mani-

festation it may be more useful to start from actual utterances with various stress reductions, and to divide the utterances into stress groups each containing one and only one main stress. At the abstract level where the reduction rules operate, the boundaries between such groups must be syntactically determined, e.g. *óverlægen / drák / et glas øl* 'the chief physician drank a glass of beer', where *lægen* is reduced in relation to *óver*, and *glás* in relation to *øl*. This is the type of boundaries used by Rischel (1982) and Basbøll (1972) for the purpose of the phonological analysis of reduction rules, and also by Andersen (1954). However, for a phonetic description it may be different. That will depend on the degree to which syntactic boundaries are reflected in the prosodic structure. There may be expected to be various interferences in different norms and styles of speech. For Advanced Standard Copenhagen (ASC) Thorsen considers each prosodic stress group to start with the stressed syllable, as it will be described in more detail in the next section.

III. PREVIOUS DESCRIPTIONS OF THE ACOUSTIC MANIFESTATION OF STRESS IN DANISH

Jespersen (1897-99, 1914, 1922) defines stress physiologically. A stressed syllable is pronounced with a higher amount of total energy, including expiration, vocal cord movements and supraglottal movements than an unstressed syllable, and the listener is able to judge the energy used by the speaker by comparison with the way he would pronounce the sequence himself. Stressed syllables may be higher or lower in pitch than unstressed syllables. They are normally higher, and this is the case in Danish. The higher pitch of stressed syllables in Danish is also assumed by Bo (1933) and Jerndorff (1896, quoted by Bo). But Jespersen and Bo state that there may be deviations in particular styles. Bo finds, e.g., a tendency for small children to reverse the pattern. But in order to find examples of a normal lowering of stressed syllables these authors refer to foreign languages. Jespersen mentions Swedish and Norwegian as examples of languages where the stressed syllables may have lower pitch. Forchhammer (1954) quotes Sievers for the observation that this type of pitch movement is used in Southern German dialects, whereas in Danish it may be a sign of irritation, or it may be an individual peculiarity which will be very unfortunate for one who wants to become an actor. None of these authors refer to the occurrence of this peculiarity in Copenhagen speech. Arnholtz (1939-40) mentions the low pitch level of stressed syllables as a recent development in vulgar Copenhagen speech which is now spreading to other classes. He considers this to be a very dangerous development which will render the whole of our classical poetry inaccessible (!), and which must therefore be fought down. (In the following issue of the same periodical (1941) Bergsveinsson publishes an Fo curve based on a gramophone record spoken by Arnholtz, and which shows low falling Fo on stressed syllables.)

Kroman (1947) has a different attitude. He states that there is no standard pitch movement in Danish, but different norms in different parts of the country according to the dialect of the area in question. Most Danish dialects have higher pitch on stressed syllables than on unstressed syllables. But in Northern Zealandish it is different. The main part of North Zealand has a low falling-rising pitch on stressed syllables with a higher pitch on following unstressed syllables in words without stød, but a rising-falling contour with lower pitch on the following unstressed syllable in words with stød, whereas a few dialects on the East coast of Zealand and on Amager have low rising pitch on the stressed syllable in all word types (and the same is true of Bornholm). The Copenhagen pronunciation is said to be influenced both by the coastal dialect and by other North Zealandish dialects. Poul Andersen (1949) is very sceptical as to the existence of a difference between words with and without stød in North Zealand, but agrees that there is low pitch on the stressed syllable and high pitch on a following unstressed syllable. He also mentions this in his textbook (1954) and adds that the same is often heard in Copenhagen speech; but in Standard Danish the stressed syllable has higher pitch, and in disyllables the contour is rising-falling. Andersen also describes the stress of compounds with main stress on the first member. This first member is dynamically stronger, and is said on a higher pitch than the second member (except at the end of questions). Moreover, the two members are temporally closer together than separate words, and the first member is characterized by a dynamic and tonal delay or gliding on, announcing that more is coming. This is no doubt a very good description of Andersen's own pronunciation which (although he is from Copenhagen) is not in its prosodic aspects influenced by the younger Copenhagen norm but rather by a lifelong occupation with Funish dialects, and I think it also covers the conservative standard (described by Jespersen and Bo) which I have spoken myself. Smith and Thyme (1978) consider the tempo to be the most important feature in compounds.

In a long series of studies (1976-1983) Nina Thorsen has demonstrated convincingly that low pitch in stressed syllables is now the general norm in Standard Copenhagen. Her informants are relatively young (in their mid twenties to mid forties), and in her first papers she cautiously talks about "Advanced Standard Copenhagen", but in her latest papers she describes it as simply Standard Copenhagen, and this is certainly justified. The quotations above from older phoneticians seem to indicate that it is a relatively recent phenomenon in the higher sociolect, but the intrusion into the higher norm may well have taken place earlier than these quotations seem to indicate. From my childhood, about 60 years ago, I remember very well the low pitch on stressed syllables in the speech of my Copenhagen cousins, and also in the speech of an uncle and aunts from Copenhagen, born in the eighties of the last century, and that was the higher sociolect. My attitude to this norm was very negative at that time (that is why I remember it clearly), but I have adopted it since then (though

it took me a long time to realize that I had changed my way of speaking).

Thorsen (e.g. 1979 and 1980c) gives the following description of the relation between stress and Fo in the Copenhagen Standard: A Danish utterance may be divided into prosodic stress groups, each beginning with a syllable with main stress. The stressed syllable is said on a relatively low pitch, and from there the pitch glides or jumps (about 2-3 semitones) up to the first posttonic syllable. The following posttonic syllables have gradually decreasing pitch. If there are less than four unstressed syllables they generally remain above the level of the next stressed syllables, and if there is only one posttonic syllable, it may remain at the level of the preceding stressed syllable. Unstressed syllables preceding the first stress group are normally said on a lower pitch, at least after a pause. The extent of the fall depends on the number of posttonic syllables and on the individual. Some speakers have steeper falling slopes than others. She places the boundary between the prosodic stress groups at the start of the stressed syllable and not in accordance with syntactic boundaries, because she has found that in Advanced Standard Copenhagen syntactic boundaries are not reflected in the Fo contour (e.g. 1980c), and the boundary is placed before and not after the stressed syllable because the relation between the stressed syllable and the posttonic syllables is more stable and can be described in a much simpler way than the relation between the stressed syllable and the preceding unstressed syllables. More specifically, the prosodic stress group boundary seems to be located immediately before the stressed vowel, excluding any initial consonants which associate tonally with the preceding stress group, if any, or constitute a prosodic unit apart (Thorsen 1983a, p. 189-190, and 1983b).

The Fo patterns of the stress groups are superposed on the general intonation contour, which is decreasing in statements, level in questions not otherwise characterized as questions, and with intermediate slopes in questions characterized as such by other means (inversed word order or question words) and in non-final phrases. The intonation contour is carried by the stressed syllables,which thus have successively decreasing pitch in statements and the same pitch in questions. This description is summarized graphically in figure 1 (from Thorsen 1980b, p. 122).

The intrasyllabic Fo movements are determined by the Fo pattern and by segmental factors. Long stressed vowels are generally falling-rising with predominant fall, short stressed vowels are falling (there is thus truncation, not compression). Both may, however, be rising in the first stress of the utterance and in cases where the preceding unstressed syllable(s) go(es) down below the next stressed syllable (1980b). The first posttonic syllable (which is placed at the peak of the pattern) may be falling, rising-falling, or (more rarely) rising. All following posttonic syllables have falling pitch.

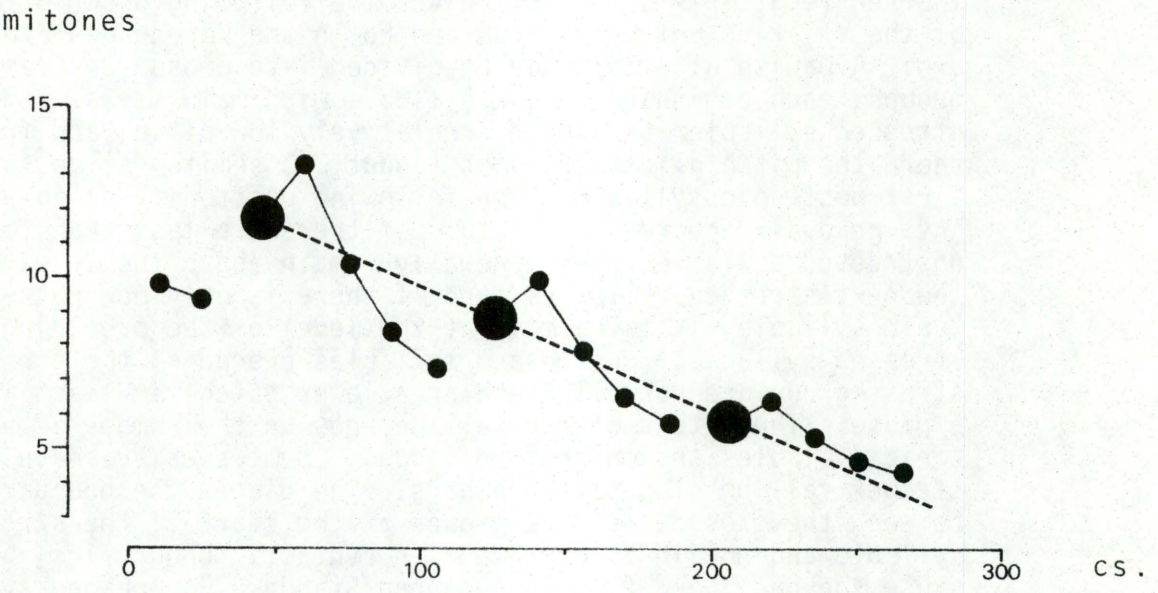

Figure 1

Thorsen's model for the course of fundamental frequency in a short terminal declarative sentence in Copenhagen Standard Danish. The big dots represent stressed syllables, the small dots unstressed syllables.

Secondary stress in compounds is only mentioned briefly (1980b, p. 125 footnote). Syllables with secondary stress are said to behave tonally like unstressed syllables (which is also in accordance with my own earlier observations), whereas they resemble stressed syllables in all other respects (vowel quality, vowel quantity and stød).

Thorsen recognizes three degrees of stress: main stress, secondary stress, and weak stress. Danish has no obligatory sentence accent, but there may be emphasis for contrast, which is characterized by a high rising pitch on the syllable in question, and (more important) a deletion of the Fo deflections (the rises from the stressed syllables) of the neighbouring stress groups to the effect that the immediate surroundings except the first posttonic syllable fall away sharply from the stressed syllable of the emphasized word (1979 and 1980b).

In a paper with Jul Nielsen (1981) Thorsen gives brief descriptions of Fo patterns in Jutlandish. The material is limited, a small number of sentences read by two dialect speakers from Thy in Northern Jutland and two speakers of Regional Standard Danish from the Århus area, but the differences from the Copenhagen pattern are obvious. All four informants have high

rising pitch on the stressed syllable and lower falling pitch on the posttonic syllables with the difference that the first posttonic syllable starts at a rather high level in the speech of the Århus informants, but very low in the sentences of the Thy dialect speakers.

Schematically the three patterns are given in figure 2 (Thorsen 1982a):

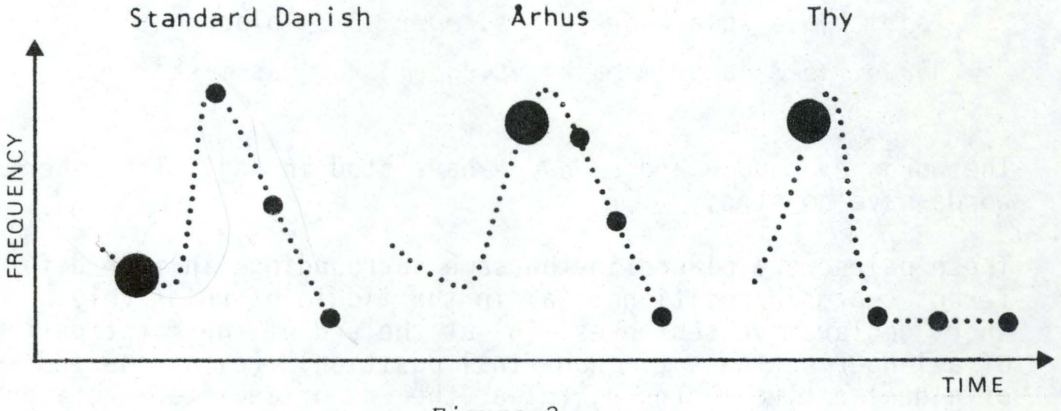

Figure 2

Stylized stress group patterns according to Thorsen (1982a) in three types of Danish: Standard Danish, Århus regional speech, and Thy dialect in West Jutland. The big dots represent stressed syllables, the small dots unstressed syllables.

The patterns in Copenhagen and Jutland can be described as inversed, but it is also, according to Thorsen, possible to describe them as the result of different timings in relation to the same undulating Fo wave. This has the advantage that the direction of the intra-syllabic movements can be more or less predicted from their position on the wave.

Thorsen has not published any measurements of duration and intensity, but she has stated that it is her general impression that the hierarchy of acoustic cues for stress in Danish is (1) Fo, (2) duration and quality, and (3) intensity (1980b), in spite of the fact that vowel duration is phonological in Danish and should thus, according to Berinstein, be the least important cue.

IV. MATERIAL, INFORMANTS AND MEASUREMENTS

The present paper is based on two recordings, one from 1961 and one from 1982. The 1961 material was only partly processed at that time and put aside due to lack of time. It is here considered as a pilot investigation and is only partly utilized.

The 1961 material comprised a number of word groups with two main stresses and comparable compounds with main stress plus secondary stress, consisting of the same words. Some had change of stød, and some were rather complicated. For the present investigation therefore only the following were utilized:

sød súppe 'sweet soup' vs. *sødsùppe* 'a kind of fruit soup'

sórt méjse 'black tit' vs. *sórtmèjse* 'coal tit'

sórt kjóle 'black dress' vs. *sórtkjòle* 'blackcoat'

hvás máske 'a grim mask' vs. *gásmàske* 'gas mask'

The words *sød súppe* and *sødsùppe* have stød in [ð]. The other words have no stød.

These pairs were placed in the same surroundings in four different sentence positions: (a) in the middle of relatively short declarative sentences, (b) at the end of the first part of a longer sentence (in non-final position), (c) at the end of a declarative sentence, (d) at the end of an interrogative sentence. (a) or (c) were used as answers to (d), e.g. (d) *Har du nógensìnde sét en sórtmèjse?* (a) *Já, jeg sǻ en sórtmèjse i skóven i går.* 'Have you ever seen a coal tit?' 'Yes, I saw a coal tit in the forest yesterday'.

Moreover, there were a number of word groups with stress reduction due to unit accentuation compared to groups with two main stresses. The following have been measured:

kássen blev sát óppe på lóftet 'the box was stored in the loft'
vs. *kássen blev sat óp på lóftet* 'the box was moved to the loft'
and *han sátte kássen óppe på lóftet* 'he placed the box in the loft'
vs. *han satte kássen óp på lóftet* 'he moved the box to the loft'.

Further measurements were made of the words *en kánde* 'a jug', *en vándkànde* 'a water jug', *en kande vánd* 'a jug of water' and *en tóm kánde* 'an empty jug', placed in the frame *han fandt ... i køkkenet* 'he found ... in the kitchen'. All the sentences used are listed in Appendix I.

This material was read once by 10 informants. Three were left out here because their type of speech was considered to be sufficiently represented by the others. The seven informants whose curves were measured were: (a) BS, born 1922, and HP, born 1938 , both representing "Advanced Standard Copenhagen speech" (ASC); (b) PD, born 1905, EF born 1911, and JR, born 1934, all representing Standard Danish of a somewhat more conservative type (CSC). They have grown up outside of Copenhagen in civil servant families speaking Standard Danish, but they had all lived for many years in Copenhagen; (c) BF, born 1935,

and SR, born 1940, both in Southern Jutland; they speak Standard Danish on a (Jutlandish) dialectal background (DSC). (The sentences with *sórt méjse* and *sórtmèjse* were only spoken by four informants.)

The 1982 material likewise comprised word groups with two main stresses compared to compounds with main stress on the first member, but moreover in various cases comparable word groups with unit accentuation. The words were varied in syllable type and syllable number. The following triplets (and pairs) were recorded:

1 *sød súppe* 'sweet soup', *sødsùppe* 'a kind of fruit soup', *en sød suppedás* 'a pretty kettle of fish' (more idiomatic: *en køn suppedas*)

2 *mát lámpe* 'dim lamp', *nátlàmpe* 'bedside lamp', *mát lampét* 'dim bracket lamp'

3 *Han lod Spíes réjse ságen* 'he let Spies bring the matter up'
Han tog Spíesrèjsen méd 'he included the Spies-travel' (Spies is the name of a well-known travel agent),
Han lod Spíes rejse méd 'he let Spies come along'

4 *Péters vén skáber sig* 'Peter's friend puts on an act'
Nú giver vénskàbet problémer 'Now the friendship gives problems'
Péters vén skaber problémer, 'Peter's friend gives problems'

5 *gás brænder* 'gas burns', *gásbrènder* 'gas burner', *gás brænder néd* 'gas burns down'

6 *måle kássen* 'paint the box', *málekàssen* 'painting box', *måle Casanóva* 'paint Casanova'

7 *måle bøtten* 'paint the pot', *málebøtten* 'the painting pot',
måle bøtte fém 'to paint pot number five', *male bøtten grøn* 'to paint the pot green'

8 *lámme lår* 'lame thighs', *lámmelår* 'lamb's thigh'

9 *det várme apparát* 'the hot instrument', *vármeapparàtet* 'the heater', *varme apparátet óp* 'to heat the instrument'

10 *mís forstår* 'Pussy understands..', *mísforstår* 'misunderstands..', *mís forstår spøg* 'Pussy understands jokes'.

For numbers 3 and 4 the whole sentences are quoted in order to facilitate the translation, but the other words and word groups were also placed in sentences, which were as similar as possible, e.g. *Otto vil måle bøtten straks i mórgen* 'Otto will paint the box immediately tomorrow morning', *Otto tager málebøtten frém i mórgen* 'Otto will take out the painting pot

tomorrow', and *Ótto vil mále bøtte fém i mórgen* 'Otto will paint pot number five tomorrow'. - The words and word groups were always placed in the middle or beginning of declarative sentences since the 1961 material did not show any basic differences between the different positions, and since measurements turned out to be difficult for words placed finally in the sentences. There was also always a stressed syllable before the test word except for the examples *gásbrènder*, *lámmelǎr* and *málekàsse* and their counterparts. The sentences are listed in Appendix II.

As mentioned in section II disyllabics reduced by unit accentuation retain some vowel length and are thus not quite as weak as monosyllabics immediately before a strong stress. Thus, of the above examples only *lampét* is a reliable example of an unstressed syllable with full vowel. A few more examples of this type were recorded in order to be able to compare weak stress and main stress, e.g. *sandálen* 'the sandal' vs.*Sánddàlen* 'Sand Valley' (a place name), *barnágtig* 'childish' vs. *gárnàgtig* 'thread-like'. Moreover, one informant read the words *bílligst* 'cheapest' and *bílist* 'motorist'. A recording of the same two words spoken by five subjects for a different purpose was also utilized.

Finally, secondary stress in a compound was compared to a weak derivative suffix in the pair *útỳske* 'monster' vs. *polítiske* 'political' and *Herrenhútiske* 'Herrenhutish'. These words were also placed in sentences, which are listed in Appendix II.

All sentences were mixed in four different randomizations, and the list was read twice by all informants. There are thus eight examples of each sentence per informant. Most sentences were read by 6 informants, but numbers 5 and 8 were read by only four informants, the pair *barnágtig* and *gárnàgtig* by three, and numbers 3 and 4 only by one speaker.

The lists were mixed with sentences used for measurement of segment duration (Fischer-Jørgensen 1982). Those sentences contained some compounds, which can be compared to the first member used as a simplex, i.e. *náttefròst*, *Dánnevàng*, *Dánfòss*, *mándfòlk*, *mándefàld*. They also contained a number of words with weak syllables in *-e* [ə] and *-er* [ɒ] or [ɔ], which together with some words from the main corpus were used in a more cursory analysis of the difference between such syllables and syllables with main stress. The words used were (1) in sentence medial and final position: *dánne*, *nátte*, *báste*, *lákke*, *mĭsse*, *mánse*, *sønner*, *láser*, *kaláser*, *pláner*, *spĭser*, *mulátter*, *básser*, *polákker*; (2) in sentence medial position only: *dánse*, *básse*, *tále*, *Dánnevàng*, *mĭssekàt*, *mǎleskĭve*, *tálestrøm*, *náttefròst*, *sønnerne*, *máser*, *plánerne*, *básserne*; (3) in sentence final position only: *máse*, *mále*, *ládte*.

The main informants used in this investigation were the same as those used in the investigation of segment duration (1982). There were 6 main informants: NR, born 1942, representing Advanced Standard Copenhagen (ASC), EF, born 1911, represent-

ing a somewhat more conservative norm (CSC), PH, born 1947, speaking Standard Danish with a very slight tint of Lolland regional language. His deviations from the ASC norm are, however, probably due rather to the more conservative norm of his parents than to Lolland dialect. He is therefore regarded as a CSC speaker. Moreover, OT, born 1928 in Himmerland in East Jutland, SR, born 1940 in Hjerting in South Jutland, IE, born 1926 in Vinderup in West Jutland, all speaking Standard Danish on a perceptible Jutlandish basis, which is relatively weak for OT, but very clear in the case of IE. In his treatment of weak syllables OT belongs rather to the CSC group, but in the contour of compounds he is in some respects closer to the other speakers with Jutlandish background, who will here be called DSC speakers. All main informants have lived in Copenhagen for many years (between 16 and 52 years). The triplet *mále kássen* etc. was not read by SR, but by two further informants, NK, born 1915, speaking Standard Danish with a perceptible Funish accent, and by BJ, born 1946, speaking Standard Danish with a perceptible Jutlandish accent. (Somewhat more detailed information is given in Fischer-Jørgensen 1982.)

Some of the sentences were also read by a number of dialect speakers. The pair *mále bøtten* and *málebøtten* was read by four Funish dialect speakers (LA, MA, HV and IP) and two speaking the Regional Standard Danish (RSD) in Odense on Funen (EK and EH). IP also read the pair *mát lámpe / nátlàmpe*, and this pair was also read by a speaker of the lower Copenhagen sociolect (ST). The same two pairs and, moreover, the pairs *Sánddàlen / sandálen* and *sød súppe / sødsùppe* were read by six bilingual dialect speakers from Jutland, who read the sentences both in their dialect and in their Regional Standard Danish, viz. TA from Thy, EA from Mors, JD from Fjends Herred, BT from Uldum (all speaking Western Jutlandish); PN from Vendsyssel (Northern Jutlandish), and PM from Himmerland (Eastern Jutlandish). The same pairs were finally read by LH, who speaks Århus Regional Standard Danish. (More detailed information on the informants is given in Fischer-Jørgensen 1982.)

The dialect speakers also read a number of sentences containing simplex words used for the measurement of segment duration. These sentences are used as basis for a cursory analysis of unstressed syllables, and particularly the general Fo-contour. Recordings of six speakers of East Jutlandish dialect, and seven speakers of North Zealandish were used for the same purpose.

The recordings of the main informants were made on a semi-professional tape recorder in a sound-treated room at the Institute of Phonetics, University of Copenhagen.

The Jutlandish speaker PM, the Funish speaker JP, and the Copenhagen speaker ST were recorded in Copenhagen. The recordings of the other Jutlandish speakers were made on a Nagra tape recorder at the Institute for Jutlandish Language and Culture at the University of Århus. Two recordings of Funish

speakers were made at the Institute of Linguistics in Odense. The recordings of the other Funish speakers and those of the Zealandish speakers were made in their private homes.

All tape recordings were processed at the Institute of Phonetics in Copenhagen; they were registered on mingograms, comprising a duplex oscillogram, an Fo curve, and two intensity curves (one unfiltered, one highpass filtered at 500 Hz).

The duration of all segments and of the whole word (or member of a compound) was measured, generally with an accuracy of ± 2.5 ms. However, [ø] and [ðʔ] in *sød* could not be delimited, and the same was often true of [l] and [ə] in [ma:lə].

The words *vârmeapparàtet* and *vârme apparât(et)* made difficulties and could only be partly segmented (these examples were intended specifically for a comparison of the intensity of the vowels). In some cases the initial or final consonant could not be delimited from the surrounding words (e.g. *en mât lâmpe*). The dialect recordings presented considerably more problems.

The Fo contours were traced for three examples of each word and sketched for all words. They turned out to be extremely stable, so that it was considered superfluous to measure all curves and to construct average curves. In unstressed syllables the duration is so short that no glide can be heard, and one might choose to indicate only the point in time at a distance of 2/3 from the start of the vowel, which according to Rossi (1971a) and Rossi et al. (1981) corresponds to the perceived pitch level, but for stressed vowels some glides may be heard, and it is possible that the movement of a following sonorant should be added, so for the time being I have preferred to simply trace the Fo movement and to present some stylized curves describing the main features. According to various studies in other languages (e.g. Fry 1958), the absolute distance in Fo is not important for the perception of stress. It is generally found to be an all-or-none phenomenon. However, this may not always be the case. In a perceptual experiment with synthesized isolated two-syllabic nonsense words and higher Fo on the second syllable Rosenvold (1981) found that Danish ASC listeners heard the first syllable as stressed when the second was much higher, and the second syllable as stressed when it was only slightly higher (but there was a fairly clear cross-over point). Thorsen (1983b) found an opposite tendency, and assumes that the second syllable in Rosenvold's test material may have been too high to be a likely stressed syllable in a one-word non-emphatic terminal declarative utterance.

As for the intensity I have measured peak intensity in the vowels, but because of difficulties with the calibration the measurements were in mm. On the whole, the measurement of intensity gives many problems because the relations to perception and to Fo are not sufficiently investigated. Very often a secondary stress has a higher intensity than the main stress in Danish, probably because Fo is higher. But what do we perceive? I will return to these problems in section V.A.1.

V. RESULTS

In the following sections different speakers will be compared. It may therefore be practical to list the informants for Standard Danish again, divided into groups.

		1961 material	1982 material
ASC speakers:	Speakers of Advanced Standard Copenhagen	HP, BS	NR
CSC speakers:	Speakers of a somewhat more conservative norm	PD, JR, EF	EF, PH, OT
DSC speakers:	Speakers with a clearly audible Jutlandish background	BF, SR	IE, SR
	Speaker with a clearly audible Funish background		NK

A. THE RELATION BETWEEN MAIN STRESS AND WEAK STRESS

As the material was not directly intended for the purpose of comparing main stress and weak stress, it is rather heterogeneous in this respect, but it contains a large number of both categories, and a few examples were constructed specifically with this comparison in mind.

1. VOWEL QUALITY AND STØD

Most unstressed syllables in native Danish words have the vowels [ə] or [ɒ], or a syllabic sonorant. *-er* is pronounced [ɒ] in a more conservative norm, [ɔ] in a more advanced norm. It is here transcribed [ɒ] in accordance with my 1982-report on segment duration. With the exception of [ɒ] none of these sounds can appear in stressed syllables, and they are thus a reliable signal for lack of stress (= weak stress). But many unstressed syllables in foreign words and in Danish words that usually or occasionally lose their stress in the sentence have full vowels, so that a full vowel does not give any information about stress. On the other hand, only syllables with main or secondary stress can have stød, so that a stød is a reliable signal of stress. Just to give an idea of the extent to which these cues may be used, I counted their number in a 1000 syllable corpus from four not very technical book reviews in a newspaper. There were 142 occurrences of stød and 189 occurrences of schwa or syllabic consonants. This means that 331 or 33% of the syllables were characterized as stressed or unstressed by these means.

Stød and schwa (or sonorant consonant) are thus important cues for stress in Danish, but not sufficient cues.

2. DURATION

Table I gives a survey of the duration of unstressed vowels in the main material. There were 92 averages of the vowel [ə] in utterance medial position, distributed over seven informants. [ə] is always very short in this position, the grand mean for all speakers being 4.4 cs. Since the material was not intended for the measurement of unstressed vowels, it is rather unsystematic as far as the quality of the preceding stressed vowel is concerned. In most cases the preceding stressed vowel was a short [a] which is, of course, much longer than [ə], the average difference being 8.3 cs. But [ə] was also significantly shorter (at the 1% level) than preceding short vowels with smaller intrinsic duration than [a]. In utterance final position the delimitation was rather uncertain.

There were 84 individual averages of the weak ending *-er*, pronounced [ɔ] or [ɒ]. It is considerably longer than [ə], the grand mean in utterance medial position being 7.2 cs. It is always significantly shorter than a preceding stressed short vowel of the same intrinsic duration ([a]). In proclitic position (in the prefix *for-*) it is shorter than in enclitic position. It is even shorter than a preceding stressed [i].

In four averages the quality of the stressed and the unstressed vowel were identical ([a]). Here, too, there was a significant difference in duration (1.9 cs) between the two vowels.

Some examples were constructed with the specific aim of comparing stressed and unstressed syllables with the same (or almost the same) segmental structure (see section IV), i.e.: *Sánddàlen / sandálen*, *gárnàgtig / barnágtig*, *en mát lámpe / en mát lampét*, *billigst / bilíst*, and the nonsense words *mámam / mamám*. In every pair it is possible to compare a stressed syllable in one member with an unstressed syllable in the other member of the pair, and in the two last pairs both syllables can be compared. Moreover, the stressed vowel can be compared with an unstressed vowel of the same quality in the same word or phrase in *barnágtig*, *en mát lampét*, and in both members of the *bilíst* and *mamam* pairs. As for *sandálen* this is not possible, because *a* and *l* could not always be delimited and because of the stød in the *a* of *dalen*.

The main durational differences are given in table II, and more detailed measurements for the individual speakers together with information on Fo and intensity are found in Appendix III, 1-5. For two of the pairs there is more than one reading by NR. They have been averaged before the grand mean of all speakers was calculated.

The first three pairs were placed in the middle of sentences with four stress groups. The pair *billigst / bilíst* was placed in a frame *det er ... de siger*, and *mámam / mamám* were said in the frame *de sagde ...* The pronunciation of this latter pair did not always sound quite natural (although the second member has a meaning as a nursery word for food), and for

Table I

Duration of unstressed vowels in Danish (in cs). N = number of individual averages, each comprising 8 tokens. Measure (a) in final position includes final weak vibrations, (b) stops approximately when the formants stop. ɒ *(1) is posttonic,* ɒ *(2) is pretonic.*

A. utterance medial position

	NR	PH	EF	OT	BJ	SR	IE	NK	av.
	(N)	(N)	(N)	(N)	(N)	(N)	(N)	(N)	
ə	(16) 4.3	(16) 3.3	(26) 4.4	(14) 4.3	(7) 6.1	(6) 4.3		(7) 4.4	4.4
(1) ɒ	(15) 6.8	(15) 7.4	(24) 7.1	(15) 7.4	(5) 8.9		(5) 6.8	(5) 6.3	7.2
(2) ɒ	(3) 5.2	(3) 3.8	(5) 5.3	(3) 6.4		(3) 5.3	(3) 6.9		5.5
i	5.3	(1) 6.1	(1) 5.8	(1) 5.8	(1) 6.5		(1) 8.4		6.3
a	(2) 6.0	(1) 6.5	(1) 5.5						6.0

B. utterance final position

	NR		PH		EF		OT			
	(N) a	b	(N) a	b	(N) a	b	(N) a	b	a	b
ə	(4) 9.2	5.3	(4) 6.6	4.6	(12) 8.7	5.7	(5) 6.6	5.1	7.8	5.2
ɒ	(3)13.9	8.0	(3) 8.5	5.7	(15)10.0	7.0	(3) 9.9	6.7	10.6	6.9

Table II

Differences in cs between stressed and unstressed syllables and vowels in comparable word pairs (A), and between vowels in consecutive syllables of the same word (B). Numbers in parentheses indicate the number of individual averages, each comprising 8 tokens.[1]

	diff.	'mad[2] 'lambə 'mad lam'pʰɛd	'san,da:ʔlɳ san'da:ʔlɳ	'ga:n,agdi ba(:)n'agdi	'bilisd[3] bi'lisd	'mamam ma'mam	bi'lisd 'bilisd	ma'mam[4] 'mamam	av.
	N	(6)	(6)	(3)	(5)	(6)	(5)	(6)	
A	vowel	4.3	2.4	6.9	2.7	2.9	1.7	0.8	3.2
	syll.	7.4	6.8	10.2	6.7	4.8	5.2	3.1	6.3
B	vowel	'mad-lam 3.4	'bi-li 1.4	'ma-ma 1.7					2.2
	vowel	ban-'agd -3.6	bi-'li -3.0	ma-'ma -2.0					-2.9

[1]) NR made three readings of *billigst/bilist* (there are thus 24 tokens) and two readings of *Sánddàlen/sandálen* (16 tokens)

[2]) *bdg* are generally voiceless.

[3]) *-st* was left out in *billigst/bilist* (*t* could not be delimited, and *s* was of approximately the same duration; the *g* in *billigst* is not pronounced).

[4]) The last *m* in *mámam* and *mamám* was not included, because it could not be delimited.

speaker IE they sounded so unnatural that they have been left out in the grand mean.

It appears from table II A that the stressed syllable is always considerably longer than the corresponding unstressed syllable in the other member of the pair (6.3 cs on the average). The differences are significant for all individual speakers except for the difference between the second syllables of *mámam* and *mamám* for two speakers; the magnitude of the difference is such that it will in almost all cases be clearly perceptible, the difference limen for vowel duration being around 2.5 - 3.5 cs (see the references in Eli Fischer-Jørgensen 1982, p. 159).

The differences in duration between stressed and unstressed syllables are distributed over the segments, and there are individual differences on this point (see Appendix III), but the vowel is significantly shorter in unstressed than in stressed position in almost all individual averages. In the second syllable of *bílligst* and *bilíst* the main difference is (for all speakers) in the *l*, which is 3.5 cs longer in *bilíst* than in *bílligst*.

A comparison between the vowels within the same word (or phrase) also shows that the vowel in unstressed syllable is significantly shorter than the vowel in a preceding or following stressed syllable in *mát lampét*, *barnágtig* and *bilíst* but rarely in *bílligst*, where the main difference is in the initial consonant, and not always in *mámam* and *mamám*.

It is conspicuous that the first [ɑ] is 3.6 cs shorter than the second [ɑ] in *barnágtig*, although the word *barn* [bɑ:ʔn] has a phonologically long vowel with stød in the norm of all the speakers, i.e. both stød and vowel length are lost in *barnágtig*.

Thus, although vowel length is phonological in Danish, it plays an important role in the manifestation of stress, contrary to Berinstein's (1979) assumption. Moreover, the reduction of duration in unstressed syllables also contributes to the reduction of loudness. The stressed vowels of the syllables *lám*, *sán*, *gárn*, *bí*, and *má* (first syllable) have an average duration of 11.3 cs and the corresponding unstressed syllables of the other members of the pairs an average duration of 7.3 cs. According to the Munson curve (see, e.g., Rossi et al. (1981)), a difference between 7.3 and 11.3 cs should give a reduction of about 4.5 phones.

Duration seems to play the same role in the dialects as in the standard language. Since all Jutlandish dialects and some of the Funish and Zealandish dialects have apocope, there are not many examples of [ə] in the dialect recordings. In the Zealandish dialects without apocope the duration of [ə] is 5.3 cs on the average, and the duration of *-er* is 6.1 cs. In the Jutlandish dialects the duration of [ə] in *Kalle* is 5.9 cs, and the duration of *-er* is 5.5 cs, i.e. [ə] is slightly longer

and *-er* slightly shorter than in the standard language, and in Jutland they are not distinguished in duration, and they may not be distinguished in quality either, *-er* being [ʌ] or [ə]. But on the whole, the durations are comparable to those in the standard language.

The name *Nánna* was read by seven East Jutlandish speakers and by six North Zealandish speakers in initial position of the sentence. The second [a] was shorter by, on the average, 5.4 cs with the East Jutlandish speakers and 3.9 cs with the North Zealandish speakers, and this difference was significant for all individual informants.

The pair *Sánddàlen / sandálen* was read by some of the Jutlandish informants. Some of them had, however, a long [ɔ:] in the first syllable of *Sánddàlen*, so that their recording could not be used (see Appendix III, 6-7). For the West Jutlandish speakers and the North Jutlandish speaker, the syllable *san-* was 6.4 cs shorter than *Sán-* and the vowel 2.7 cs shorter. The East Jutlandish speaker PM and the speaker of the Århus RSD had a difference of 6.4 cs in the syllable and 2.3 cs in the vowel. This is in good agreement with the standard speakers.

3. THE Fo CONTOUR

All informants have a difference in Fo between stressed and unstressed syllables, but not quite the same. It is therefore practical, for the purpose of this description, to distinguish between the groups set up in the beginning of section V: Advanced Standard Copenhagen (ASC), a somewhat more conservative norm (CSC), and Standard Copenhagen on a dialectal (i.e. Jutlandish or Funish) background (DSC). (As far as the Fo contour of stressed and unstressed syllables are concerned, OT belongs to the CSC-group.) It is also practical to treat the dialect speakers together with the speakers of the standard language because the DSC-speakers are influenced by their dialectal background. The growing influence can be seen by comparing SR's two recordings from 1961 and 1982. In 1961 he had lived in Copenhagen for only one year, and at that time he had a very small rise (about 1½ semitone) on the first posttonic syllable and sometimes none at all. In the 1982 recording his rise is higher and consistent (at least after single consonants; there were no examples of clusters).

a. Different types of contours seen as different timing

It is possible to describe some of the deviations in the way suggested by Thorsen, i.e. as a different timing in relation to the same or a similar Fo wave. Thus both the relative height and the direction of the Fo movement in stressed and unstressed syllables can be seen as a consequence of their placement on the wave. In figure 3 I have depicted some typical cases. These sketches should, of course, only be seen as rather crude indications of the main trends.

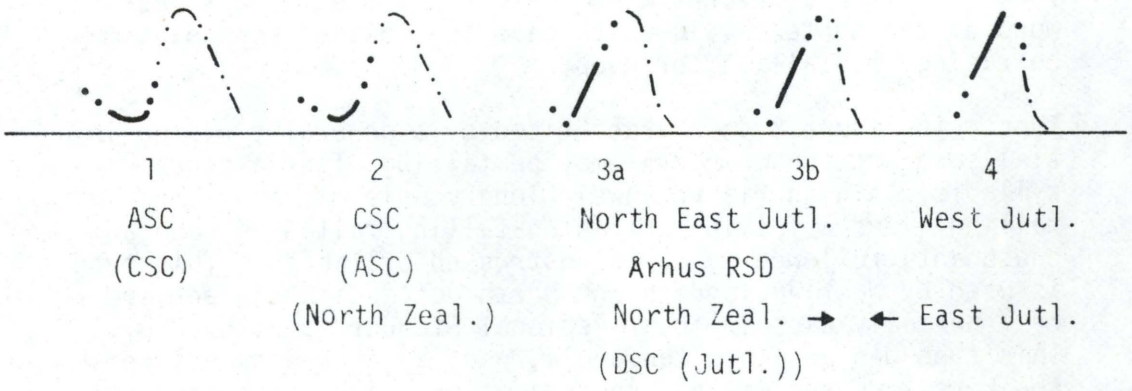

Figure 3

Stylized stress group patterns for various types of Danish. Thick lines represent stressed vowels, thick dots surrounding sonorant consonants, and thin lines unstressed syllables.

Type 1 is the typical ASC contour as described by Thorsen. The stressed syllable is low, often falling (i.e. starting at the end of the falling slope of the previous wave) with a jump or glide up to the first posttonic syllable, followed by a fall through the following unstressed syllables. This type is used by all the ASC speakers of the present investigation (NR, HP, BS, two young Copenhagen speakers JBC and ODL, and the speaker of the lower sociolect ST). The second unstressed syllable may be higher than the first posttonic if the stressed plus first posttonic syllables are too short to reach the peak of the pattern (Thorsen 1982b). Examples from the present investigation are, e.g., *mon sønnerne kómmer*, and *Nánna tákker for gáven*.

Type 2 differs from type 1 by having a more rising stressed syllable. It is often used by the CSC speakers, who may, however, also use type 1. Figures 4 and 5 give some examples of the difference between type 1 and 2. The sentences in figure 4 are read by the ASC speaker HP and the CSC speaker PD from the 1961 material, the sentences in figure 5 by NR (ASC), PH (CSC) and EF (CSC) from the 1982 material. The CSC speakers also often seem to have a somewhat steeper rise and fall than the ASC speakers, i.e. larger intervals; but there are, of course, individual differences in this respect (Thorsen also found a tendency towards a steeper fall for the CSC speaker JR (1980a)). Anyhow, the most conspicuous characteristics of the ASC pitch contour from a perceptual point of view, at least in the subtype used by speakers of the lower sociolect, is not the height of the unstressed syllables but the slow falling-rising movement of the stressed syllable. - In both types an

initial voiced consonant normally has falling Fo (i.e. it belongs to the end of the preceding wave, also when the stressed vowel is rising), except when the word is the first stressed word of the sentence, in which case the initial consonant may be rising, or falling, or even.

Type 4 in figure 3 is characterized by a generally rising initial sonorant consonant (it may be falling after a stressed syllable), a high rising vowel (long vowels may be rising-falling), and a falling or rising-falling following sonorant consonant, followed by lower unstressed syllables. This type is used by West Jutlandish and North Jutlandish dialect speakers, normally also in their Regional Standard Danish (RSD). This type was also, on the whole, used by the East Jutlandish speakers analysed in this investigation, with the exception of PM and LH. (The location of these dialects can be seen on the map in my report on vowel duration (Fischer-Jørgensen 1983b).)

Type 3 deserves a somewhat more detailed analysis. It is in between type 2 and type 4 and is characterized by a rising Fo in the stressed vowel, having a low start and a strong rise after a sonorant consonant (which is generally falling) and a somewhat higher start after voiceless consonants. A following sonorant consonant continues the rise, but from there the curve decreases rather abruptly. In figure 3 two subtypes (3A and 3B) are distinguished. The difference between them depends on the duration of the medial consonant(s). After a single consonant (except when it is particularly long, which may be the case for *s*) and after a few very short clusters (e.g. sometimes *mb*) the first posttonic vowel will be higher than the preceding stressed vowel, whereas after almost all clusters (and sometimes *s*) it will be lower than the preceding stressed vowel. The contour is in fact the same in the two cases, but it will have reached a lower level at the vowel start after a longer consonant (cluster). It looks as if the Fo contour is planned independently of the segmental structure (cf. also Rossi et al. (1981, p. 31-32) and Thorsen (1982b)). This independent planning is, of course, not restricted to type 3, but it is more conspicuous in type 3 because it has consequences for the relative height of stressed and unstressed syllables. In types 1 and 2, where the rise continues for a time after the stressed syllable, the posttonic will also be high after clusters (but as mentioned above the rise may continue in the second posttonic after a short intervening consonant in type 1). In type 4 the first posttonic will always be lower than the stressed vowel (except sometimes in an initial word with single short intervening consonant). Figure 6 shows some superposed Fo contours with the start of the stressed vowel as line-up point, demonstrating different locations of unstressed vowels on the same contour after single consonants and clusters.

Type 3 is used by the North-East Jutlandish dialect speaker PM (Molbæk Hansen, who first drew my attention to the two subtypes), by the speaker of the Århus Regional Standard, and by most North Zealandish dialect speakers. However, the latter

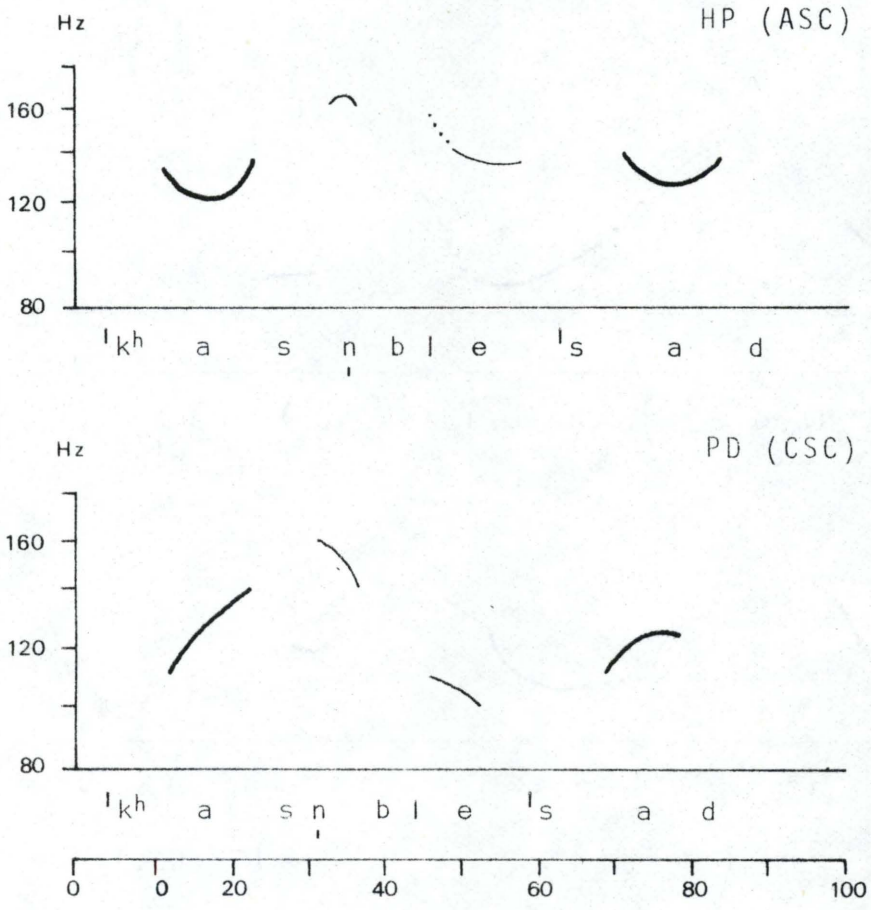

Figure 4

Curves showing the difference between ASC and CSC speakers in the direction of the Fo movement in stressed syllables (1961 material), ——— vowels and syllabic consonants, ... non-syllabic sonorant consonants.

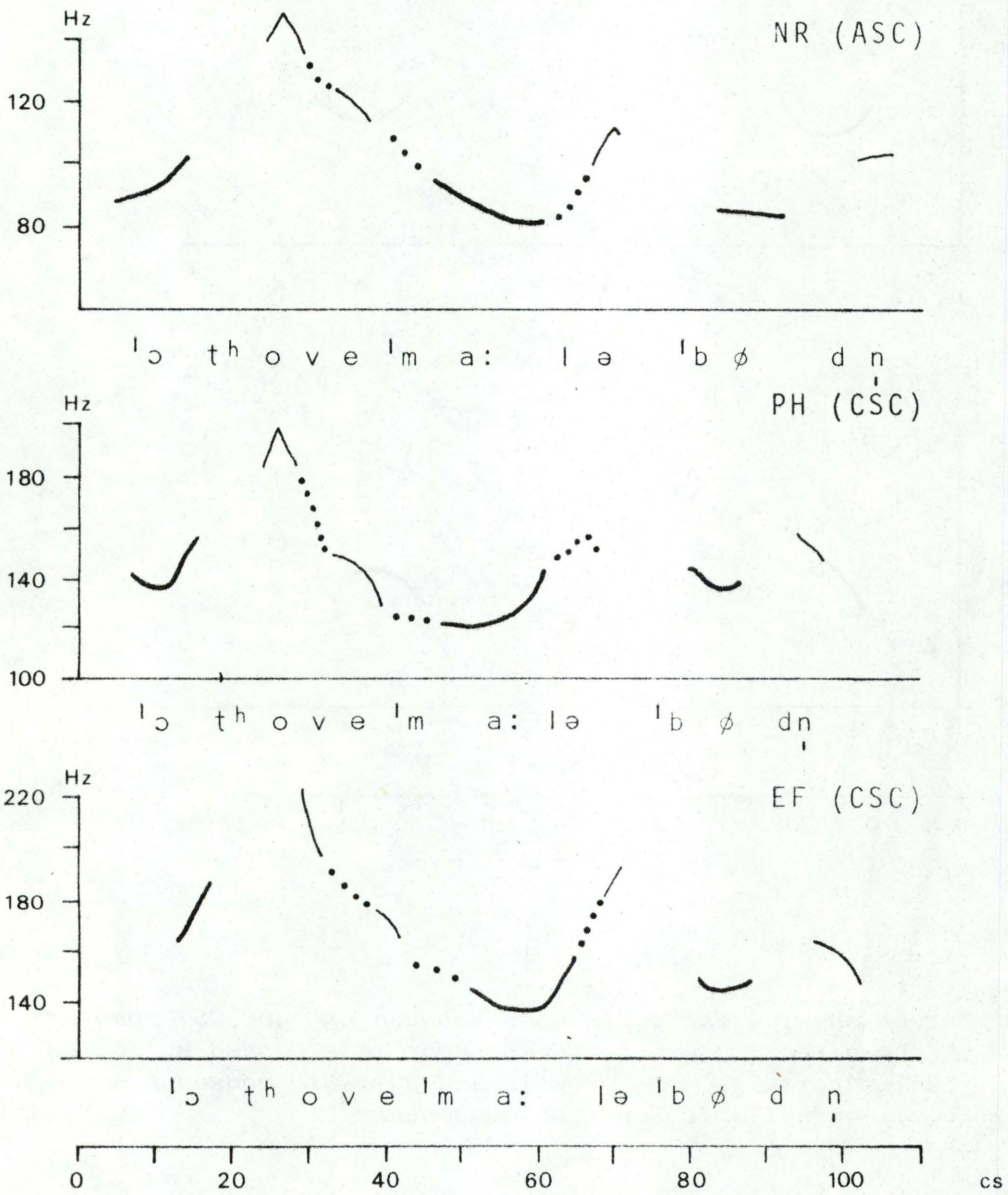

Figure 5

Curves showing the difference between ASC and CSC speakers in the direction of the Fo movement in the non-initial stressed syllable [ma:] *(1982 material),* —— *vowels,* .... *sonorant consonants.*

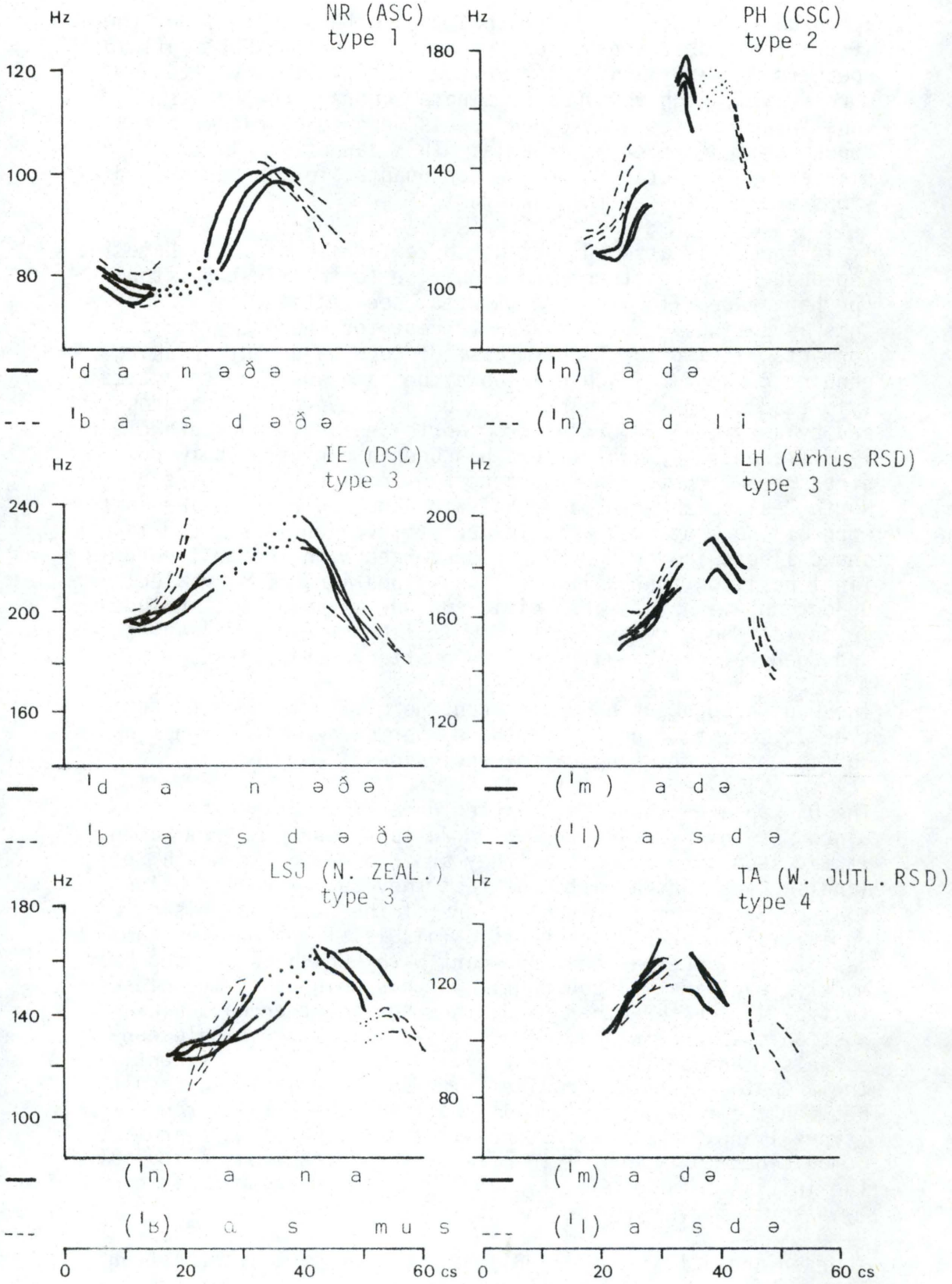

Figure 6

Curves from different types of speakers showing the location of unstressed syllables after single consonants and clusters on the same Fo wave, —— vowels in words with single medial consonant, ---- vowels in words with medial clusters, ... medial sonorant consonants.

approach type 4 in the sense that they often have a lower vowel after single obstruents. On the other hand, the East Jutlandish speakers may approach type 3 in the sense that they often have a relatively high vowel after single sonorant consonants. Thus in both cases unstressed vowels tend to be higher after sonorants than after obstruents. This cannot simply be explained by the duration of the consonants, for in Danish medial stops are not longer than sonorants.

It is generally assumed that North Zealandish dialects have the Copenhagen type pattern with high rise to the first posttonic (perhaps except for words with stød, see section III). But this is obviously not the case (except for one of my six informants, living about 20 km east of Copenhagen but speaking genuine dialect). Figure 7 shows the same sentence (practically), read by the informant ST, who has a typical ASC contour, and by a typical informant from North Zealand. They are clearly different. Probably there has been a confusion between stress group contour and sentence intonation. Most of the North Zealandish informants had a pronounced rise in the last word of the sentence, also in declarative sentences, and if one collects isolated words or sentences with the test word in final position, one will get this intonation. (The dialect in Dragør on Amager has a specific contour which is not included in any of the 4 types - with low falling stressed syllables and (generally) gradually rising posttonic syllables.)

The Funish speakers have different norms. Some come close to type 3, some to type 4, but the number of examples is not quite sufficient to draw any valid conclusions.

The DSC speakers have been listed under type 3 in figure 3. Since most of them are from West Jutland, and one from Funen, it may seem surprising that they are closer to the North Zealandish type. As a matter of fact they do not really belong to type 3. In the first place one of them (IE) has rising Fo on initial sonorant consonants. This is also sometimes the case for BJ, whereas the informant with Funish background has mostly level initial sonorant. On this point they are closer to type 4. On the other hand, they now and then have a high posttonic also after consonant clusters as after single consonants. And on this point they approach type 2. Evidently their contour is a compromise (with somewhat variable results) between their dialect (type 4) and their present environment (types 1 and 2). It is not really type 3, but the compromise comes close to type 3. (In Fischer-Jørgensen 1983a I indicated the initial consonant of type 3 as rising, because I had based my description mainly on the DSC speakers.)

Thorsen and Jul Nielsen (1981) have placed the first posttonic lower than the stressed syllable in the schematic pattern for their Århus speakers (Figure 2); but in their tracings it may be slightly higher or at the same level for speaker BBA, so that there does not seem to be any real deviation from my description. As for their Thy speaker, they have placed the first posttonic quite low in the schematic pattern (Figure 2),

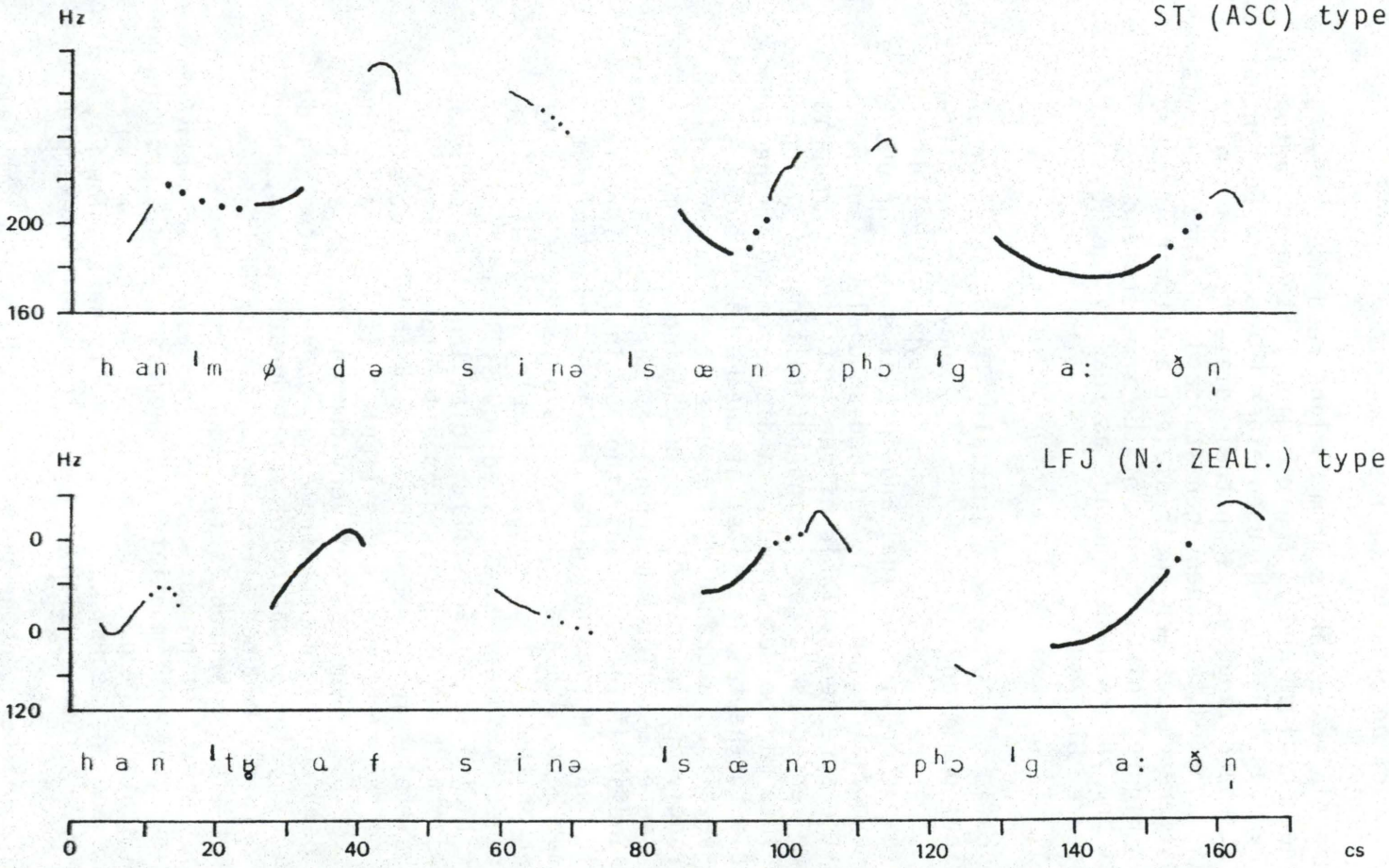

Figure 7

Comparison of Fo curves by ST, who uses the ASC Fo pattern, and LFJ from North Zealand (near Frederiksværk), who is typical for the North Zealandish pattern.

but according to their tracings of individual sentences he does not really go all the way down, so on this point there is no contradiction between our results either.

Some of the dialect speakers from Jutland read the sentences both in their dialect and in their Regional Standard language. Most of them (TA, EA, JD, PN) used exactly the same Fo contours in their standard language as in their dialect. But two (PM and BT) had adopted the Copenhagen standard, so that there is a clear difference between their dialect and their standard language. Figure 8 gives curves of the same sentence in dialect and in standard language as read by the West Jutlandish speaker BT.

b. Modifications in utterance initial and final position

The description given above of the different types is valid for medial stress groups. In final and initial stress groups there may be some modifications. In Jutlandish dialects and regional standards the stressed syllable of the last stress group in declarative sentences is not rising but falling or rising-falling. This may be described as a displacement of the stressed syllable to the falling slope of the Fo wave, but I should prefer to see it as a change of the wave itself under influence of the strongly declining sentence intonation in terminal declarative sentences. The same change is rare in Funish or North Zealandish dialects because the terminal declarative sentence intonation does not generally have this declination. On the other hand, ASC and CSC speakers often have a rising Fo movement on the first stressed syllable, particularly if it is preceded by initial unstressed low syllables (cf. Thorsen's description in section III). Initial unstressed syllables need not, however, be said on a low tone. There are very many examples in my recordings of a higher start with fall down to the first stressed syllable. It is rare in the speech of the DSC speakers, but very common for ASC and CSC speakers, particularly in the frame *de sagde* ... 'they said ...' (used in my investigation of vowel duration 1982, where *sagde* has strongly reduced stress which may count as weak stress), but also in sentences like *Han tog málebøtten frém* 'he took out the painting box', or *Han vil måle bøtten stråks* 'he will paint the box immediately', whereas a single pronoun starting a sentence, e.g. *Jeg købte* ... 'I bought ...', or *Hans sønner* ... 'his sons ...' will normally have a low Fo, and this may, of course, also be found in the other examples.

c. The relation between the prosodic structure and grammatical boundaries

Unstressed medial syllables always belong to the falling slope of the preceding stress group, also where they belong to the following stressed syllable syntactically, or even as part of the same word. This is understandable in types 1 and 2, where the stressed vowel starts at the bottom. But in types 3 and 4, where a stressed vowel after a voiceless con-

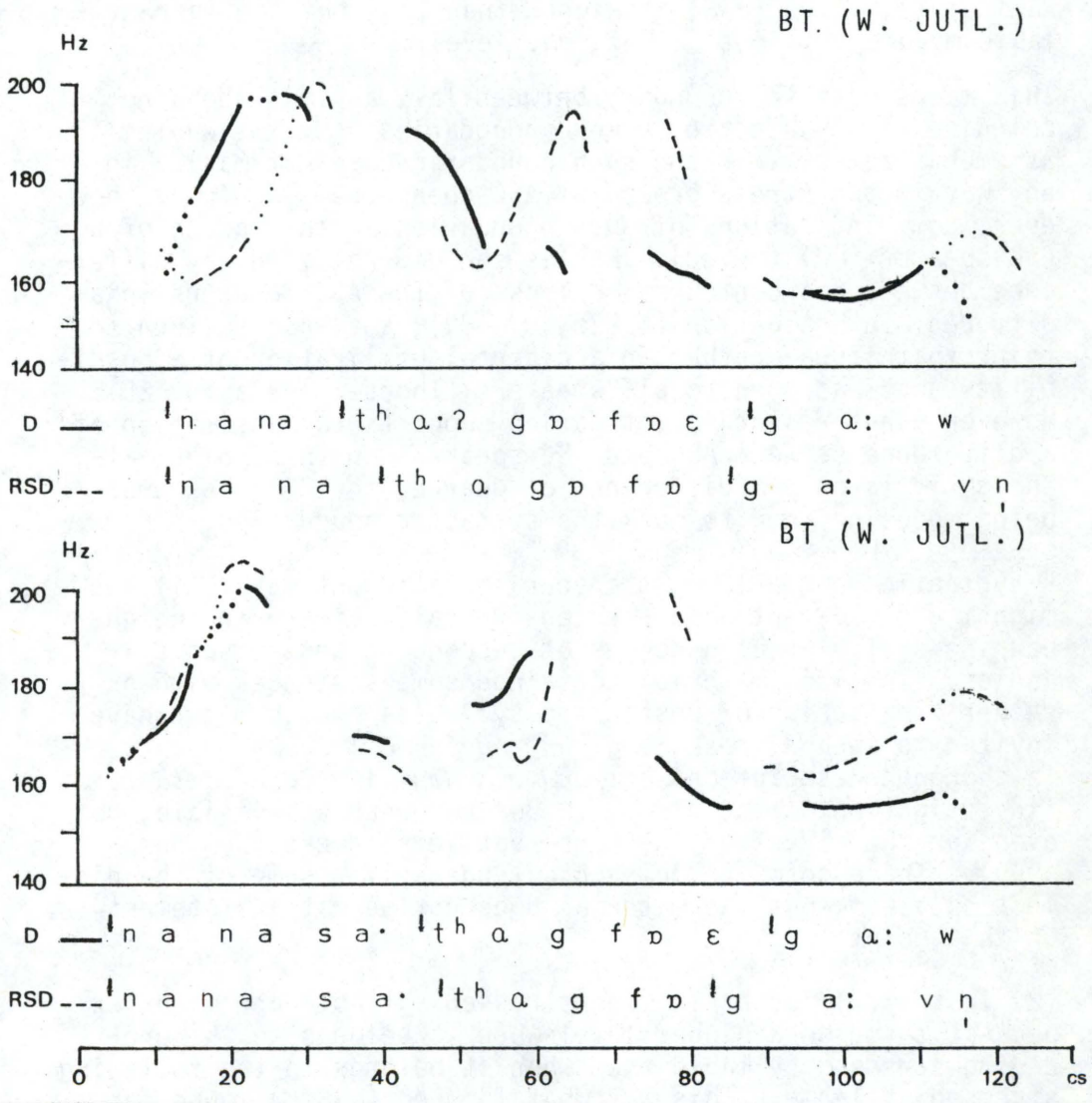

Figure 8

Sentences read by BT in her West Jutlandish dialect (——) and in her RSD (----) which, in contradistinction to the RSD of other West Jutlandish speakers, is very close to the Copenhagen CSC norm (.... = voiced consonants).

sonant may start at a rather high level, one might envisage the possibility of a weak prefix starting the rise. This is, however, not the case. The unstressed syllable is falling or low level. There is only one sentence where three of the West Jutlandish speakers pronounce the last unstressed syllable on a higher level than the preceding one, i.e. [han kʰa'se:ɒð ɛ san'da:ʔl], where [san] is higher than [ɛ], but the intrasyllabic movement is not rising, but level.

This means that the boundary between fall and rise does not coincide with syntactic or word boundaries. On the whole, as emphasized by Thorsen, such boundaries are not marked in any way in the stress groups of ASC speakers. She found, however, some indications of such boundaries in the speech of a CSC speaker (JR) (1980c). But as she did not find any difference between his contours and those of the ASC speakers in a different investigation (1982b, p. 189), she was inclined to think that it was rather an accidental utilization of a possibility that was open to all speakers (Thorsen 1980a, p. 25). However, the present investigation supports the assumption of a difference between ASC and CSC speakers on this point, although it is only a difference of degree, the CSC speakers being more inclined to mark the syntactic boundaries.

A syntactic boundary might appear in different ways: (1) One might, e.g., expect a more extensive fall between two neighbouring syllables of a series of descending unstressed syllables. The 1961 material contained some sentences with rather long series of unstressed syllables, which might have invited to such a break, e.g. *en índgående | beskrívelse* 'a thorough description' or: *úndersøgelse | af den gámle ..* 'investigation of the old ..'. But no break was visible, not even for the oldest of the conservative speakers (PD, born 1905). There seems to be such a tendency for some of the dialect speakers, but the material does not permit a statement on this point.

(2) In the case of a single unstressed syllable one might expect it to be on a higher level when it belongs to the preceding stressed syllable than when it belongs to the following stressed syllable. This was what Thorsen (1980c) found for JR, and a similar tendency can be found in the present data. The CSC speakers of the 1961 material (particularly PD and JR) often pronounce the proclitic indefinite article *en* on a lower Fo than the preceding stressed syllable, e.g. *fándt en kánde* 'found a jug', whereas the enclitic definite article is always said on a higher Fo, e.g. *etnográfen* 'the ethnographer'. The lower Fo of the proclitic article is also used by the DSC speakers but hardly ever by the ASC speaker HP. In the sentence *Hánne mísforstår spøg* (of the 1982 material), in which there is no word boundary between *mís* and *for*, all speakers (except SR) have a higher Fo on *for* than on both *mís* and *står*. In *Hánnes mís forstår spøg* 'Hanne's pussy understands jokes' only the ASC speaker NR and two of the CSC speakers (PH and OT) have a higher Fo on *for*, whereas the CSC speaker EF and the DSC speaker SR and (partly) IE have *for* slightly lower than *mís*. Finally, in *Hánnes mís forstår spøgen* 'Hanne's pussy

understands the joke', where *for* belongs to a following stressed syllable, only the ASC speaker NR has a consistently higher Fo on *for*, whereas EF, OT and PH have an Fo which may be sometimes higher, sometimes lower than *mís*, but at least not as high as in the first sentences, and SR and IE have *for* lower than both *mís* and *stár*. In the sentence *hans plán forkástes* 'his project is rejected' (in contradistinction to *hans pláner frémmes* 'his projects are furthered'), one of the three CSC speakers has a lower Fo on *for* than on *plán*. Finally, in the sentence ...*en mát lampét*... 'a dim bracket lamp' the ASC speaker NR always, and OT mostly, have a higher Fo on *lam* than on both *mát* and *pét*. EF has this pattern in a few cases, but otherwise she and PH have *lam* lower than *pét*, and SR and IE have *lam* lower than both *mát* and *pét*.

The 1961 material also contains the examples *en stór bedráger* 'a great swindler' and *en stórbedràger* 'a great (professional) swindler'. All three CSC speakers, and one DSC speaker had a difference, the syllable *be* being always higher than *stor* in the compound, but generally lower in the separate words (or sometimes slightly higher, but not as high as in the compound), whereas the ASC speaker HP did not have any difference, *be* being always higher than *stór*.

Nina Thorsen (oral communication) suggests that in the examples *mís forstár*, *mát lampét* and *stór bedráger* the relatively low unstressed syllable may be due to the fact that it is the only unstressed syllable of the contour (cp. Thorsen 1982b, p. 125), which is not the case in the compound, where the member with secondary stress behaves like an unstressed syllable as far as the Fo contour is concerned (see below, V.B.2). That may be of influence, but at any rate there is a difference between the ASC speakers, who have high Fo in all these examples and the others, who often have a lower Fo, and who have this lower Fo particularly when the syllable belongs syntactically to the following stressed word, cf. that the CSC speakers in the 1961 material always had a high Fo in the last unstressed syllable of, e.g., *etnográfen*, although this was also the only unstressed syllable.

(3) Closely related to the behaviour of a single unstressed syllable is the tendency for the last of a series of unstressed syllables to go down below the next stressed syllable, particularly in the cases where it is part of the next word or when it belongs to the following word as part of a unit accentuation group.

In the 1961 material the CSC speakers PD and EF have more examples of this kind than the ASC speaker HP, and it is not because they start the posttonic syllables at a lower level. In the 1982 material this phenomenon is hardly ever found in the recordings of the ASC speaker NR, but it is not infrequent for the other speakers. Three examples can be quoted where a syllable is part of the following word. In the sentence *Søren kóm med nogle barnágtige údtàlelser* 'Søren made some childish remarks' EF has a lower Fo on *barn* than on *ágt* in

six out of eight readings, whereas the other two informants who read this sentence (NR and PH) have a higher Fo on *barn*. In the sentence *han kassérede sandálen sídste sómmer* 'he discarded the sandal last summer' the CSC speaker PH and the DSC speakers IE and SR have a lower Fo on *san* than on *dálen*, whereas NR, EF, and in almost all cases OT have a higher Fo on *san*. (All the Jutlandish speakers (except for PM) have, in accordance with their whole pattern, low Fo on *san*.) In both the above quoted sentences the low Fo is favoured by the number of preceding unstressed syllables. In the sentence *han vil mále Casanóva* 'he will paint Casanova' (where *Casanóva* is the last word of the sentence) only the DSC speakers IE, BJ and NK have a lower Fo on *Casa* than on *nóva*.

In the examples with phrasal unit accentuation the distinction between the ASC speaker NR and all the others (the CSC speakers PD, EF and OT, and the DSC speakers IE and SR) is very clear. In the sentence *Ótto vil male bøtten grøn imórgen* 'Otto will paint the box green tomorrow' all except NR have a lower Fo on *male* than on *bøtten*, and in *Ótto vil mále bøtte fém imórgen* 'Otto will paint box number five tomorrow' all except NR have a lower Fo on *bøtte* than on *fém* (OT has one and EF two counterexamples out of eight). In the sentence *Óle spiser sødsùppe til míddag* (and the same with *sød súppe*) *spiser* is lower than *sød* for all informants except NR, who, however, in this case has two examples with lower Fo on *spiser* (for the CSC speakers *spiser* is also low in relation to the preceding stressed word *Óle*). The relation between the unstressed syllable and the following stressed syllable in these cases may be due to a particularly high Fo on the syllable carrying the unit accentuation more than to a particularly low Fo on the unstressed syllable (see section V.C.2). These differences between ASC and CSC speakers can only with difficulty be interpreted as a displacement of the syllable on the Fo wave. The problem of the influence of grammatical boundaries is complicated because various factors may interfere: the number of unstressed syllables, the steepness of the fall in various norms, the distinctness of the speech style, etc. However, as far as I can see on the basis of the present material, CSC speakers differ from ASC speakers particularly in cases where there are grammatical boundaries. These preliminary results should, of course, be controlled by further investigations with this specific purpose.

d. Syllables with stød.

Syllables with stød, which are not treated by Thorsen, raise some problems. They often have a decrease of Fo in the latter half of the syllable, and this favours a lower Fo on the following unstressed syllable. For the ASC speakers it is, however, very rare that it gets lower than that of the preceding syllable. There is not a single example for the speaker NR and only a few for HP and BS, although both texts contain quite a number of words with stød. But the CSC speakers often have a lower unstressed syllable after a stød. The degree of tongue height of the stressed vowel plays a role. High vowels, which

have a higher intrinsic Fo, are more often higher than a following unstressed vowel than low vowels. In the 1961 material the CSC speakers have, e.g., a higher Fo on the unstressed [ɲ] in ['ɛdno'gra:ʔfɲ] but often a lower Fo on the unstressed syllables in [be'sgri:ʔvɻsə] and [be'sgre:ʔvəð], and the CSC speakers of the 1982 material generally have a higher Fo on the final unstressed syllables of [ɑbɑ'ʁɑ:ʔdð̩], [san'da:ʔlɲ], ['blɔmʔsdɲ] and ['pla:ʔnɒ], but often a lower Fo on the unstressed vowel of ['sbi:ʔsɒ], sometimes [pʰe:ʔdɒ], and all (except the ASC speaker NR) have consistently lower Fo on the posttonic syllables in the words [kʰa'se:ʔɒðə] and [pʰa'se:ʔ-ɒðə]. These differences between words with higher and lower vowels cannot be explained by the number of following unstressed syllables. The DSC speakers have almost regularly lower Fo after stød; the same is true of PM's Himmerland dialect and mostly for the North Zealandish speakers. Kroman (1947) was thus right that there tends to be a difference between words with and without stød in the dialects of North Zealand, and Poul Andersen's criticism (1949) was not justified on this point. Figure 9 shows the sentence *han passérede Sánddàlen*, read by

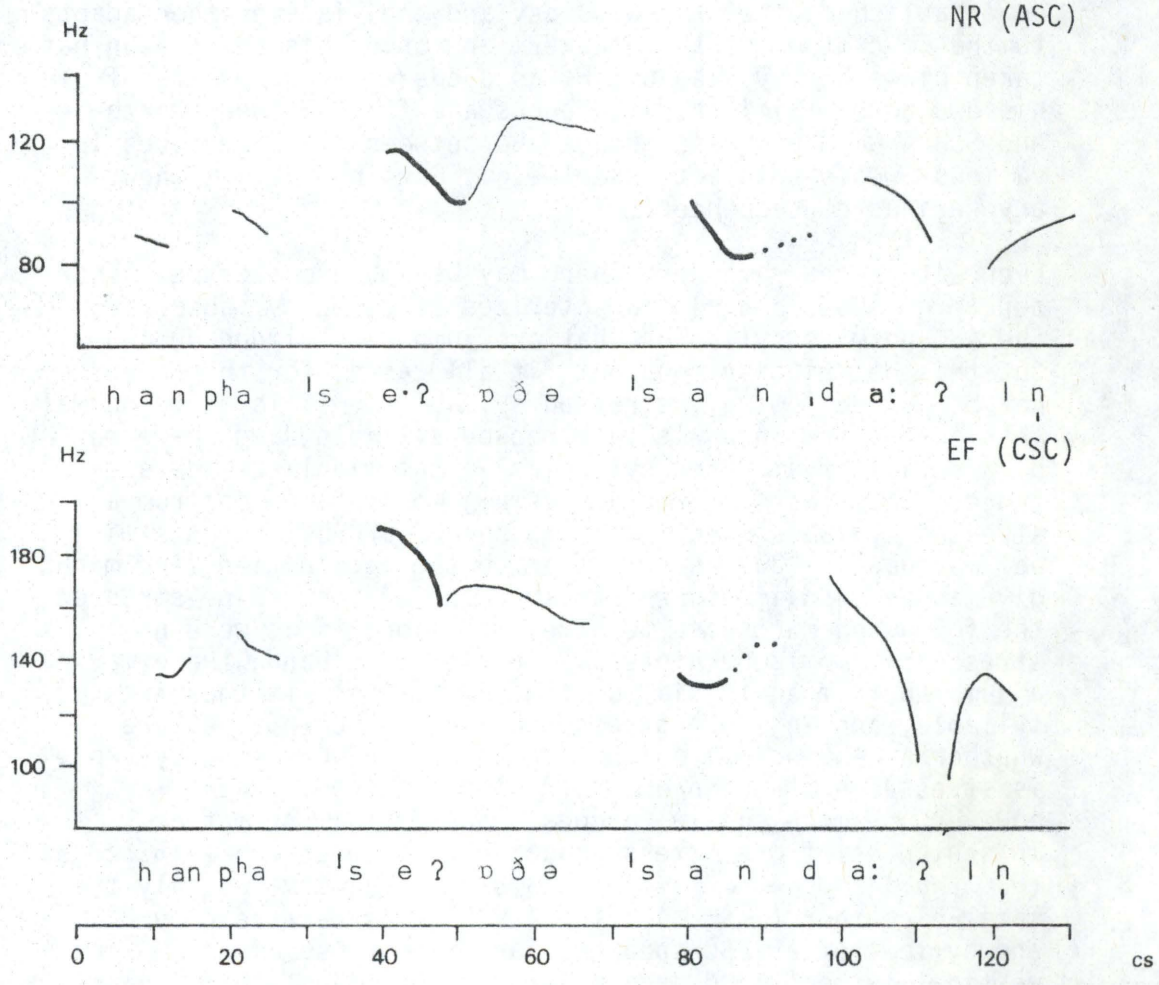

Figure 9

Fo tracings of two sentences with stød read by an ASC (NR) and a CSC speaker (EF).

the ASC speaker NR and the CSC speaker EF. It is difficult to fit the description of the latter curve into the pattern of an undulating wave with possible displacements of the syllables. There is simply no peak (nor any valley) between the two stressed syllables, although there are two unstressed syllables between them.

e. The perceptual relevance of the Fo contours.

It has appeared from the preceding pages that, within the same norm, the same dialect or sociolect, the Fo relations between stressed and unstressed syllables are very stable. It must thus be possible for the listener to use Fo as a perceptual cue for stress. But the differences between different norms are conspicuous. In type 1 and type 4 the relations are almost reversed. And types 3 and 4 are not only used in dialects but in the regional standards of dialect speakers. Almost all Danes are thus exposed to all these norms, e.g. in radio and television, and this does not seem to give any difficulties (with the exception of some compounds, see section V.B.2). Probably the other cues (vowel quality, stød, duration) will be established after a few words, and the listener then adapts to the Fo contour of the speaker, and once this adaptation has taken place he may also use Fo as a cue when it deviates from his own norm. Similar differences are found between North- and South German stress groups and between the word tones in various Swedish dialects (see, e.g., Gårding 1977) without any serious consequences.

Even within the same norm there may be ambiguous cases. Thorsen (e.g. 1980a and b) characterizes stressed syllables in the ASC norm as syllables that are jumped or glided up from. But this description does not fit all cases, for there need not be any following unstressed syllables. It is quite normal that a sentence ends with a stressed syllable, and there may be a series of stressed syllables in the middle of the sentence. Thus there is not always a jump or glide up from a stressed syllable, and a falling series of Fo movements will be ambiguous. (But the relation to the declination line might give a cue, and if other cues show one of them to be stressed, the following must also be stressed, since if it were unstressed it would be higher.) On the other hand, there may be a jump up from an initial unstressed syllable to the stressed syllable, and in a one-stress sentence one cannot be sure whether a sequence of a low level plus a high rising syllable is stressed-unstressed or unstressed-stressed. There may, however, be more subtle Fo cues which decide the matter. In sentences of one stress group the sequences *det er billigst* (*de siger*) and *det er billist* (*de siger*) may have roughly the same Fo contour (- - ´). These sentences were read by NR and by four other ASC speakers for the purpose of an EMG-investigation, and by NR again for the purpose of this investigation. There were clear differences of duration, but the Fo contours were similar (see Appendix III,4). However, NR had a much higher rise in the unstressed than in the stressed [lisd] (but this difference was not found for all the other

speakers). Some had a slight decrease at the end of the unstressed [lisd], but the most obvious and really consistent difference was in the timing of the rise: in *billigst* the rise starts in the *l* or sometimes already in the first *i*, whereas in *bilíst* it never starts until the boundary between *l* and the following *i*. Thorsen (1982a and 1983b) has shown that the Fo level of the *l* alone may be a sufficient perceptual cue for the stress difference, in synthetic speech with no other cues present. The same timing of the rise as in *bilíst* is found in some other words of the same type, e.g. *kalás*, *muláttər*. The frame *det er ... de siger* will give further Fo cues. *det er* [de:] will be slightly lower before a stressed syllable and (more important) the following *de* will be higher after a stressed syllable than after an unstressed syllable.

4. INTENSITY

The intensity of weak syllables has not been measured, but visual inspection of the curves showed that in by far the most cases the unstressed vowels [ə] and [ɒ] of the Copenhagen standard have lower intensity than the preceding stressed vowel, although they generally have a higher Fo. But the speaker of the Copenhagen lower sociolect ST, who has a high rise in Fo, generally also has higher intensity. The West Jutlandish dialect speakers have both lower Fo and lower intensity in unstressed syllables. The same is true in most cases for East Jutlandish and North Zealandish speakers. In the cases where they have a higher Fo on the unstressed syllable, i.e. often after sonorant consonants, they also mostly have lower intensity, but some of the East Jutlandish speakers and one of the North Zealandish speakers often have higher intensity in this case. The North Zealandish speaker who follows the Copenhagen norm and PM, who also in his Standard Danish follows the Copenhagen norm, have higher Fo but lower intensity on unstressed syllables, like the Standard Copenhagen speakers. The intensity contour of the individual speaker is, however, more variable than duration and Fo.

In some cases it is possible to compare syllables with the same full vowel quality. The examples with *Sánna* as first word of the sentence all have a rising Fo contour in the standard language, but they have lower intensity in the second unstressed syllable. In *Nánna*, however, NR has generally a rising intensity contour, and the same is true of the North Zealandish dialect speaker who follows type 2, as well as of PM and often of some of the other East Jutlandish and North Zealandish speakers.

Of the examples which can be compared pairwise (see Appendix III), the pair *Sánddàlen / sandálen*, which has been read by 14 informants, partly with different Fo contours, is the most informative. All the Jutlandish dialect speakers (Appendix III,6-7) have lower intensity on the weak syllable *san-* than on the following stressed syllable, and almost all have higher

intensity on the stressed *Sán-* than on the following syllable with secondary stress (JD has *Sán-* slightly lower, but the difference is much smaller than in *sandálen*). This is in accordance with their Fo contour (except for PM's RSD). The same is true of the standard speakers with Jutlandish background. The only Jutlandish speaker who has a more rising intensity contour (in her RSD) in *Sánddàlen* than in *sandálen* is the one (BT) who has taken over the Copenhagen Fo contour in her RSD. Thus the difference between the intensity contours of *Sánddàlen* in her dialect (¯-) and in her RSD (-¯) follows the difference in her Fo contours. Of the non-Jutlandish standard speakers, who all have a high Fo fall in the second syllable of *Sánddàlen*, two have approximately the same intensity contour in the two words and one has intensity contours that follow his Fo contour very clearly, so that both Fo and intensity are reversed compared to the stress relation, i.e. lower Fo and lower intensity on the stressed syllable. One, however, (NR) has an Fo-independent intensity contour which parallels the stress relation. He has the same Fo-independent intensity contour in the pair *billigst / bilíst*. For the other three pairs NR and the other standard speakers (except those with a Jutlandish background) have an intensity contour which either follows the Fo contour against the stress relation, or which is the same for the two words.

Thus, if a weak syllable has low Fo, it also has low intensity. If it has high Fo there are individual differences, and the same individual may behave differently from one word to the next (NR).

The reason why I have only looked at relations and not made any measurements (except in mm for the word pairs) is that measurements would not tell us much more; and as long as we do not know more about the perceptual value of intensity and its relation to Fo, quantitative evaluations do not seem worth while, except for a limited and specifically constructed material. Rossi et al. (1981) consider Fo and intensity to be mutually independent, because Fo is produced by the laryngeal muscles and intensity by the subglottal pressure. But that is not certain. He gives an example of an isolated [a:] with rising Fo but falling intensity in the latter half. It is possible that this decrease of intensity in the one-sound-sentence is due to the decrease of the subglottal pressure at the end of a sentence (cp. Lieberman 1967), but in the interior of a sentence the subglottal pressure seems to be rather constant, and variations in connection with stress, except for emphatic stress, have been found to be rather small (see e.g. Katwijk 1974). Moreover, a tension of the vocal folds may very well result in a longer closure phase and a larger amplitude and thus contribute to both Fo and intensity rise (see Hirano and Ohala 1969, and Ohala 1973 and 1977). Further, acoustically, higher frequency of vibration will automatically give higher intensity. This may be counteracted by compensatory adjustments in the production, but it is at least dubious whether such compensations take place for full vowels within a limited range of the chest voice. One may therefore expect Fo and intensity to follow the same trend, and the contours are in fact often similar. The traditional view

is that the relation of cause and effect is the opposite, i.e. that higher subglottal pressure in stressed syllables causes Fo to increase. But in the first place the subglottal pressure differences observed in speech can only cause a relatively small rise in Fo (see, e.g., Ohala and Ladefoged 1970 and Ohala 1970 and 1973), and in the second place nobody will probably assume that a high Fo in unstressed syllables, as it is the norm in the Copenhagen standard, is caused by a heightened subglottal pressure. But the similar trend of Fo and intensity is not a necessity; there may be compensations and individual production habits.

The problem is now how perception works.

Stress may be signalled conventionally by either high or low Fo, but low intensity in stressed syllables can hardly ever be a signal for stress. If both intensity and Fo decrease in unstressed syllables - as they do in West Jutlandish dialects - they may support each other perceptually, and if Fo increases and the intensity decreases in unstressed syllables, as was the case in several examples with [ə] and in some examples with full vowels in Copenhagen speech, intensity may perhaps act as a separate cue. But if both rise, as it is often the case, one may assume either that the intensity contour counteracts the perception of stress, or that it passes unnoticed because Fo and intensity are expected to move in the same direction. One cannot know for sure which expectation is the stronger: the expectation to have the same contour in intensity and Fo, or the expectation to have lower intensity in unstressed syllables, and this may determine possible perceptual compensations. More research is needed here.

In the case of weak [ə] and [ɒ] following a vowel of different quality the problem is complicated by the phenomenon of intrinsic intensity. The open back vowel [ɒ] is known to have high intrinsic intensity, so that when it is of lower intensity than the preceding vowel there seems to be an intended intensity reduction in the unstressed syllable. As for [ə], its intensity does not seem to have been investigated. It can only be compared with other vowels in unstressed syllables. One of the informants has read the words [mána] and [mánə] in the same environment. Here [ə] had a definitely higher intensity than unstressed [a] (Fo was about 1 semitone higher). This points to a rather high intrinsic intensity of [ə], but further investigations are required (and a complication is that the degree of openness of [ə] is rather variable). In perception the loudness relations may be changed relative to the intensity relations, because the listener compensates for the intrinsic intensity although we do not know whether this compensation is due to a comparison with his own effort (cp. Ladefoged 1967), or to social experience (which is probably the case with intrinsic pitch and duration), or dependent on the auditory mechanism because the vowels with low intrinsic intensity seem to be just the ones which have their formants distributed over more critical bands (see, e.g. Rossi et al. 1981).

5. CONCLUSION

The difference between stressed and unstressed syllables seems to be manifested acoustically by a combination of duration, Fo, and intensity.

The differences in duration are clear and significant and common to all speakers and dialects. Moreover, since the duration of unstressed vowels is so short that the integration time of the ear plays an important role, duration also influences loudness.

There are also clear and stable differences in the Fo contour, but they are not the same for all speakers and dialects. The intensity differences are more problematic, but intensity seems to play an independent role at least for the weak vowels [ə] and [ɒ], and also in some other cases, though very irregularly. In Appendix III indications of duration, Fo, and intensity are combined for the word pairs with different stress.

B. MAIN STRESS AND SECONDARY STRESS

As mentioned in section II Danish compounds with main stress on the first member are considered to have secondary stress on the second member. The problem is now how this secondary stress differs from main stress, or more precisely: What is the difference between a combination of two main stresses and a combination of main stress and secondary stress?

Both the 1961 and the 1982 material contain a number of sentences with compounds that can be compared with a combination of separate words with the same or nearly the same segmental structure, e.g. *en mát lámpe* 'a dim lamp' and *en nátlàmpe* 'a bedside lamp'. In the 1961 material each sentence was spoken only once in four different sentence positions, which makes it impossible to distinguish accidental and systematic differences for the individual speakers. Therefore this material will only be treated briefly. A more detailed analysis will be given of the 1982 material, where each sentence was read eight times. In the 1961 material one might expect to find some differences according to sentence position, for example more shortening of the second member medially in the sentence than finally. But no such tendency could be seen. The only recurrent feature is that the Fo differences are less clear at the end of a statement, and sometimes they could not be measured in this position.

As mentioned in section II syllables with secondary stress retain their vowel quality, their phonological vowel length, and their stød (they may even acquire one), so that fewer cues are at the disposal of the listener than for the distinction between main stress and weak stress. The differences must thus be looked for in duration, Fo, or intensity.

1. DURATION

Compounds might be expected to involve some shortenings, particularly of the second member, but perhaps also of the first member because of the increased number of syllables in the stress group, and perhaps a shortening of the distance between the stressed vowels giving an impression of a more intimate connection. The investigation has therefore been concentrated on these possible differences between compounds and separate words.

The main material contained 10 pairs for comparison, read by one to seven ASC, CSC and DSC informants. The pairs are listed (with translations) in section IV and the full sentences in Appendix II. The compound members of the pairs are also listed in Tables III-VII. The most important data for each pair are given in Appendices IV-V together with data for some comparable examples of unit accentuation, which will be treated in a later section. For each word the appendix gives the duration of the first and second member as well as the duration of their vowels if they could be delimited; moreover, the differences between the different types are given. The sequence with two main stresses is always listed as number one, the sequence with main stress plus secondary stress (compound) as number 2, and the sequence with unit accentuation and weak first member (within one word or a syntactic group) as number 3, e.g. (1) *mát lámpe*, (2) *nátlàmpe*, (3) *mát lampét*, or (1) *mále bøtten*, (2) *málebøtten*, (3) *mále bøtte fém*, and the line "1-2" gives the difference between the sequence of two words with main stress and the corresponding compound. For the present, only this difference will be treated.

a. Reduction of the first member of a compound

In recordings of the same informants made for a different purpose (see Fischer-Jørgensen 1982), there were sentences of the type *han sagde mále tó gánge*, *han sagde málekàsse tó gánge*. In these examples there was almost always a reduction in the duration of the first member of the compound compared to the simplex word in the same frame. In the examples *mále* - *málekàsse*, spoken by 4 informants, the shortening of the first member was 4.2 cs on the average, and the difference was significant for all four subjects (the vowel [a:] was shortened by 2.7 cs on the average). In the pair *dánne* - *Dánnevàng* (5 speakers), the shortening of the first member was 3.5 cs, in *nátte* - *náttefròst* (7 speakers), the shortening of the first member was 5.3 cs, in *mánde* - *mándefàld* (1 speaker) 4.6 cs, *músse* - *míssekàt* (1 speaker) 4.1 cs, *dan* - *Dánfòss*(6 speakers) 3.1 cs, *man* - *mándfòlk* (1 speaker) 2.5 cs, *mis* - *míslyd* (1 speaker) 4.0 cs, *nat* - *nátpòtte* (1 speaker) 3.3 cs, but *nat* - *nátlàmpe* (6 speakers) no shortening. The shortening was distributed over the segments, the vowel being responsible for between one third and half of the shortening. In *nátlàmpe* the *t* was lengthened, the vowel shortened by 0.9 cs. Thus, with the exception of the last pair, there was always an appreciable shortening of the first member, and it was significant for all speakers.

In the present material the frame was different. The words were spoken in normal sentences and there was always the same number of syllables in the sentences, thus: *Óle spiser sød súppe til míddag* vs. *Óle spiser sødsùppe til míddag*, or *Ótto vil mále bøtten stráks i mórgen* vs. *Otto tager* [tɑ:] *málebȍtten frém i mórgen*. This gave a different result. Table III gives a survey of the data. More detailed measurements are given in Appendix IV, 1-10.

I tried to find examples of different types: mono- or disyllabic first and second members, long and short vowels, second member with prefix, etc., but the choice was restricted by the possibilities of finding sequences of the same (or almost the same) segmental structure that could be used in natural sentences.

Table III

*Reduction in duration (in cs) of the first member of compounds compared to the first word of a sequence of two separate words with main stress and (practically) the same segmental structure. * indicates significance at the 1% level. There were 8 readings of each word. The numbers 1-10 correspond to the numbers in Appendix IV.*

		NR	PH	EF	OT	SR	IE	BJ	NK	average
1	ˈsøðʔˌsobə	3.0*	0.5	-0.2	1.6*	3.6*	4.9*			1.2
2	ˈnadˌlɑmbə[1]	0.4	0.3	-1.3	0.2	0.2	2.4*			0.4
3	ˈsbi:ʔs ˌʁɑisɳ			1.3						1.3
4	ˈvɛn ˌsgɑ:ʔbǒ			1.6*						1.6
5	ˈgasˌbʁænɒ[3]	1.2	1.5	0.3	0.5					0.9
6	ˈma:lə ˌkʰasɳ	1.4	-0.3	3.1*	1.0		-0.6	-0.3	4.3*	1.2
7	ˈma:ləˌbødɳ	3.0*	-0.4	2.6*	1.8	-0.5	-0.9			0.9
8	ˈlɑməˌlɒ:ʔ	-0.1	2.1	1.8	3.1*					1.7
9	ˈvɑ:məɑbɑ ˌʁɑ:ʔdǒ[2]	2.0*	1.5	-0.5	1.8	-0.9	1.5			0.9
10	ˈmisfɒ ˌsdɒ:ʔ	-0.5	0.2	1.4*	4.0*	2.3*	0			1.2
average		1.3	0.7	1.0	1.8	0.9	1.2	-0.3	4.3	1.4 \ 1.2

[1]) In *nátlàmpe* and *mísforstȁr* the initial consonant has not been included because it could not be delimited from the preceding word.

[2]) In *várme-* the [ə] has not been included because it could not be delimited from the following *a*.

[3]) EF had two readings of *gásbrènder/gás brænder*. They have been combined in this table and in tables IV-V and VIII-X but not in the counting of individual averages in the text.

(All individual averages have been included in the grand mean in tables III-X. Except for tables IV and X it does not make much difference whether the two speakers BJ and NK, who read only one pair, or the two pairs read by only one informant are included or not.)

Table III shows that there is a tendency to shortening of the first member (73% of the averages have a shortening), but it is slight (1.4 cs averaged over speakers) and inconsistent. It does not exceed 2.5 cs (which may be considered the lowest limit for an audible difference) except in 9 cases out of 48, and it is only significant in 15 (31%) of the averages.

There does not seem to be any clear difference due to the structure of the sequences (i.e. mono- or disyllabic first member, long or short vowel, etc.). The only consistent difference is that all speakers have more shortening in *sǿdsùppe* than in *nátlàmpe*. This is hardly accidental, for the dialect speakers make the same difference, and moreover, *sǿdsùppe* was the word with most shortening in the 1961 material, and *nátlàmpe* the word with least shortening in the sentences used for the duration analysis mentioned above. One reason may be that *sǿd súppe* (in two words) is not very commonly used, whereas *sǿdsùppe* is a current word, and some speakers seemed to take pains to pronounce *sǿd súppe* in two words. This was also the only pair which, in the given context, would be ambiguous disregarding the stress difference. There is, as might be expected, a certain similarity between the treatment of *málekàsse* and *málebǿtte*. The same three speakers have shortening in both words, and the same two have lengthening. But on the whole, many differences seem to be accidental. Nor is there any clear grouping of speakers. The differences between BJ and NK may be accidental, since they have only spoken one pair each, and in the examples in frame sentences NK does not have more shortening than the other speakers.

A shortening that is so inconsistent and of such small extent can hardly have any function for the perceptual distinction of compounds and sequences of two words.

It is a problem why the shortening in the normal sentences is much less pronounced than in the frame *de sagde ... to gange* mentioned above. It cannot be due to speakers or words. The speakers were the same, and the words were of the same type. One pair was identical: *måle* vs. *målekàsse*. For the four speakers who read this pair both in the frame and in the normal sentences, the shortening of the word was 4.2 cs in the frame and 1.3 cs in the sentence, and the shortening of the [a:] 2.7 and 0.5 cs, respectively. In both cases the relevant stress group was lengthened by two syllables. One might think of an influence from the total sentence length.(Lehiste (1980) has shown that the length of the frame may be of influence). The sentence with *målekàsse* in a frame was two syllables longer but had the same number of stress groups as the sentence with *måle*. The normal sentence with *målekàsse* had the same number of syllables but one stress group less (3 versus 4) than the

sentence with *mále*. One might then conclude either that an increase of the total number of syllables causes shortening, or that reduction of the number of stress groups prevents the shortening. I am inclined, however, to think that the explanation should be sought in the sentence type. There is a stronger boundary between a test word and its frame than between verb and object in a normal sentence, and this boundary may cause lengthenings (cf. Fischer-Jørgensen 1982, p. 179). The word *mále* is longer in the frame than in the normal sentence for the four speakers common to both recordings (5.8 cs), and the same is true of the vowel [a:] (3.7 cs). In the normal sentence the [a:] of *mále* is only 14.9 cs, i.e. it is rather close to a short [a], and therefore it does not tolerate as much shortening as the longer [a:] of the frame sentence.

b. Reduction of the second member of a compound

Table IV gives a survey of the reduction of the second member (with secondary stress) (for more details, see Appendix IV). The shortening of the second member is much more consistent than the shortening of the first member. It is found in 43 of the 48 averages (90%); it is significant in 31 cases (66%), and the grand mean is 2.9 cs averaged over speakers, 3.2 cs averaged over words. But it is not quite consistent. There is a conspicuous lack of shortening in *gásbrènder*. It may be partly due to the fact that in this case the words were not completely identical. There is stød in the *n* in *gás bréndər*, but not in *gásbrènder*, and a stød may have a shortening effect. On the other hand, the conspicuous shortening in *vénskàbet* may be due to the fact that *-skàbet* has stød in contradistinction to the separate word *skáber*. Moreover, in this example the full word *skáber* was the last stressed word of the sentence (in the other cases a stressed syllable followed), so that it may be somewhat lengthened. But there is more to it, for also the initial consonant (*b*) is shortened less in *gásbrènder* (0.3 cs) than other initial consonants (*-sùppe* 2.0 cs, *-làmpe* 1.0 cs, *-kàsse* 1.4 cs, *-bǿtte* 1.7 cs, and *-lǎr* 1.5 cs). If the two words *vénskàbet* and *gásbrènder* are left out, the averages will be somewhat higher for NR, PH, OT and EF, and the grand mean will be 3.1 cs. Leaving out NK and BJ, who read only one pair, will make a difference here, increasing the average by 0.5 cs.

Again all informants have more shortening in *sǿdsùppe* than in *nátlàmpe*. But the second member of *sǿdsùppe* is not much more shortened than the second member of e.g. *málebǿtten* (for four of six speakers it is shortened less), so one should perhaps not only look for special reasons for the large difference between *sǿdsùppe* and *sǿd súppe*, but also for the small difference in *nátlàmpe* vs. *mát lámpe*.

One might think of an influence from syntactic differences, but this is not obvious. Both *sǿd súppe* and *mát lámpe* represent attributive adjective plus substantive, and these sequences as well as the corresponding compounds are all objects

Table IV

*Reduction in duration (in cs) of the second member of compounds compared to a sequence of separate words with main stress and (practically) the same segmental structure. The reduction of the vowel alone is given in parentheses. * indicates significance at the 1% level.*

	NR	PH	EF	OT	SR	IE	BJ	NK	av.
1 'søð?ˌsobə[1]	6.2* (2.5*)	4.3* (2.4*)	5.2* (2.3*)	5.3* (3.1*)	4.3* (2.2*)	6.8* (1.7)			5.4 (2.4)
2 'nadˌlɑmbə	2.0 (1.1)	1.7 (0.8)	4.9* (0)	0.4 (-0.4)	3.1* (-0.2)	5.2* (1.5)			2.9 (0.5)
3 'sbi:?sˌʁɑisn̩			1.0 (0.8)						1.0
4 'vɛnˌsga:?bð̩			5.4* (3.1*)						5.4 (3.1)
5 'gasˌbʁænɒ[2]	-0.3	1.4*	0.3	0					0.5
6 'ma:ləˌkʰasn̩	4.4* (2.0)	3.4* (0.8)	3.6* (0.5)	4.6* (1.4)		2.2 (1.2)	1.3 (-0.6)	2.0 (0.4)	3.1 (0.8)
7 'ma:ləˌbødn̩	5.0* (1.8*)	4.6* (1.1)	5.8* (2.1*)	5.7* (2.6*)	0.7 (-1.0)	7.6* (3.0*)			4.9 (1.6)
8 'lɑməˌlɒ:?	4.5* (2.8*)	3.4* (2.3*)	4.3* (1.7*)	3.9* (1.8*)					4.0 (2.2)
9 'vɑ:məɑbɑˌʁɑ:?dð̩	3.1* (2.5*)	0.9 (0.4)	1.7 (1.5)	3.9* (5.0*)	0.8 (0.2)	7.6* (4.6*)			3.0 (2.4)
10 'misfɒˌsdɒ:?	2.9* (2.2*)	4.8* (2.7*)	3.3* (2.6*)	4.2* (4.0*)	-1.7 (-1.7*)	-0.3 (-0.4)			2.2 (1.6)
average	3.5 (2.1)	3.1 (1.5)	3.6 (1.6)	3.5 (2.5)	1.4 (-0.1)	4.9 (1.9)	1.3 (0.6)	2.0 (0.4)	2.9 3.2[3] 1.3 1.7

[1]) The final unstressed vowel or syllabic consonant was not included except for *súppe* because of difficulties of delimitation and because it was not always the same in the two members of the pair.

[2]) The second vowel in *gásbrènder* could not be delimited from the [ʁ]

[3]) The difference between the average over speakers and over words is diminished if the speakers who read only one pair (and the pairs read by only one speaker) are left out: 3.4/3.3.

in the sentences: *Óle spiser sødsùppe (sød súppe) til míddag* 'Ole has (a special type of) fruit soup (sweet soup) for dinner' and *jeg købte en mát lámpe (en nátlàmpe) til sóvekàmmeret* 'I bought a dim lamp (a bedside lamp) for the bedroom'. And in the example *gás brænder / gásbrènder* the words *gás brænder* are subject plus predicate, and here one should expect a less intimate connection so that one might expect a clearer shortening in the compound *gásbrènder*. It might also be possible that the consonant cluster [sbʁ] and in *nátlàmpe* the cluster [dl] invite to a slower pronunciation.

It is not possible either to find any reason for the differences between speakers. SR has the slightest shortening, IE the strongest, and they are both from Jutland. SR has the lowest average of all subjects, but he has a very unequal distribution: some words are shortened considerably, some not at all.

For the longer words (*vármeapparàtet* and *mísforstår*), there is great divergency among the speakers, but not in the same way. IE has more shortening than everybody else in *vármeapparàtet*, less than everybody else (except SR) in *mísforstår*. No speaker is quite consistent. This seems to show that shortening of the second member of the compound is very common, but that it is not a necessary feature of compounding. In this connection it should be mentioned that OT's pronunciation of *sødsùppe* generally sounds to me as two words, although he has just as much difference in duration as the other speakers. And SR's *sødsùppe* and *nátlàmpe* sound a few times like two words, but they are just as much shortened as in other cases (see below, section V.B.2).

c. Reduction of the distance between the sounds of the first and second member in compounds

It appears from table IV that the vowel is responsible for only about half of the shortening of the second member. Particularly the preceding consonant seems to be involved. That may have something to do with a disjuncture in separate words compared to compounds.

Table V gives the reduction in the distance between the vowels in the first and second member of a compound (the vowels with main and the vowels with secondary stress) compared to the distance between the two vowels with main stress in a corresponding sequence of two words. The intermediate consonant cluster has also been measured, but vowel distance (i.e. inclusion of the first vowel) gives larger differences and may be more interesting because it seems to be a plausible hypothesis that one perceives the syllable as starting approximately with the vowel. Experiments have shown that it is not that simple (see, e.g., Marcus (1979) with references). The whole structure of the syllable and particularly the type and number of initial consonants play a role. But since the pairs compared have the same structure, this is not very important, and vowel start seems to be a reasonable choice.

Table V

*Reduction of the distance (in cs) between the start of the first vowel and the vowel with secondary stress in compounds compared to the distance between the vowels in a sequence of two words with main stress and (practically) the same segmental structure. * indicates significance at the 1% level.*

		NR	PH	EF	OT	SR	IE	BJ	NK	av.
1	'sø̲ð?ˌso̲bə	4.9*	1.3	3.2*	3.1*	4.4*	5.2*			3.7
2	'na̲dˌla̲mbə	0.7	1.1	0.2	0.8	1.5	3.6*			1.3
3	'sbi̲:?sˌʁa̲isɳ			1.7						1.7
4	'vɛ̲nˌsga̲:?bð̲			3.0*						3.0
5	'ga̲sˌbʁæ̲nɒ	0.9	0.6	0.9	1.3					0.9
6	'ma̲:ləˌkʰa̲sɳ	2.7*	1.7	5.2*	2.1*		-0.3	0.8	5.0*	2.5
7	'ma̲:ləˌbø̲dɳ	3.1*	3.2*	3.4*	3.8*	1.0	0.7			2.5
8	'la̲məˌlɒ̲:?	2.8*	2.3*	1.7*	2.8*					2.4
9	'va:məabaˌʁa̲:dð̲	5.5*	1.2	-2.5	4.3*	0.3	5.3*			2.4
10	'misfɒˌsdɒ̲:?	0.7	3.2*	3.0*	4.5*	4.3*	1.5			2.9
average		2.7	1.8	2.0	2.8	2.3	2.7	0.8	5.0	2.5\2.3

The distance is reduced in compounds in 47 of 48 averages (98% of the cases), but it is significant in only 25 averages (52%); this reduction has a somewhat more even distribution across words and speakers, but it is of slightly less magnitude than the reduction of the second member (2.5 cs as an average over speakers vs. 2.9 cs). Of course this measure is a combination of shortenings in the first and second member and not an independent feature, but it might have been expected to be the best measure. Probably the best measure is the combined shortening of first and second member. This is shown in table VI. The combination of shortenings in first and second member gives an average of 4.3 cs. This means that in many cases it will be audible but not always for all speakers (cf. the average 2.3 cs for SR).

It can be concluded that there is very often a reduction of duration in compounds, and in many cases it will be audible, but it cannot be a sufficient cue.

d. Supplementary evidence from the 1961 material and the recordings of dialect speakers

Four pairs from the 1961 material have been analyzed, i.e. *sórt méjse* vs. *sórtmèjse*, *sórt kjóle* vs. *sórtkjòle*, *sød súppe* vs. *sødsùppe*, and *hvás máske* vs. *gásmàske*. The sentences are listed in Appendix I.

The first member of the compound was shortened in 58% of the cases but not very much, the grand mean being 1.3 cs, and there were differences according to words and to speakers, but no clear distribution according to speaker

Table VI

Standard Danish

Reduction (in cs) of first and second member and total reduction of compounds compared to a sequence of two separate words with main stress and (practically) the same segmental structure. The difference in distance between first and second vowel is also given (10 word pairs).

	NR	PH	EF	OT	SR	IE	BJ	NK	av.
first member	1.3	0.7	1.0	1.8	0.9	1.2	-0.3	4.3	1.4
second member	3.5	3.1	3.6	3.5	1.4	4.9	1.3	2.0	2.9
total reduction	4.8	3.8	4.6	5.3	2.3	6.1	1.0	6.3	4.3
distance	2.7	1.8	2.0	2.8	2.3	2.7	0.8	5.0	2.5

categories. The speaker who had the most consistent shortening (14 out of 16 cases, or 88%) was the CSC speaker PD.

There was a much more pronounced tendency to shorten the second member of the compound. This shortening was found in 83% of the cases with relatively small differences between speakers and words. The grand mean was 3.4 cs.

There was also a tendency to shorten the distance from the start of the first vowel to the start of the second vowel, the grand mean being 2.6 cs and the shortening taking place in 73% of the cases. There is thus complete agreement with the results of the main material.

The pairs *sød súppe / sødsùppe*, *måle bøtten / målebøtten* and *mát lámpe / nátlàmpe* were also read by a number of dialect speakers, four West Jutlandish speakers (BT, TA, EA and JD), one from Vendsyssel (North Jutland) (PN), and one from North-East Jutland (PM) and moreover by a speaker of the Århus Regional Standard. The pair *måle bøtten / målebøtten* was also read by six Funish dialect speakers. The Jutlandish dialect speakers read the sentence both in their dialect and in their Regional Standard Danish (RSD). A detailed account of the measurements is given in Appendix V followed by surveys of the differences corresponding to tables III-VI for the Standard Danish speakers. A brief summary corresponding to table VI for the standard language is given in table VII. It appears from this table that the Jutlandish speakers have a slight shortening in the first member of a compound, the average being 1.1 cs. This shortening is found in 68% of the individual averages, but it is only significant in 26%.

Table VII

Reduction (in cs) of first and second member and total reduction of compounds compared to a sequence of two separate words with main stress and (practically) the same segmental structure. The difference in distance between first and second vowel is also given.

A. Jutlandish (3 word pairs)

	BT	TA	EA	JD	PN	PM	LH	av.
first member	1.7	0.9	0.8	3.2	0.8	0.3	-0.2	1.1
second member	2.4	2.0	1.6	3.5	3.1	2.3	2.1	2.4
total reduction	4.1	2.9	2.4	6.7	3.9	2.6	1.9	3.5
distance	2.0	2.0	1.8	4.3	3.5	1.4	1.6	2.4

B. Funish (1 word pair)

	MA	LA	HV	EK	EH	av.
first member	-1.1	0.5	2.7	3.8	1.7	1.5
second member	0.2	0.5	0.6	3.2	1.7	1.2
total reduction	-0.9	1.0	3.3	7.0	3.4	2.8
distance	-3.4	0.5	5.9	2.3	1.1	1.3

In the second member the shortening is more pronounced (2.4 cs); it is found in 82% of the averages and is significant in 50%. Finally, the shortening of the distance between the first and the second vowel is 2.4 cs. It is found in 88% of the averages and is significant in 56%. This corresponds to the shortenings in the standard language. The Funish speakers have a shortening of 1.5 cs in the first member of *málebøtten*, 1.2 cs in the second member, and 1.3 cs for the distance, that is less shortening than for the other speakers but with a good deal of variation. (IP, who had a large reduction in the second member, has been left out, because her pronunciation of this word was unnatural).

In some cases compounds read by the Jutlandish speakers sounded as two words, also when the durational relations (reductions) were as expected (see the next section).

2. Fo-CONTOUR

a. Different types of compounds and speakers

For the analysis of the Fo contour it is practical to distinguish between different types of compounds according to the number and placement of unstressed syllables. The examples used in the main material belong to five different types (˘ indicates unstressed syllables here, — main and secondary stress and | the grammatical boundary; only the compound is cited as example, and the number of speakers is indicated in parentheses):

(a)	— | — ˘	*sødsùppe* (6), *nátlàmpe* (6), *gásbrènder* (4), *Spíesrèjsen* (1), *vénskàbet* (1)
(b)	— ˘ | — ˘	*málekàssen* (7), *málebøtten* (6)
(c)	— ˘ | —	*lámmelår* (4)
(d)	— | ˘ —	*mísforstår*
(e)	— ˘ | ˘ ˘ — (˘)	*vármeapparàtet*

(*gásbrènder* was read in two different sessions by EF, so that there is a total of 5 averages of this word.)

The four pairs used from the 1961 material all belonged to type (a). Most of the examples thus belong to types (a) and (b). These types are used here as examples of very clear differences between the Fo contours of sequences of two words with main stress and compounds with main plus secondary stress, and as examples of differences between various categories of speakers. The three remaining types are used to show that the location of unstressed syllables and the presence of stød may sometimes blur the distinction, so that there may be cases where Fo is not a sufficient cue for compounds. Sketches of the different contours are given in figure 10. They are only meant as rough indications of the main trends. (There are, of course, individual differences.) (See Appendix IV.)

In a sequence of two main stresses the second will start a new stress pattern but, due to the general declination in declarative sentences, on a slightly lower level. As described in section V.A.2, the stressed syllable will be placed at the bottom of the Fo wave for the ASC and CSC speakers and often be falling-rising, with a tendency to be more falling for the ASC, and more rising for CSC speakers. For the DSC speakers (who, in practically all the examples are represented by IE and SR, who have a West- and South-West Jutlandish background), and for the West Jutlandish dialect speakers the start is higher and the movement is rising, particularly for the dialect speakers (in syllables with stød most speakers have falling Fo, see, e.g., the Fo contour of the syllables *sød* in Appendix IV.1).

In compounds, however, the syllable with secondary stress behaves like an unstressed syllable in the Fo pattern. This also means that there will be differences between speaker cate-

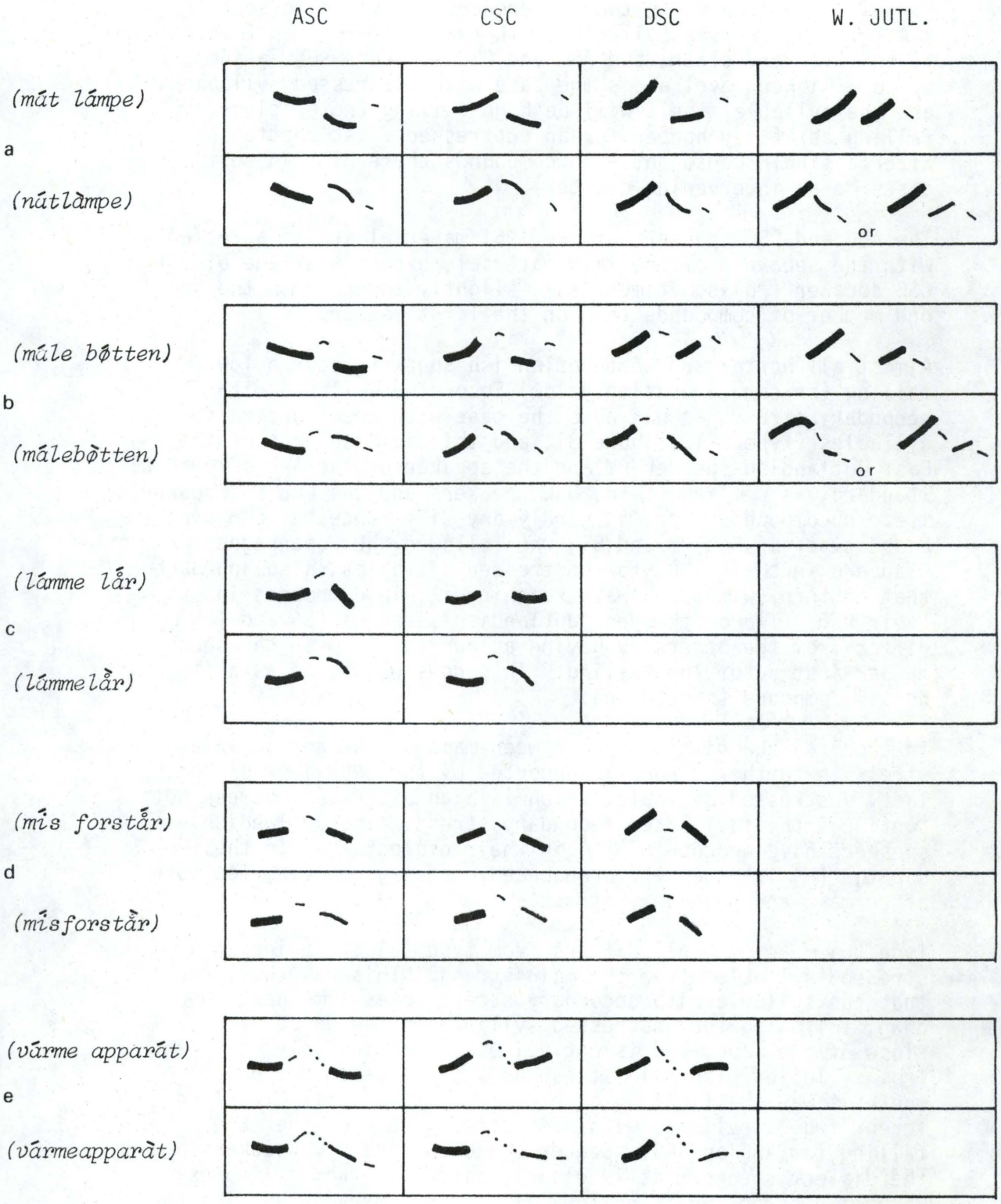

Figure 10

Rough sketches of Fo patterns for various types of compounds and various categories of speakers. Only the vowels are indicated. Thick lines = vowels with main stress; thinner lines = secondary stress, thin lines = weak stress.

gories corresponding to the differences described in section V.A.2 for unstressed syllables. In type (a) —ˈ— ˘ in figure 10 this is very clear; the ASC and CSC speakers show a jump up to a higher level as is the case with unstressed syllables, and the syllable itself will be high-falling (not rising-falling as it may happen for an unstressed first posttonic after a single consonant - in compounds there will in most cases be an intervening cluster).

The ASC and CSC speakers of the 1961 material are in agreement with the speakers of the main material, except that the oldest CSC speaker (PD) sometimes has a slightly lower Fo on the second member of compounds than on the first member.

Almost all North- and West-Jutlandish speakers have a low falling (or sometimes simply low) Fo on the syllable with secondary stress, as was also the case with their unstressed syllables (type 4 in figure 3), and this is also true of the East Jutlandish speaker PM and the speaker of the Århus Regional Standard, as well as of the DSC speakers and the Funish speakers; i.e. in compounds there is hardly any difference between type 3 and type 4. But PM and BT, who followed the Copenhagen standard in their RSD, for unstressed syllables, also approach that pattern (without always reaching it) in compounds in their RSD. Two of the West Jutlandish speakers (EA and TA) differ from the others by having a low rising Fo on the second member instead of low falling. This does not sound as a normal compound (see below).

In type (a) the distinction between main stress and secondary stress is further strongly supported by the behaviour of the last, unstressed syllable, which is high after main stress but continues the fall after secondary stress. The Jutlandish speakers have apocope of [ə] in their dialect, but in their RSD the [ə] is generally pronounced. It is, however, low both after main and secondary stress.

Type (b) — ˘ ˈ — ˘ only differs from type (a) by having an unstressed syllable after the main stress. This has the effect that the syllable with secondary stress comes somewhat lower down, following the unstressed syllable on the descending slope of the wave, and is not quite as conspicuously different from syllables with main stress as was the case in type (a) where it was the first posttonic. But it is still clearly different from a syllable with main stress, being rather high falling for ASC and CSC speakers, and for the DSC speakers and the dialect speakers it is clearly different from syllables with main stress by being low falling in contradistinction to the high rising syllable with main stress. Moreover, the last unstressed syllable which for the standard speakers is high after main stress and low after secondary stress makes the difference quite clear. The DSC speakers often have a higher Fo on the syllable *le* in *male* in the compound.

Types (c) — ∪ | — and (d) — | ∪ — differ from types (a) and (b) by not having a final weak syllable to indicate whether the preceding syllable has main stress or not. Moreover, in the examples chosen the syllables *lår* and *står* have stød and therefore a falling Fo movement. There will thus only be a difference in level between secondary and main stress, and this is not always quite clear. There are some cases of overlapping, where it is not possible to decide from the Fo contour alone whether the syllable has main or secondary stress. In (c) there is, however, a cue in the following word, which has reduced stress and is thus higher after the stressed *lår* than after the *lår* with secondary stress.

Whereas in (c) the weak syllable following the first stressed syllable belongs syntactically to this preceding syllable (*lámmelår*), it belongs to the following syllable in (d) (*mís-forstår*). In the sequence of separate words (*mís forstår*) there is, moreover, a word boundary between *mis* and *for* in contradistinction to what is the case in the compound. Now, as mentioned in section V.A.2, the CSC and DSC speakers have a tendency to place an unstressed syllable at a lower level when it belongs grammatically to a following stressed syllable, and thus they make a difference between *mís forstår* and *mís-forstår*, which is not quite consistent for the CSC speakers but which is consistent for the DSC speakers. Only the ASC speaker NR has complete overlapping (cf. the discussion in section V.A.3, p. 82).

In type (e) - ∪ ∪∪ — (∪) there is the further complication that there are three intermediate unstressed syllables, so that the last syllable comes rather low down. The CSC and DSC speakers have more often rising Fo on the syllable *rát* with main stress (although it has stød) than on the *ràt* with secondary stress, but all speakers have overlapping cases.

The texts contained a number of other compounds which did not have any counterparts consisting of separate words. These words were also read by the DSC speakers NK and BJ. They belonged to the types a, b and c, and their Fo contour was in complete accordance with the description given above of the compounds in the test words.

b. "Equal stress" in some Jutlandish compounds. As mentioned in section II, some compounds in Jutlandish dialects are described as having equal stress on both members. In the present material the words *nátlàmpe*, *sødsùppe* and *málebøtten*, read by the West Jutlandish speaker EA, sounded to me as two separate words, and in TA's pronunciation I could not decide whether they were two separate words or not, sometimes I tended to hear one word, sometimes two. The word *sødsùppe* has been left out in the measurements for these two speakers because there was nothing in the environment that could indicate what word was meant,

and so it could not be decided whether they had used the wrong word or had intended the right word; moreover, this word was not natural for them. There was no clear difference in these pairs in their RSD either; some other compounds in the texts which were not members of pairs (*Dánfòss*, *sóvekàmmeret*) sounded as normal compounds. In the pronunciation of the RSD speaker from Århus the words *sødsùppe* and *nátlàmpe*, but not *málebøtten*, also sounded as two words. Some of the compounds read by the DSC speakers made the same impression of being two separate words. In the 1961 material this was true of *sødsùppe* and *sórtkjòle* read by SR, and of these words plus *sórtmèjse* read by BF. A small informal listening test with two ASC listeners and one CSC listener showed much uncertainty in the identification of these words. In the 1982 material I heard two of SR's examples of *sødsùppe* and all OT's examples of the same word as two separate words, and I was in doubt about the stress in some examples of *nátlàmpe*.

Asked directly both OT and EA declared that there was a difference; they had meant them to be compounds. And of course these words are grammatically compounds and not simply separate words. In the case where they consist of attributive adjective + substantive (e.g. *sødsùppe*, *sórtkjòle*) they might be separate words as long as they have no definite article. But both OT and the DSC and Århus speakers who used these words would place the definite article at the end (*sødsùppen*, *sórtkjòlen*), whereby they are characterized as compounds. So did the West Jutlandish speakers in their RSD in the case of *málebøtten*. And words like *málebøtte* and *nátlàmpe* do not give any grammatical sense except as compounds. But they may be described as compounds with equal stress, i.e. they may constitute two stress groups.

The durational relations in the words heard as separate words do not generally differ from those found for other speakers whose compounds were heard as quite normal. OT even has a very clear durational difference between *sødsùppe* and *sød súppe* But in most cases there were deviations from normal compounds in the Fo contour (see Appendix IV and V).

Both EA and TA (particularly EA) had rising Fo in the syllable which should have secondary stress, i.e. in this respect it behaves as a syllable with main stress starting a new stress contour. For OT and SR the difference seems to lie in the last unstressed syllable of *sødsùppe* (and *nátlàmpe*). It was slightly higher than the preceding syllable which was rather level, and for SR this only happened in the two examples which I heard as having two main stresses. LH had rising Fo in the sonorant consonant following the vowel in *-làmpe* and no Fo difference between *sød súppe* and *sødsùppe*. This seems to indicate that the Fo movement is a more important cue than duration, at least for ASC and CSC listeners. In the 1961 material, however, it was difficult to find any explanation of the differences. It would be interesting to undertake some well planned listening tests both with Copenhagen and dialect listeners. They might

show more clearly what are the important perceptual cues. The problem is not quite simple. The Copenhagener does not simply use his own norm in listening. He is not confused by the fact that most dialect speakers have low falling Fo in unstressed syllables and in syllables with secondary stress, whereas he himself has high falling Fo. The listener probably quickly adapts to this difference. But when the dialect speaker has rising Fo he hears a stressed syllable because in the dialect this normally signals stress, and he expects syllables with secondary stress to be treated like unstressed syllables as far as the Fo contour is concerned.

3. INTENSITY

Peak intensity has been measured in mm, and the sequence of two main stresses was compared to the sequence of main stress plus secondary stress for each pair. If the compound has a more extensive decrease or a smaller increase in the second part than the sequence of two words (i.e. ˉ _ vs. ˉ – , or – – vs. _ ˉ), the contribution of the intensity to the reduction of the second part of the compound was considered positive (see Appendix IV). This was the case in 80% of the pairs for IE, SR and EF; and for IE 67% of the individual averages were significantly different, but for EF and SR only 9 and 17%, respectively. For PH there were 50% positive relations, for NR 25%, and for OT 13%. There are thus great individual differences, and the positive cases are very rarely significant except for IE. It is therefore not probable that these differences have any value as cues for stress differences. The consistent difference for IE can probably be explained by the fact that she has a very low Fo on syllables with secondary stress. SR also has a relatively low Fo combined with secondary stress, but EF has a high Fo.

In the 1961 material the intensity relations are also irregular, but here too, EF often combines high Fo and low intensity.

For the Funish and Jutlandish speakers the result is quite different (see Appendix V). There were 41 individual pairs, 76% of these were positive, and for 49% the difference was significant. Six of the ten exceptions were due to the recordings in standard language of BT and PM, and they do not really use a regional standard but the Copenhagen standard. If they are excluded, there will be 89% positive pairs, of which 57% have a significant difference.

This means that almost all the speakers who have low falling Fo on syllables with secondary stress have a relative decrease in intensity, whereas those who have a high falling Fo, do not have this decrease in intensity. Thus the intensity difference seems to depend on the Fo difference and may not be an independent cue. But EF has high Fo combined with low intensity. She thus seems to use intensity as a separate factor, but even in this case it is only a tendency, since only one of her nine positive averages shows a statistically significant

difference. This generally negative result was one of the reasons why I did not find it worth while for the time being to re-record the whole material in order to get dB-measures instead of mm.

The Jutlandish examples read by TA, EA, and LH, which sound to me as having two main stresses, have a clear intensity difference like the other compounds in Jutlandish. This does not seem to have influenced my identification. It is possible that the Jutlandish speakers themselves use different perceptual criteria. However, dialectologists with a Jutlandish background also describe a number of compounds as having two main stresses (e.g. Ejskjær 1954).

4. CONCLUSION

The analysis of compounds with secondary stress on the second member shows that they differ from a sequence of two words with main stress both in duration and in Fo. The shortening is small and inconsistent in the first member of the compound, whereas the shortening of the second member and of the distance between the start of the two vowels is more pronounced and more regular. The total shortening is quite considerable, 4.3 cs for the standard speakers and 4.2 cs for the Jutlandish speakers on the average.

The difference in Fo contour is in almost all cases quite clear, but it is not the same for different categories of speakers, i.e. for different dialects and sociolects. This does not seem to hamper mutual understanding except in the cases where some Jutlandish speakers use what listeners from other dialects hear as equal stress on the two members of the compound.

The differences in intensity seem to follow the differences in the Fo contour: Speakers who have high falling Fo on the second member of compounds tend to have higher intensity too, whereas those who have low falling Fo also have low intensity. There are, however, exceptions; higher Fo may be combined with lower intensity, particularly for informant EF, but it is only a tendency. There seems to be individual differences in the degree to which Fo and intensity vary in parallel.

Fo seems to be the decisive factor in the cases where CSC listeners hear two equal stresses in Jutlandish dialects or Standard Danish influenced by Jutlandish.

C. STRESS REDUCTION IN THE SECOND MEMBER OF COMPOUNDS COMPARED TO STRESS REDUCTION IN UNIT ACCENTUATION

As mentioned in section II there is a clear difference between the reduction of stress in second members of compounds and in first members of a unit accentuation group, since the reduced second members of compounds retain their stød and their phono-

logical vowel length difference, whereas syllables reduced by unitary stress loose their stød and - at least for monosyllabics - also the vowel length difference. But the question is whether there is any difference between the two types in the cases where there is short vowel and no stød, i.e. whether there are also differences in other features which might be relevant as cues for stress perception.

The main material contains a number of examples of stress reduction by unit accentuation which may be compared both to words with main stress and to words with reduced stress in second members of compounds. The pairs are listed in section IV with translation and the sentences are listed in Appendix II, but it may be practical to repeat the triplets here (with number of speakers in parentheses): *sød súppe / sødsùppe / sød suppedás* (6), *mát lámpe / nátlàmpe / mát lampét* (6), *mále kássen / málekàssen / mále Casanóva* (7), *mále bøtten / málebøtten / mále bøtte fém* (6), *gás bréndər / gásbrèndər / gás brænder néd* (4), *mís forstår spøgen / mísforstår spøg / mis forstår spøg* (6), *Spíes réjse / Spíesrèjsen / Spíes rejse méd* (1), *vén skáber sig / vénskàbet / vén skaber problémer* (1). (The sentence *Sánna mísforstår spøg* may also be pronounced with unit accentuation, but a complex compound need not be weakened as first member of a unit accentuation group.) There were further two examples where only main stress and unit accentuation reduction could be compared: *det várme apparát / varme apparátet óp* (6), and *mále bøtten / male bøtten grøn*. Three examples from the 1961 material were also analyzed: *vándkànde / kande vánd*, and (only for comparison with main stress): *sát óppe / sat óp* and *sátte kássen óppe / satte kássen óp*.

1. DURATION

As mentioned in section V.B.1, there is only a very weak tendency to shorten the first member of compounds (1.4 cs on the average). In unit accentuation there is no shortening at all of the preceding stressed syllable (0.2 cs on the average). This means that the stressed syllable of the preceding prosodic stress group which is expanded by the reduced word, e.g., *mále bøtte | fém* (vs. *mále | bøtten*) is not shortened.

The reduced syllable is, however, shortened, and more so than in the second member of compounds. Table VIII gives the differences in duration between syllables with reduced stress and syllables with main stress. The reduction in duration is considerable: 5.3 cs on the average. There is shortening in 46 (92%) of the cases. There is no clear grouping of speakers: the ASC speaker and the DSC speaker IE have the strongest reductions, and the DSC speaker SR the smallest reduction, but still 3.4 cs, which is probably audible. There are more conspicuous differences between words. The shortening is of considerably larger magnitude in intraword unit accentuation (7.4 cs) than in phrasal unit accentuation (4.0 cs), but the example *mále bøtte fém* comes very close to the reduction in intraword unit accentuation (6.8 cs). The pair with the least

Table VIII

Standard Danish

*Reduction in duration (in cs) of a word or syllable weakened by unit accentuation compared to a word or syllable with main stress and the same segmental structure, following the same stressed word (A), or preceding the same stressed word (B). * indicates significance at the 1% level.*

A.		NR	PH	EF	OT	SR	IE	BJ	NK	av.
1	'søð? sobə 'da:?s	6.2*	5.6*	5.3*	5.3*	8.5*	10.4*			6.9
2	'mad lam'pʰɛd	9.1*	6.0*	6.7*	7.8*	5.9*	9.0*			7.4
3	'sbi:?s ʁaisə 'mɛð			5.3*						5.3
4	'vɛn sga:bɒ pʁo'ble:?mɒ			4.0*						4.0
5	'gas bʁænɒ 'neð?	1.6	2.0*	0.7	-0.2					1.0
6	'ma:lə kʰasa 'no:va	12.7*	7.2*	5.3*	9.3*		10.9*	7.3*	3.5*	8.0
7c	'ma:lə bødə 'fɛm?	8.9*	2.8*	7.2*	6.2*	5.3*	10.6*			6.8
10	'mis fɒsdɒ 'sbɔi?	10.0*	4.2*	6.2*	6.5*	-0.9	4.9*			5.2
B.										
7d	ma:lə 'bødn̩ 'gʁœn?	6.1*	2.8*	3.9*	5.1*	2.4*	3.2*			3.9
9	va:mə aba 'ʁa:?dð̩ 'ɔb	1.4	2.2*	3.0	1.2	-0.8	2.9*			1.7
	average	7.0	4.1	4.8	5.2	3.4	7.4	7.3	3.5	5.3 5.1

shortening is *gás brænder néd* vs. *gás bránder* (1.0 cs). ['bʁænɒ] was also hardly shortened as second member of a compound (see above V.B.1, where it was supposed to have something to do with the loss of stød). In *varme apparátet óp* the relatively slight shortening is probably due to the long distance between the reduced syllable and the following main stress. The long vowel [a:] of *varme* [va:mə] is only reduced by 1.6 cs and certainly not reduced to be as short as a phonologically short vowel. The other example with a long vowel is *male* in *male bøtten grøn*. The vowel is here shortened by 2.5 cs.

The shortening in these words is somewhat more pronounced than the shortening in second members of compounds. In table IX the two types are compared. The syllable with unit accentuation has more reduction than the compound in 31 (79%) of the 39 comparable pairs, and the difference is significant in 24 pairs (62%). IE has

Table IX

*Reduction in duration (in cs) of a word or syllable weakened by unit accentuation compared to a sequence with secondary stress and the same segmental structure following the same stressed word (reduction in unit accentuation - reduction in the compound). * indicates significance at the 1% level.*

		NR	PH	EF	OT	SR	IE	BJ	NK		av.
1	'søð? sobə 'da:?s	0	1.3	0.1	0	4.2*	3.6*				1.5
2	'mad lam [1] 'pʰɛd	7.7*	4.8*	3.5*	6.3*	4.2*	6.5*				5.5
3	'sbi:?s ʁaisə 'mɛð			4.3*							4.3
4	'vɛn sga:bɒ pʁo'ble:?mɒ			-1.4							-1.4
5	'gas bʁænɒ 'neð?	1.9*	0.6	0.4	-0.2						0.7
6	'ma:lə kʰasa 'no:va	8.3*	3.8*	1.7*	4.7*		8.7*	6.0*	1.5		5.0
7	'ma:lə bødə 'fɛm?	3.9*	-1.8*	1.4	0.5	4.6*	3.0*				2.5
10	'mis fɒsdɒ [2] 'sbɔi?	7.1*	-0.6	2.6*	2.3*	0.8	5.2*				2.9
	average	4.8	2.0	1.6	2.3	3.5	5.4	6.0	1.5	3.4	2.6 [3]

[1]) In no. 2, *lam* in the compound is compared to *lam* in unit accentuation, whereas in table IV the [b] of *lampe* was included in the comparison with main stress.

[2]) EF had two readings of *mísforstår* vs. *mís forstår spøg*.

[3]) The difference between the average over speakers and over words is diminished if the two pairs read by only one speaker (and the two speakers reading only one pair) are left out: 3.2 3.0 cs.

a significant difference in all five pairs, and the smallest difference is 3.0 cs; thus she seems really to use this distinction consistently. For the other subjects there are one or two word pairs with very little difference. The types are thus not kept consistently apart by means of duration. *lampét* compared to *lámpe* is the only word pair with a consistent and clear difference for all speakers (average 5.5 cs, minimum 3.5 cs). In other words, some speakers have very small differences, but the tendency is very clear. The only clear counterexample is *vén skaber problémer* vs. *vénskàbet*. This may perhaps be due to the lack of stød in *skaber* vs. *skàbet* (cf. the example *gásbrænder* above).

One might also expect to find a difference in the distance from the preceding word (see table X), because the second member of the compound belongs to the preceding part (and there was a difference in distance between the vowels of the compound compared to two words with main stress), whereas the reduced syllable with unit stress belongs to the following word syntactically, and one should therefore not expect a shortening of the distance from the preceding word. However, the distance is in fact shortened in this case too. The first 8 cases in table X can be compared to the shortening in compounds. The shortening is here seen in relation to an identical preceding stressed word. The average shortening of the distance is here 1.1 cs. It is found in 71% of the averages but is only significant in 21% of the pairs. It is thus less than in compounds where the shortening was 2.3 cs with 98% positive and 54% significant cases. But that there is a certain shortening shows that the word boundary is not marked very clearly (the difference from compounds is only significant in 15% of the averages). The two last examples show the reduction in distance to a following stressed syllable to which the reduced word belongs syntactically. This shortening seems to be somewhat more pronounced in *male bøtten grøn*. The relatively small reduction in *varme* may be due to the many intervening weak syllables. The syntactic connection thus seems to play a certain role, but more examples would be needed to prove it.

In the 1961 examples the syllable *sat* in *sat óp* was shortened by 7.5 cs compared to *sát óppe*, and the vowel by 3.7 cs, and *sat* in *satte kássen óp* was shortened by 8.3 cs and the vowel by 3.5 cs compared to *sátte kássen óppe* (seven speakers). For all speakers the *a* in *kande* was shortened more in *kande vánd* than in *vándkànde*, and the same was true of the whole word, but the differences were small.

2. THE Fo CONTOUR

Like syllables with secondary stress syllables with reduced stress due to unit accentuation are also treated as unstressed syllables as far as the Fo contour is concerned, i.e. they form part of the descending slope of the preceding stress group, and if the preceding word is monosyllabic the reduced syllable will therefore be high-falling in the pronunciation of ASC and CSC speakers, whereas it will be somewhat lower if it is preceded by weak syllables. In all cases the difference from main stress is clear, except for *mís forstår* and *mís forstår spøg* because of the fall of stressed *står*, which has stød (as was the case for the difference between a compound and two words).

In principle the Fo contour will thus be the same in the second member of compounds and in syllables reduced by unit accentuation, e.g. *málebøtten* and *måle bøtte fém*. The individual speakers often do have small differences between the two types, and there is a consistent difference (i.e. the same in all eight tokens) in 15 out of 39 pairs (thus in 38%), but the difference,

Table X

Reduction of the distance (in cs) between the start of the vowel with reduction due to unit accentuation and the vowel of the preceding stressed syllable (1-10), or the start of the following stressed vowel (9 and 7d) compared to the start of vowels in two consecutive stressed syllables.

		NR	PH	EF	OT	SR	IE	BJ	NK	average	
1	'sø̲ð? so̲bə 'da̲:?s	2.3	1.4	2.5*	3.2*	4.0*	5.0*			3.1	
2	'mad la̲m 'pʰɛ̲d	1.0	1.1	1.5	1.2	2.2	3.9*			1.8	
3	'sbi̲:?s ʁa̲isə 'mɛð			0.1							
4	'vɛ̲n sga̲:bɒ pʁo̲'ble̲:?mɒ			1.0							
5	'ga̲s bʁæ̲nɒ 'ne̲ð?	-0.2	-0.4	-0.4	-0.1					-0.3	
6	'ma̲:lə kʰa̲sa 'no̲:va	1.8	1.1	3.3*	2.3		1.2	0.3	0.3	1.5	
7c	'ma̲:lə bø̲də 'fɛm?	2.4*	1.0	1.8	1.6	1.8*	-0.1			1.4	
10	'mis fɒsdɒ 'sbɔi?	-0.5	0.7	-0.1	-0.2	-1.1	-0.4			-0.3	
	average	1.1	0.8	1.1	1.3	2.1	1.7	1.5	0.3	1.1	1.0
7d	'ma̲:lə 'bø̲dn̩ 'ʏʁœn?	4.4	2.2	2.5*	5.0*	2.5*	3.8*			3.4	
9	vɑ̲:mə ɑba 'ʁɑ̲:?dð̩ 'ɔb	2.4	-0.5	-1.1	3.8*	-0.5	2.7*			1.1	
	average	3.4	0.8	0.7	4.4	1.0	3.3			2.3	2.3
total average		1.7	0.8	1.1	2.1	1.5	2.3	0.3	0.3	1.3	1.4

which mainly consists in a different height of the weakened syllable, is not the same for all speakers, nor is it the same for the different words read by the same speaker, and therefore these differences hardly have any value as perceptual cues.

There is only one more general tendency: The CSC and, still more, the DSC speakers, in contradistinction to the ASC speakers, show a certain tendency to have a relatively lower Fo on a weak syllable which belongs syntactically to the following word (see section V.A.2). Seen in relation to the preceding stressed syllable this tendency is not very obvious for the CSC speakers in the 1982 material except for two of the three speakers in

mísforstår (see section V.a.2), and in *mále bøtte fém* vs. *málebøtten*. It is true that *suppe* is lower in *en sød suppedás* than in *sødsùppe* for all three CSC speakers, but that may be because *suppedás* is the last word of the sentence. A relatively low level in relation to the following stressed word is counteracted in most of the examples by the final position of this latter word. But it is clear in the two examples where the following stressed syllable is not the last stressed syllable of the sentence, i.e. *Ótto vil mále bøtte fém i mórgen* and *Jeg købte en (gámmel) mát lampét til sóvekàmmeret (igår)*. This is, however, mainly due to a particularly high level of the word which carries the unit accent. The syllables *fém* and *-pét* do not lie on the general declination line of the sentence, but are either on the same level or higher than the preceding stressed syllables for all speakers. This cannot be due to a difference in intrinsic Fo, for the intrinsic difference between [a] and [ɛ] is less than three Hz (according to Petersen 1976), and for EF and PH the difference is considerably larger. It cannot, either, be a simple resetting in a longer sentence. It is true that PH has a rather irregular declination line, but EF does not have resetting in other sentences with four to five stresses. The relatively high Fo is mostly accompanied by higher intensity. In the sentences *kássen er sat óp på lóftet* and *han fándt en kande vánd i køkkenet* (from the 1961 material) *óp* is not only higher than *sat*, and *vánd* than *kande* for four out of five CSC and DSC speakers. They are also higher than the preceding stressed words (*kássen* and *fándt*, respectively) for three of the five speakers.

3. INTENSITY

The difference in intensity contributes somewhat more in the case of reduction by unit accentuation than in compounds with secondary stress. In the latter case there were very great individual differences, the grand mean for all speakers being 55% positive cases, i.e. cases where the intensity difference parallels the stress difference, but with only 4% significantly different cases. In the former case, i.e. unit accentuation, all speakers except NR had reduction of intensity in the majority of cases, the grand mean being 65% positive and 23% significant cases. Thus there is a somewhat stronger tendency to decrease the intensity in the stress reduced member of a unit accentuation group, and this cannot be explained by the Fo contour, but it is only a tendency, and it cannot be of much importance as a perceptual cue.

4. CONCLUSION

Reduced stress due to unit accentuation differs from secondary stress in compounds by loss of stød and (at least in monosyllabics) of phonological vowel length, by a more pronounced tendency to reduction in duration and a slight tendency to more reduction in intensity.

D. SECONDARY STRESS IN COMPOUNDS COMPARED TO WEAK STRESS

As mentioned in section II, Rischel has suggested that in syllables with short vowels there is hardly any difference between secondary stress and weak stress. In an oral discussion he gave the example *útỳske* 'monster' (compound) - *emfátiske* 'emphatic' (derivative). This has been tested in a single pair. Instead of *emfátiske* which has stød, I chose *polítiske* for three informants to be compared with *útỳske*; then, as this might be said to be a very common word with more reduction than the more rare word *ùtỳske*, I chose *herrenhútiske* (which certainly cannot be said to be a common word) for three more informants.

All speakers had a very clear and highly significant difference in the duration of *tỳsk* vs. *tisk* (9.7 cs on the average). The vowels were only significantly different for three speakers (two examples of *politiske* and one of *herrenhútiske*), and the closure of the *t* for two speakers. The main difference was in the aspiration, which was 8.6 cs in *útỳske* and 2.7 cs before the derivative *isk*, thus practically reduced to [d] (with the exception of SR's pronunciation of *polítiske*), and this lack of aspiration may be interpreted as indicating a following weak syllable, since it is a general rule that Danish stops are unaspirated before [ə] and the weak ending *-ig*. Moreover, four of the six informants had a clear difference in the Fo contour of the two words, and two had an inconsistent difference. OT, SR and IE have a much higher pitch in *-tisk* than in *-tỳsk*, and NR has a rise in *-tisk* and a fall in *-tỳsk*, whereas PH and EF sometimes have a rising-falling contour in *-tisk* but never in *-tỳsk*. This difference evidently depends to a large extent on the difference in the duration of the preceding consonant, which is much longer in *-tỳsk*, so that the Fo contour has come farther down when the vowel starts. However, this does not explain the whole difference. If the curves are superposed they fit completely for NR, who has a rise in *tisk* and a (higher starting) fall in *tỳsk*. But for PH and EF *tỳsk* starts at a too high level and, what is more important, for OT, SR and IE, who generally have a relatively low Fo on second members of compounds but otherwise a higher unstressed syllable, *tỳsk* is considerably lower than it should be according to the Fo wave of *polítiske*. Finally, NR, PH and OT have a significant difference in the intensity which is lower in *-tisk*, although Fo is higher, and EF and IE have a tendency in the same direction.

Thus, in this example there was no merging of secondary stress and weak stress. But more examples are needed, also examples with other consonants than stops, before any safe conclusion can be drawn about the general tendency.

VI. GENERAL CONCLUSIONS

The present investigation is in many respects very preliminary, and the conclusions must be taken with some reservations. I can only hope that it will provoke some more intensive studies of restricted problems combined with perceptual tests.

The preliminary conclusions are the following:

(1) Weak stress is distinguished from main stress in Danish by loss of stød and phonological vowel length, by duration, by the Fo contour and, for weak syllables with [ə] and [ɒ/ɔ] also - though less consistently - by intensity, in the sense that lower intensity is often combined with higher Fo. The shortening of unstressed syllables may be considerable; for the word pairs where syllables of the same structure could be compared it was 6.3 cs on the average. This must be of perceptual importance. The same must be true of the Fo differences, which are very clear and stable within the same norm, but of different type in different dialects.

The data for Advanced Standard Danish (ASC) is in complete conformity with Nina Thorsen's description of the ASC stress contour, i.e. a low predominantly falling, stressed syllable plus a high posttonic with a gradual fall of following, unstressed syllables. (This is here called type 1.) Speakers of a slightly more conservative norm (CSC speakers) follow the same pattern in principle, but with small deviations: somewhat more frequently low rising stressed syllables and a tendency to lower an unstressed syllable which belongs syntactically to the following stressed syllable and after stød. (This is here called type 2.) A North-East Jutlandish speaker (PM) and a speaker of the Århus regional standard had generally rising Fo in stressed syllables and a quicker fall, so that posttonic vowels after single consonants are higher than the stressed vowels, whereas they are lower after clusters (type 3). Finally, West Jutlandish speakers have high and rising stressed syllables and a steeper fall, all unstressed syllables being relatively low (type 4). The North Zealandish speakers follow type 3 in principle, but approach type 4 after obstruents. East Jutlandish speakers (apart from PM) follow type 4 in principle, but approach type 3 after sonorants. Copenhagen standard speakers with a Jutlandish background compromise between type 2 and type 4, and thus come close to type 3.

The relative importance of duration and Fo should be investigated by perceptual tests. The importance of intensity is more problematic. For full vowels it generally follows the Fo contour and increased intensity can hardly be expected to support the impression of weak stress, unless the increase is smaller than should be expected, if intensity is expected to follow Fo. It remains to be investigated what type of compensation the listener will make. But for the time being I assume that intensity is less important as a perceptual cue than both Fo and duration.

(2) Secondary stress in second members of compounds is distinguished from main stress by a reduction of syllable duration (on the average 2.9 cs in the standard language, thus less than in unstressed syllables). There is also a shortening of the distance between the start of the vowel in the syllables with main and secondary stress (2.6 cs), and a very weak tendency to shorten the first member of the compound (1.4 cs on the average). The total shortening, i.e. the sum of the shortening of first and second member of a compound thus amounts to 4.3 cs on the average, but there are large variations according to words and speakers, and there are countercases without shortening, which are nevertheless perceived correctly.

The Fo contour of syllables with secondary stress is the same as for unstressed syllables and very stable. The Fo contour of a compound thus differs clearly from the Fo contour of a sequence of words with main stress. 85% of the individual pairs were consistently distinguished, but there was some overlapping in certain word types.

The intensity is very variable in Standard Danish and only significantly lower for one informant, who has low Fo on secondary stress. In Jutlandish secondary stress has lower intensity, following Fo. Its perceptual importance is thus dubious.

(3) Reduced stress due to unit accentuation differs from secondary stress in compounds by loss of stød and (at least in monosyllabics) of phonological vowel length, by a more pronounced tendency to reduction in duration, and a slight tendency to more reduction in intensity. The Fo contour is practically the same, but there may be a difference in relation to the following stressed syllable. It approaches weak stress, but it may have overlapping both with secondary stress and with weak stress.

(4) The very limited material (one pair spoken by six informants) shows a clear distinction between secondary stress in a compound and weak stress in the derivative *-isk*.

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APPENDIX I

The 1961 material.

1. a. Vi får sikkert sødsùppe/sød súppe til fórmåd.
   b. Hvis det víser sig at menúen står på sødsùppe/sød súppe, skal jeg ikke håve nóget.
   c. Kan du líde sødsùppe?/sød súppe?
   d. Néj, jeg bryder mig ikke om sødsùppe/sød súppe.

2. a. Har du nógensìnde sét en sórtmèjse /sórt méjse?
   b. Jå, jeg så en sórtmèjse/sórt méjse på túren igår.
   c. Hvis man skal ópnå at få øje på en sórtmèjse/sórt méjse, må man forhólde sig méget rólig.
   d. Jeg har áldrig ópnået at sé en sórtmèjse/sórt méjse.

3A. a. Dórthe vil méget gérne håve en sórt kjóle.
   b. Hun vil have en sórt kjóle på til fésten.
   c. Har Dórthe fået en sórt kjóle?
   d. Hvis Dórthe ikke får lóv at få en sórt kjóle, bliver hun fornærmet og går ikke méd.

3B. a. En katólsk præst blev tídligere ófte kaldt for en sórtkjòle.
   b. Når man kaldte den katólske præst for en sórtkjòle, blev han fornærmet og gík sin véj.
   c. Kaldte mánden præsten for en sórtkjòle?
   d. Ja, men han kalder ham kún for en sórtkjòle når han er vréd.

4A. a. Enhvér déltàger i øvelsen må sélv médbrìnge en gásmàske.
   b. Man skal have gásmàske på héle áftenen.
   c. Har du fået ánskàffet en gásmàske?
   d. Hvis du ikke har fået fát i en gásmàske, kan du ikke komme méd til øvelsen.

4B. a. Han havde en hvás máske på héle áftenen.
   b. Han går áltid rúndt og víser en hvás máske.
   c. Går han áltid rúndt med sádan en hvás máske?
   d. Hvis han áltid víser sádan en hvás máske, vil han ikke égne sig til stíllingen.

5. Kássen blev sát óppe / sat óp på lóftet.
   Han sátte kássen óppe / satte kássen óp / på lóftet.

6. Han fándt en kánde, en vándkànde / en kande vánd / en tóm kánde i køkkenet.

The sentences a,b,c,d within each group (1,2,3,etc.) were read in the given order, a and b (and c and d) in immediate succession, but otherwise the order was random, and other sentences were interspersed. - 3A was read by some speakers, 3B by others.

APPENDIX II

The 1982 material

The numbers of the sentences correspond to the numbers in Appendices III and IV and in the tables.

In some cases the sentences varied in details for different speakers, the variants are given in parentheses.

A. Main stress vs. weak stress

1a Blómsten hávde nogle gárnàgtige støvdrägere.
b Søren kóm med nogle barnágtige údtàlelser.

2a Jeg fík (købte) en (en gámmel) mát lámpe til sóvekàmmeret (igár)
b Jeg fík (købte) en (en gámmel) mát lampét i fórgårs (igár).

3a Han passérede Sánddàlen sídste sómmer (i fórgårs)
b Han kassérede sandálen sídste sómmer (i fórgårs)

3a Det er Sánddàlen de síger (NR only)
b Det er sandálen de síger

4a Jórdbær er bílligst om sómmeren (NR only)
b Jéns er bilíst om en háls

4a Det er bílligst de siger (EMG material)
b Det er bilíst de siger

5a De sagde mámam
b De sagde mamám

B. Main stress (a) vs. secondary stress in compounds (b) and unit accentuation reduction (c)

1a Óle spiser sød súppe til míddag (dáglig)
b Óle spiser sødsùppe til míddag (dáglig)
c Det var en sød suppedás

2a Jeg fík (købte) en (en gámmel) mát lámpe til sóvekàmmeret (igár)
b Jeg fík (købte) en (en gámmel) nátlàmpe til sóvekàmmeret (igár)
c Jeg fík (købte) en (en gámmel) mát lampét til sóvekàmmeret (igár)

3a Han lod Spíes réjse ságen
b Han tog Spíesrèjsen méd (EF only)
c Han lod Spíes rejse méd

APPENDIX II (continued)

4a Péters vén skåber sig
b Nú giver vénskàbet problémer (EF only)
c Péters vén skaber problémer

5a Hendes gás brænder dårligt
b Hendes gásbrænder söder
c Hendes gás brænder néd

6a Han vil måle kássen nú
b Han tog málekàssen méd
c Han vil måle Casanóva

7a Ótto vil måle bøtten stråks i mórgen (hér i gården)
b Ótto tager målebøtten frém i mórgen
c Ótto vil måle bøtte fém i mórgen
d Ótto vil male bøtten grøn i mórgen

8a Hendes lámme lår sygner hén
b Hendes lámmelår smager gódt

9a Péter smed det várme apparát néd på køkkengùlvet
b Péter tog vármeapparàtet méd til sómmerhùset
c Péter vil varme apparátet óp i fórvèjen

10a Sánnas (Hánnes) mís forstår spøgen
b Sánna (Hánne) mísforstår spøg
c Sánnas (Hánnes) mís forstår spøg

C. Secondary stress in compounds vs. weak stress

a Han var et útỳske mod sine børn.
b I det politiske kom han til kórt.
c Det Herrenhútiske var ham imód.

APPENDICES III-V

Introduction

In Appendix III syllables with main stress are compared to syllables with weak stress of the same (or almost the same) segmental structure; in Appendix IV syllables with main stress (a) are compared to syllables with reduced stress as second member of compounds (b), or weakened by unit accentuation (c), and the latter two are compared with each other. In Appendix V syllables with main stress are compared to syllables with reduced stress as second member of compounds, read by some dialectal speakers.

The duration measurements are averages of 8 tokens (for the dialect speakers sometimes only 6). In Appendix III the difference in duration between the first and the second vowel of the same word is also given if they had the same quality.

In Appendix IV-V the distance in cs between the start of the vowels of the first and second syllable (with stress or reduced stress) is also given.

In the graphs for Fo and intensity the time relations are not maintained in details. The Fo graphs are based on 3-4 superposed tracings and on sketches of all eight tokens. The tokens were generally very similar. Vowels with main stress are represented by thick lines, vowels with secondary or weak stress by thin lines, and sonorant consonants by dots. There may be dips in Fo for stød which are not indicated because the curves were not sufficiently clear. The absolute vertical dimensions are not comparable between individuals since the scales differed. In the row for differences (below the graphs) a + indicates that there is a consistent difference in all eight tokens, a + in parentheses that there are some overlappings, and a 0 that there is no clear difference. The difference may be either in the direction or in the level of the syllables, or both, or it may be in the intervening or following unstressed syllable. But a following stressed syllable, e.g. *(mát lam)pét* or *(mále bøtte) fém* is not included in the comparison. It is only included in the graph in order to show the difference in height from the preceding stressed syllable.

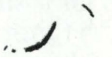
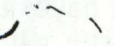
The intensity graphs are based on measurements of 5-7 tokens. The horizontal lines indicate the relative height of the peak measured in mm (because the calibration curves could not be used). The dB scale was not linear, but the upper part has been somewhat compressed in the graphs, though not sufficiently to show dB distances. Based on a few dB measurements and on a comparison with an earlier calibration curve it can be said that very roughly 0.5 mm in the graph corresponds to 1 dB in the lower part of the square, and to about 2 dB in the upper part. The indications of higher or lower within the same graph, or larger or smaller difference between pairs are, however, correct, also seen as dB differences. There

were only a few cases with displacement of the differences on the vertical scale and slightly larger differences for the higher pair where this was uncertain. They have been marked with a ?. For a few later recordings by NRP (of *bílligst - bilíst* and *Sánddàlen - sandálen*) both Fo measurements in Hz and intensity measurements in dB have been given. The Fo in Hz has been measured at the 67% point of the vowel duration (in [da:ʔlɳ] only the part until the abrupt fall or start of the irregular vibrations has been included in the vowel duration). A + in the row for differences means that the intensity relations parallel the stress relations, i.e. a syllable with weaker stress shows a larger decrease (or a smaller increase) of intensity in relation to the syllable with main stress than was found in the sequence of two main stresses (or, in Appendix II,1 and 3-5, than in the reversed sequence: weaker plus main stress), e.g. *sødsùppe* vs. *sød súppe* ‾ _ vs. - ‾ or - ‾ vs. _ ‾ . A - means that intensity and stress relations are reversed, and a 0 that there is no difference in the relations. (In the comparison between secondary stress in compounds and stress reduced by unit accentuation + and - are based on the preliminary experience that the latter is weaker.) One might also give the interpretation that a + means that the intensity relations support the perception of the stress differences, a - that it counteracts this perception, and a 0 that intensity does not play any role. However, as it is rather uncertain how the listener perceives intensity combined with sometimes higher, sometimes lower Fo on the more weakly stressed syllable, this may be a premature interpretation.

* means that the difference is significant at the 1% level according to the Mann Whitney test. (In the dialect recordings, which often comprised 6 readings only, significance at the 5% level is also indicated (by a * in parentheses).) Since the Fo curves have not been measured, no stars for significance are added to the plusses for Fo differences. But since a + means that there is a consistent difference, the weight of a + for Fo is the same as a +* for intensity and a (+) for Fo has the same weight as a + without star for intensity.

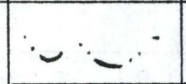
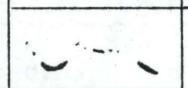
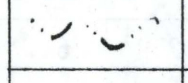
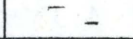
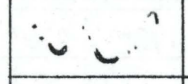
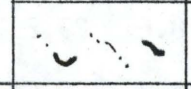
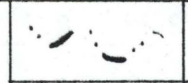
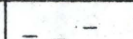
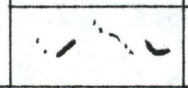
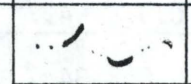
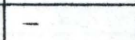
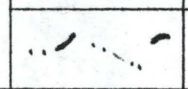
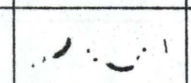
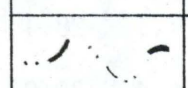
Appendix III,1

Differences in duration (in cs), Fo, and peak intensity between (a) gárnàgtig and (b) barnágtig in a medial stress group in Standard Danish. See further the introduction to App. III-V.

		Duration						Fo	Intensity	
		g/b	a:	n	(agt) a	g/ba:n	diff. a:-a	a:na i	a: a	á:-à > a:-á
NR	a	8.8	17.3	4.7	15.2	30.8	2.1*		— —	
	b	7.1	8.9	5.0	14.6	20.0	-5.7		— —	
a-b		1.7*	8.4*	-0.3	0.6	10.8*	7.8	+		-
PH	a	9.8	15.4	5.4	10.1	30.6	5.3*		— —	
	b	7.8	9.0	5.9	9.9	22.7	-0.9*		— —	
a-b		2.0*	6.4*	-0.5	0.2	7.9*	6.2*	+		0
EF	a	8.4	15.4	5.9	12.9	29.7	2.5*		— —	
	b	6.1	7.8	3.9	11.9	17.8	-4.1*		— —	
a-b		2.3*	7.6*	2.0	1.0	11.9*	6.6*	+		-

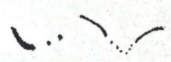
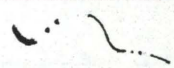
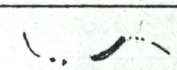
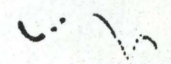
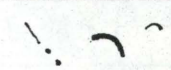
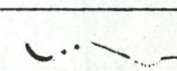
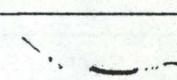
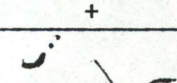
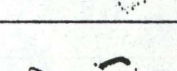
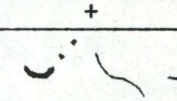
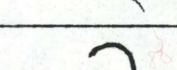
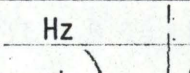
Appendix III,2

Differences in duration (in cs), Fo, and peak intensity between (a) mát lámpe and (b) mát lampét in a medial stress group in Standard Danish. See further the introduction to App. III-V.

	Duration						Fo	Intensity	
	(mat) a	l	ɑ	m	lɑm	diff. a-ɑ	ma lɑm^{ə}/ɛ	a ɑ ə/ɛ	á-ɑ > á-ɑ́
NR a	10.7	7.9	11.4	6.3	25.6	-0.7			
b	10.3	5.6	5.4	5.5	16.5	4.9*			
a-b	0.4	2.3*	6.0*	0.8	9.1*	-5.6*	+		0
PH a	8.9	5.9	10.2	6.8	22.9	-1.3			
b	9.1	4.9	6.2	5.8	16.9	2.9*			
a-b	-0.2	1.0	4.0*	1.0	6.0*	-4.2*	+		0
EF a	8.5	6.9	7.8	6.8	21.5	0.7			
b	8.9	5.1	4.6	5.1	14.8	4.3*			
a-b	-0.4	1.8	3.2*	1.7*	6.7*	-3.6*	+		0
OT a	11.1	7.1	11.2	6.9	25.2	-0.1			
b	10.1	5.2	7.3	4.9	17.4	2.8*			
a-b	1.0	1.9*	3.9*	2.0*	7.8*	-2.9*	+		-
SR a	8.3	6.5	9.9	6.1	22.5	-1.6*			
b	8.0	4.6	5.9	6.1	16.6	2.1*			
a-b	0.3	1.8*	4.0*	0	5.9*	-3.7*	+		-
IE a	12.4	7.9	13.4	10.8	32.1	-1.0			
b	12.1	6.6	8.7	7.8	23.1	3.4*			
a-b	0.3	1.3	4.7*	3.0*	9.0*	-4.4*	+		+ *

Appendix III,3

Differences in duration (in cs), Fo, and peak intensity between (a) Sánddàlen and (b) sandálen in a medial stress group in Standard Danish. See further the introduction to App. III-V.

						Fo		Intensity		á > à:ʔ	
	s	a	n	san	da:ʔlɒn	an	a:ʔlɒn	a	a:ʔ	a	á:ʔ
NR a	13.7	8.1	6.9	28.7	35.9			—	—		
b	8.3	5.1	6.1	19.5	38.1			—	—		
a-b	5.4*	3.0*	0.8	9.2*	-2.2	+				+	
PH a	12.4	7.2	9.0	28.6	37.3			—	—		
b	10.4	5.3	6.2	21.9	35.9			—	—		
a-b	2.0*	1.9*	2.8*	6.7*	1.4	+				0	
EF a	9.8	7.6	6.2	23.6	31.0			—	—		
b	7.4	6.3	5.0	18.7	32.6			—	—		
a-b	2.4*	1.3	1.2*	4.9*	-1.6	+				0	
OT a	10.8	9.8	8.6	29.2	36.1			—	—		
b	8.8	6.9	4.8	20.5	38.2			—	—		
a-b	2.0*	2.9*	3.8*	8.7*	-2.1	+				- *	
SR a	11.7	9.1	6.2	27.0	36.3			—	—		
b	10.6	6.4	5.3	22.3	37.3			—	—		
a-b	1.1	2.7*	0.9	4.7*	-1.0	+				+ *	
IE a	13.1	10.8	10.8	34.7	40.5			—	—		
b	12.1	8.2	6.9	27.2	40.4			—	—		
a-b	1.0	2.6*	3.9*	7.5*	0.1	+				+ *	
(one-stress utterance)						Hz		Hz	dB		dB
NR a	13.1	7.9	7.1	28.1	37.4			-26.3*	— —		0
b	9.5	4.9	6.4	20.8	41.7			-4.9*	— —		-5.7
a-b	3.6*	3.0*	0.7	7.3*	-4.3*	-1.1	20.3*	21.4*	-5.9*	-0.2	5.7
							+				+ *

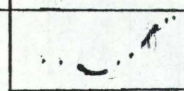
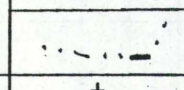
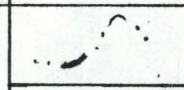
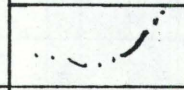
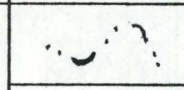
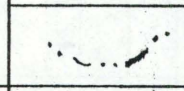
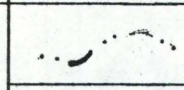
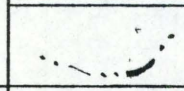
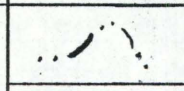
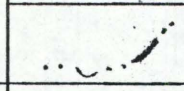
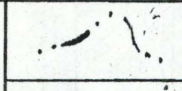
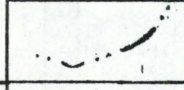
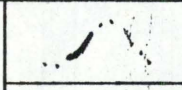
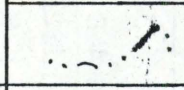
Appendix III,4

Differences in duration (in cs), Fo, and peak intensity between (a) bílligst and (b) bilíst in a medial stress group (= NR_1), and in a one stress group (in all other cases) in Standard Danish. For NR - BHo all averages comprise 11-15 tokens. See further the introduction to App. III-V.

		Duration						diff.	Fo	Hz		Intensity dB		Hz	
		b	i	l	i	bi	li	i-i	i i	i-i		i	i	i-i	
NR_1	a	12.0	7.9	6.1	7.6	19.9	13.7	0.3		-8.0*		—	—	3.2*	
	b	10.1	4.8	8.5	8.6	14.9	17.1	-3.8*		11.0*		—	—	0	
a-b		1.9*	3.1*	-2.4*	-1.0	5.0*	-3.4*	4.1*	-12.0* 7.0*	-19.0*	+	2.9*	0.3	3.2*	+
NR_2	a	13.9	8.4	7.1	8.2	22.3	15.3	0.2		-26.1*		—	—	1.7*	
	b	10.7	5.6	9.5	9.1	16.3	18.6	-3.5*		-9.4*		—	—	-1.2*	
a-b		3.2*	2.8*	-2.4*	-0.9*	6.0*	-3.3*	3.7*	2.4 19.1*	-17.3*	+	2.8*	-0.1	2.9*	+
NR_3	a	17.8	8.4	7.8	8.6	26.2	16.4	-0.2							
	b	12.4	6.5	11.7	8.2	18.9	19.9	-1.7*							
a-b		5.4*	1.9*	-3.9*	0.4	7.3*	-3.5*	1.5	+						
JJ	a	18.9	10.5	6.7	7.4	29.4	14.1	3.1*							
	b	12.1	7.2	11.4	10.5	19.3	21.9	-3.3*							
a-b		6.8*	3.3*	-4.7*	-3.1*	10.1*	-7.8*	6.4*	+						
BHu	a	11.9	11.6	6.9	10.2	23.5	17.1	1.4							
	b	9.6	8.2	10.1	11.2	17.8	21.3	-3.0*							
a-b		2.3*	3.4*	-3.2*	-1.0	5.7*	-4.2*	4.4*	+						
BM	a	14.2	8.9	6.1	7.5	23.1	13.6	1.4*							
	b	10.8	7.1	8.8	9.2	17.9	18.0	-2.1*							
a-b		3.4*	1.8*	-2.7*	-1.7*	5.2	-4.4	3.5*	+						
BHo	a	16.2	8.9	7.2	8.0	25.1	15.2	0.9							
	b	12.6	6.3	11.4	9.9	18.9	21.3	-3.6*							
a-b		3.6*	2.6*	3.8*	-1.9	6.2*	-6.1*	4.5*	+						

Appendix III,5

Differences in duration (in cs), Fo, and peak intensity between (a) mámam and (b) mamám in a one stress utterance in Standard Danish. See further the introduction to App. III-V.

		Duration								Fo	Intensity	
		m	a	m	a	ma	ma	diff. a-a	diff. ma-ma	ma mam	a a	á-a > a-á
NR	a	11.3	12.7	4.5	10.5	24.0	15.0	2.2*	9.0*		– –	
	b	7.8	8.1	9.9	11.2	15.9	21.1	-3.1*	-5.2*		– –	
	a-b	3.5*	4.6*	-5.4*	-0.7	8.1*	-6.1*	5.3*	14.2*	+		- *
PH	a	9.5	9.8	6.6	9.4	19.3	16.0	0.4	3.3*		– –	
	b	7.8	6.4	7.7	9.3	14.2	17.0	-2.9*	-2.8*		– –	
	a-b	1.7*	3.4*	-1.1	-0.1	5.1*	-1.0	3.3*	6.1*	+		+
EF	a	8.9	9.5	6.8	8.6	18.4	15.4	0.9	3.0*		– –	
	b	7.9	6.3	8.5	8.3	14.2	16.8	-2.0*	-2.6*		– –	
	a-b	1.0	3.2*	-1.7*	0.3	4.2*	-1.4	2.9*	5.6*	+		- *
OT	a	9.2	13.1	6.8	10.1	22.3	16.9	3.0*	5.4*		– –	
	b	7.5	8.9	7.1	12.0	16.4	19.1	-3.1*	-2.7*		– –	
	a-b	1.7*	4.2*	-0.3	-1.9*	5.9*	-2.2*	6.1*	8.1*	+		-
BJ	a	9.4	12.0	6.2	9.6	21.4	15.8	2.4*	5.6*		– –	
	b	8.5	10.3	8.5	11.3	18.8	19.8	-1.0	-1.0		– –	
	a-b	0.9	1.7*	-2.3*	-1.7*	2.6*	-4.0*	3.4*	6.6*	+		0
IE	a	10.1	13.6	12.8	16.5	23.7	29.3	-2.9*	-5.6*		– –	
	b	9.1	11.8	10.4	13.5	20.9	23.9	-1.7*	-3.0*		– –	
	a-b	1.0	1.8	2.4*	3.0*	2.8*	5.4*	-1.2	-2.6	+		+
NK	a	12.1	10.0	7.9	8.6	22.1	16.5	1.4*	5.6*		– –	
	b	9.6	9.5	11.0	9.5	19.1	20.5	0	-1.4		– –	
	a-b	2.5*	0.5	-3.1*	-0.9	3.0*	-4.0*	1.4*	7.0*	+		+

Appendix III,6

West and North Jutlandish

Differences in duration (in cs), Fo, and peak intensity between (a) Sánddàlen and (b) sandálen in a medial stress group. D means dialect, RSD regional Standard Danish. See further the introduction to App. III-V.

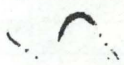
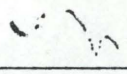
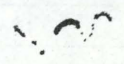
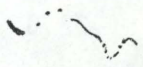
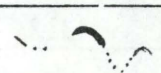
		Duration					Fo	Intensity	
		s	a	n	san	da:ʔl(n)	an a:ʔlŋ[1]	á a:ʔ	á-à: ≷ a-á:
BT D	a	9.3	7.8	9.0	26.1	-		– –	
	b	8.5	5.1	6.6	20.2	-		– –	
	a-b	0.8	2.7*	2.4*	5.9*		+		+ *
BT RSD	a	9.8	8.9	7.9	26.6	28.9		– –	
	b	9.0	4.6	5.7	19.3	28.9		– –	
	a-b	0.8	4.3*	2.2*	7.3*	0	+		-
TA RSD	a	9.4	7.7	8.1	25.2	39.7		– –	
	b	9.8	5.4	6.8	22.0	39.9		– –	
	a-b	-0.4	2.3*	1.3*	3.2*	-0.2	+		+*
EA RSD	a	12.5	9.6	12.9	35.0	38.9		– –	
	b	11.2	5.9	9.1	26.2	40.8		– –	
	a-b	1.3*	3.7*	3.8*	8.8*	-1.9	+		+ *
JD[1] D	a	9.8	9.8	11.8	31.4	27.4		– –	
	b	9.6	6.4	6.3	22.3	30.9		– –	
	a-b	0.2	3.4*	5.5*	9.1*	-3.5	+		+ *
JD RSD	a	11.6	9.1	8.3	29.0	39.2		– –	
	b	11.8	6.2	5.7	23.7	41.1		– –	
	a-b	-0.2	2.9*	2.6*	5.3*	-1.9	+		+*
PN RSD	a	15.1	8.4	9.8	33.3	46.9		– –	
	b	11.2	7.8	9.0	28.0	41.6		– –	
	a-b	3.9*	0.6	0.8	5.3(*)	5.3	+		+

[1]) JD(D) has [ɔ] [ɔ:ʔ] for [a] [a:ʔ] and no [n̩].

Appendix III,7

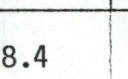
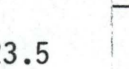
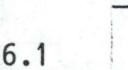
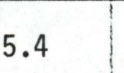
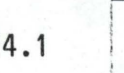
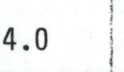
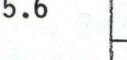
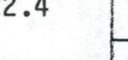
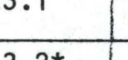
East Jutlandish

Differences in duration (in cs), Fo, and peak intensity between (a) Sánddàlen and (b) sandálen in a medial stress group. See further the introduction to App. III-V.

		Duration					Fo		Intensity	
		s	a	n	san	da:ʔln	an	a:ʔln	a a:ʔ	á-à: > a-á:
PM D	a	9.8	6.0	9.1	24.9	28.3			– –	
	b	9.5	4.1	7.7	21.3	28.3			– –	
a-b		0.3	1.9*	1.4*	3.6*	0	+			+ *
PM RSD	a	10.5	5.4	8.1	24.0	27.1			– –	
	b	8.6	4.0	6.7	19.3	27.0			– –	
a-b		1.9*	1.4*	1.4*	4.7*	0.1	+			+ *
LH RSD	a	9.8	8.5	9.9	28.2	34.6			– –	
	b	10.7	5.7	6.9	23.3	37.9			– –	
a-b		-0.9	2.8*	3.0*	4.9*	-3.3	+			+

Appendix IV,1

Duration, distance (in cs), Fo, and peak intensity in (a) sød súppe, (b) sødsùppe, and (c) sød suppedás, and the differences a-b, a-c, and b-c in Standard Danish. See further Introduction to App. III-V.

	Duration			Distance	Fo	Intensity
NR	søðʔ	sobə	o	ø — o	ø o ə	ø o
a	29.5	34.9	12.5	28.4		
b	26.5	28.7	10.0	23.5		
c	30.1	28.7	8.6	26.1		
a-b	3.0*	6.2*	2.5*	4.9*	+	-
a-c	-0.6	6.2*	3.9*	2.3	+	-
b-c	-3.6*	0	1.4*	-2.6*	+	0
PH						
a	26.9	30.1	9.6	25.4		
b	26.4	25.8	7.2	24.1		
c	27.7	24.5	6.0	24.0		
a-b	0.5	4.3*	2.4*	1.3	+	-
a-c	-0.8	5.6*	3.6*	1.4	+	+
b-c	-1.3	1.3	1.2	0.1	(+)	+
EF						
a	24.5	29.3	7.9	25.6		
b	24.7	24.1	5.6	22.4		
c	23.6	24.0	4.1	23.1		
a-b	-0.2	5.2*	2.3*	3.2*	+	+
a-c	0.9	5.3*	3.8*	2.5*	+	+
b-c	1.1	0.1	1.5	-0.7	(+)	+

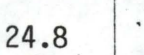
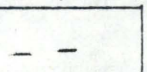
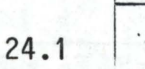
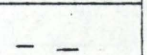
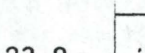
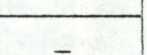
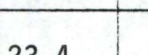
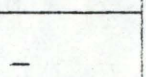
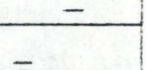
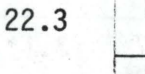
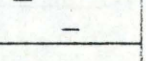
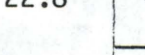
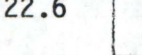
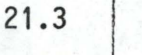
continued

(Appendix IV,1, continued)

	Duration			Distance	Fo			Intensity	
OT	søðʔ	sobə	o	ø - o	ø	o	ə	ø	o
a	27.9	35.4	13.3	28.4				—	—
b	26.3	30.1	10.2	25.3				—	—
c	26.3	30.1	7.9	25.2				—	—
a-b	1.6*	5.3*	3.1*	3.1*		+		+	
a-c	1.6	5.3*	5.4*	3.2*		+		+ *	
b-c	0	0	2.3*	0.1		(+)		+ *	
SR									
a	28.9	34.1	11.0	28.9				—	—
b	25.3	29.8	8.8	24.5				—	—
c	26.9	25.6	6.4	24.9				—	—
a-b	3.6*	4.3*	2.2*	4.4*		+		+	
a-c	2.0	8.5*	4.6*	4.0*		+		+	
b-c	-1.6	4.2*	2.4*	-0.5		(+)		0	
IE									
a	39.4	43.1	15.5	37.6				—	—
b	34.5	36.3	13.8	32.4				—	—
c	35.7	32.7	8.1	32.6				—	—
a-b	4.9*	6.8*	1.7	5.2*		+		+ *	
a-c	3.7*	10.4*	7.4*	5.0*		+		+ *	
b-c	-1.2	3.6*	5.7*	-0.2		0		+	

Appendix IV,2

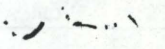
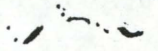
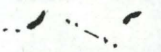
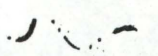
Duration and distance (in cs), Fo, and peak intensity in (a) mát lámpe, (b) nátlàmpe, and (c) mát lampét, and the differences a-b, a-c, and b-c in Standard Danish. See further introduction to App. III-V. [1]

	Duration					Distance	Fo	Intensity
NR	at	a	lɑm	lɑmb	ɑ	a — ɑ	ma lɑm ə/ɛ	a ɑ ə/ɛ
a	16.8	10.7	25.6	29.5	11.4	24.8		
b	16.4	11.2	24.3	27.5	10.3	24.1		
c	17.7	10.3	16.5		5.4	23.8		
a-b	0.4	-0.5	1.3	2.0	1.1	0.7	+	0
a-c	-0.9.	0.4	9.1*		6.0*	1.0	+	0
b-c	-1.3	0.9	7.8*		4.9*	0.3	+	0
PH								
a	17.5	8.9	22.9	27.7	10.2	23.4		
b	17.2	8.8	21.7	26.0	9.4	22.3		
c	17.4	9.1	16.9		6.2	22.3		
a-b	0.3	0.1	1.2	1.7	0.8	1.1	+	-
a-c	0.1	-0.2	6.0*		4.0*	1.1	+	-
b-c	-0.2	-0.3	4.8*		3.2*	0	0	+
EF								
a	16.0	8.5	21.5	27.4	7.8	22.8		
b	17.3	9.0	18.3	22.5	7.8	22.6		
c	16.1	8.9	14.8		4.6	21.3		
a-b	-1.3	-0.5	3.2*	4.9*	0	0.2	+	+
a-c	-0.1	-0.4	6.7*		3.2*	1.5	+	0
b-c	1.2	0.1	3.5*		3.2*	1.3	0	-

[1]) The difference ə-ɛ is not included in the comparisons a-c and b-c, only *mat lam*.

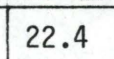
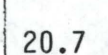
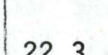
continued

(Appendix IV,2, continued)

	Duration					Distance	Fo	Intensity
OT	at	a	lɑm	lɑmb	ɑ	a — ɑ	ma lɑm ə/ɛ	a ɑ ə/ɛ
a	18.2	11.1	25.2	31.7	11.2	25.2		— — —
b	18.0	11.1	23.7	31.3	11.6	24.4		— — —
c	19.0	10.1	17.4		7.3	24.0		— — —
a-b	0.2	0	1.5	0.4	-0.4	0.8	+	-
a-c	-0.8	1.0	7.8*		3.9*	1.2	+	-
b-c	-1.0	1.0	6.3*		4.3*	0.4	(+)	0
SR								
a	18.7	8.3	22.5	28.6	9.9	25.1		— — —
b	18.5	8.8	20.8	25.5	10.1	23.6		— — —
c	18.3	8.0	16.6		5.9	22.9		— — —
a-b	0.2	-0.5	1.7*	3.1*	-0.2	1.5	+	-
a-c	0.4	0.3	5.9*		4.0*	2.2	+	-
b-c	0.2	0.8	4.2		4.2*	0.7	(+)	+
IE								
a	26.8	12.4	32.1	43.8	13.4	34.8		— — —
b	24.4	11.6	29.6	38.6	11.9	31.2		— — —
c	24.4	12.1	23.1		8.7	30.9		— — —
a-b	2.4	0.8	2.5*	5.2*	1.5	3.6*	+	+
a-c	2.4	0.3	9.0*			3.9*	+	+ *
b-c	0	-0.5	6.5*		3.2*	0.3	0	+ *

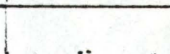
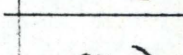
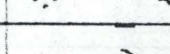
Appendix IV,3

Duration and distance (in cs), Fo, and peak intensity in (a) Spíes réjse, (b) Spíesrèjsen, and (c) Spíes rejse (méd), and the differences a-b, a-c and b-c in Standard Danish. See further introduction to App. III-V.

	Duration				Distance	Fo	Intensity
EF	sbi:ʔs	i:ʔ	ʁais͡ə	ɑi	i: ɑi	i:ʔ ɑi ə/n	i:ʔ ɑi
a	30.6	8.9	26.4	15.1	22.4		
b	29.3	9.1	25.4	14.3	20.7		
c	32.0	9.7	21.1	11.2	22.3		
a-b	1.3	-0.2	1.0	0.8	1.7	+	+
a-c	-1.4	-0.8	5.3*	3.9*	0.1	+	+
b-c	-0.7	-0.6	4.3*	3.1*	-1.6	0	-

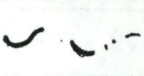
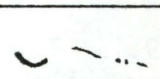
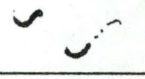
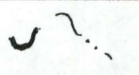
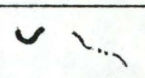
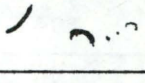
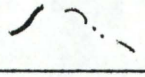
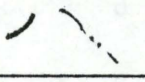
Appendix IV,4

Duration and distance (in cs), Fo, and peak intensity in (a) vén skáber, (b) vénskàbet, and (c) vén skaber (problémer), and the differences a-b, a-c, and b-c in Standard Danish. See further introduction to App. III-V.

	Duration				Distance	Fo	Int.
EF	vɛn	ɛ	sga:(ʔ)b	a:(ʔ)	ɛ-a:	vɛn a: ɒ/ð	
a	16.8	5.8	30.7	11.8	25.7		
b	15.2	5.6	25.3	8.7	22.7		
c	16.7	5.7	26.7	8.6	24.7		
a-b	1.6*	0.2	5.4*	3.1*	3.0*	+	-*
a-c	0.1	0.1	4.0	3.2*	1.0	+	-*
b-c	-1.5*	-0.1	-1.4	0.1	-2.0	0	+

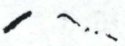
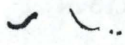
Appendix IV,5

Duration and distance (in cs), Fo, and peak intensity in (a) gás brænder, (b) gásbrænder, and (c) gás brænder (néd), and the differences a-b, a-c and b-c in Standard Danish. See further introduction to App. III-V.

	Duration			Distance	Fo	Intensity
NR	gas	a	bʁæn(ʔ)ɒ	a — ʁæ	a ʁænɒ	a æ
a	26.3	11.7	33.7	26.9		— —
b	25.1	11.3	34.0	26.0		— —
c	26.4	11.4	32.1	27.1		— —
a-b	1.2	0.4	-0.3	0.9	+	- *
a-c	-0.1	0.3	1.6	-0.2	+	0
b-c	-1.3	-0.1	1.9*	1.1	0	+ *
PH						
a	25.1	11.7	30.9	25.4		— —
b	23.6	11.1	29.5	24.8		— —
c	24.8	11.7	28.9	25.8		— —
a-b	1.5	0.6	1.4*	0.6	+	-
a-c	0.3	0	2.0*	-0.4	+	+ *
b-c	-1.2	-0.6	0.6	-1.0	+	+
EF(A)						
a	22.4	9.9	30.8	24.3		— —
b	22.0	10.4	30.8	23.6		— —
c	23.1	10.3	29.3	24.6		— —
a-b	0.4	-0.5	0	0.7	+	+
a-c	1.3	-0.4	1.5	-0.3	+	-
b-c	-1.1	0.1	1.5	-1.0	0	-

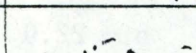
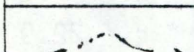
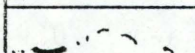
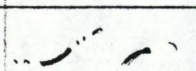
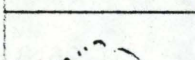
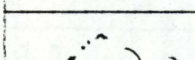
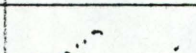
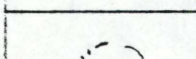
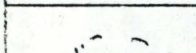
continued

(Appendix IV,5, continued)

	Duration			Distance	Fo	Intensity
EF(B)	gas	a	bʁæn(ʔ)ɒ	a - ʁæ	a ʁænɒ	a æ
a	22.1	8.8	29.3	24.1		— —
b	22.0	8.9	28.7	23.1		— —
c	22.9	9.6	29.4	24.6		— —
a-b	0.1	-0.1	0.6	1.0	+	+
a-c	-0.8	-0.8	-0.1	-0.4	+	+
b-c	-0.9	-0.7	-0.7	-1.4	0	-
OT						
a	26.9	11.8	36.1	29.1		— —
b	26.4	11.6	36.1	27.8		— —
c	26.8	11.6	36.3	29.2		— —
a-b	0.5	0.2	0	1.3	+	0
a-c	0.1	0.2	-0.2	-0.1	+	-
b-c	-0.4	0	-0.2	-0.4	0	-

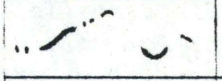
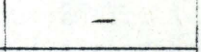
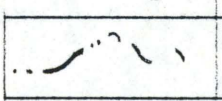
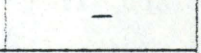
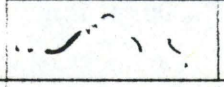
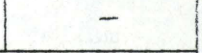
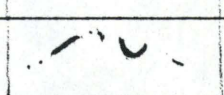
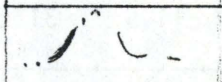
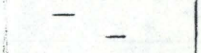
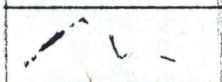
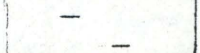
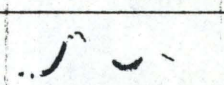
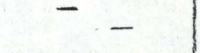
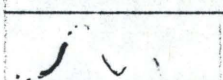
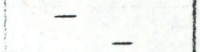
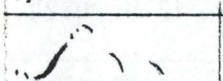
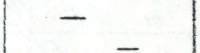
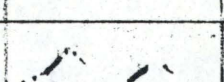
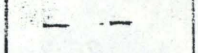
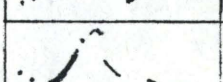
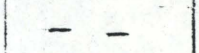
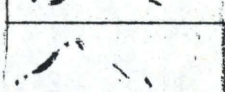
Appendix IV,6

Duration and distance (in cs), Fo, and peak intensity in (a) mále kássen, (b) málekàssen, and (c) mále Casanóva, and the differences a-b, a-c and b-c in Standard Danish. See further introduction to App. III-V.

	Duration				Distance	Fo	Intensity
NR	ma:lə	a:	kʰas	a	a: — a	ma:lə a n/a	a: a
a	36.6	16.3	38.3	16.4	39.9		— —
b	35.2	15.9	33.9	14.4	37.2		— —
c	36.6	16.4	25.6	9.8	38.1		— —
a-b	1.4	0.4	4.4*	2.0*	2.7*	+	-
a-c	0	-0.1	12.7*	6.6*	1.8	+	-
b-c	-1.4	-0.5	8.3*	4.6*	-0.9	0	+
PH							
a	28.0	12.8	28.8	10.7	32.0		— —
b	28.3	13.4	25.4	9.9	30.3		— —
c	29.5	14.0	21.6	7.0	30.9		— —
a-b	-0.3	-0.6	3.4*	0.8	1.7	+	0
a-c	-1.5	-1.2	7.2*	3.7*	1.1	+	+
b-c	-1.2	-0.6	3.8*	2.9*	-0.6	0	+
EF							
a	28.9	14.9	27.3	9.4	33.5		— —
b	25.8	13.0	23.7	8.9	28.3		— —
c	28.9	14.9	22.0	7.3	30.2		— —
a-b	3.1	1.9	3.6*	0.5	5.2*	+	+
a-c	0	0	5.3*	2.1*	3.3*	+	+
b-c	-3.1	-1.9	1.7*	1.6*	-1.9*	+	+

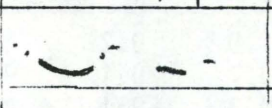
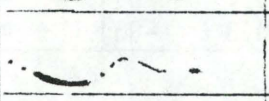
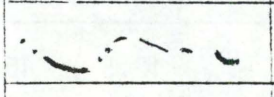
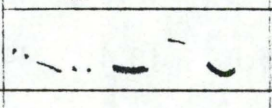
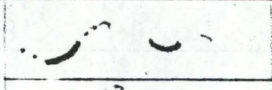
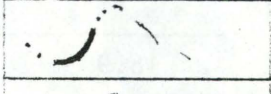
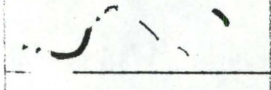
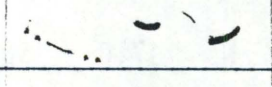
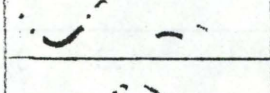
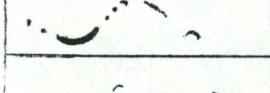
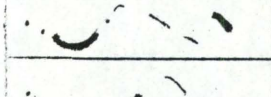
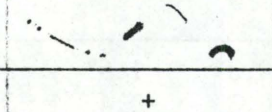
continued

(Appendix IV,6, continued)

	Duration				Distance	Fo	Intensity
OT	ma:lə	a:	k^has	a	a: – a	ma:lə a ə/a	ə: a
a	31.1	15.5	38.2	13.5	37.3		
b	30.1	15.3	33.6	12.1	35.2		
c	30.4	15.4	28.9	7.4	35.0		
a-b	1.0	0.2	4.6*	1.4	2.1*	+	0
a-c	0.7	0.1	9.3*	6.1*	2.3	+	-
b-c	-0.3	-0.1	4.7*	4.7*	0.2	+	-
IE							
a	34.4	18.5	46.8	16.0	41.9		
b	35.0	18.4	44.6	14.8	42.2		
c	35.5	18.4	35.9	10.4	40.7		
a-b	-0.6	0.1	2.2	1.2	-0.3	+	0
a-c	-1.1	0.1	10.9*	5.6*	1.2	+	+
b-c	-0.5	0	8.7*	4.4*	1.5	(+)	0
BJ							
a	31.1	16.9	38.1	14.7	38.2		
b	31.4	17.1	36.8	15.3	37.4		
c	31.1	17.0	30.8	9.6	37.9		
a-b	-0.3	-0.2	1.3	-0.6	0.8	+	0
a-c	0	-0.1	7.3*	5.1*	0.3	+	+
b-c	0.3	0.1	6.0*	5.7*	-0.5	0	+
NK							
a	34.1	14.3	34.6	11.8	36.7		
b	29.8	12.7	32.6	11.4	31.7		
c	34.4	14.7	31.1	10.3	36.4		
a-b	4.3*	1.6*	2.0	0.4	5.0*	+	+
a-c	-0.3	-0.4	3.5*	1.5*	0.3	+	+
b-c	-4.6*	-2.0*	1.5	1.1	-4.7*	(+)	+

Appendix IV,7

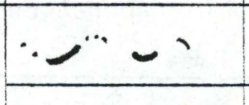
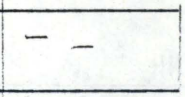
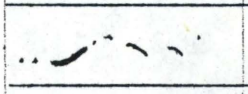
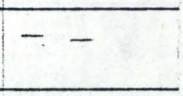
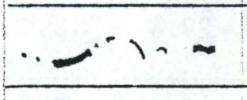
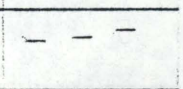
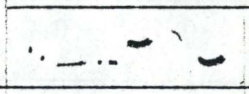
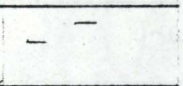
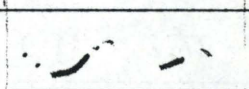
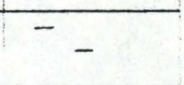
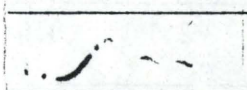
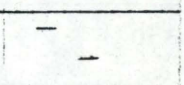
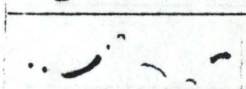
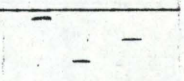
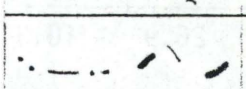
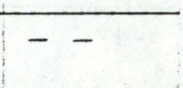
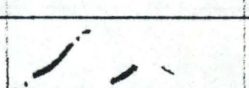
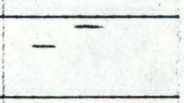
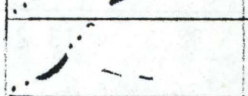
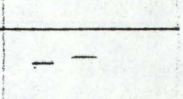
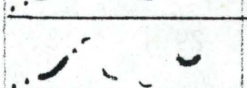
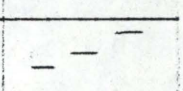
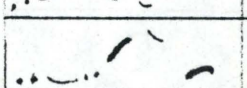
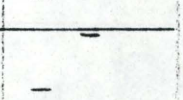
Duration and distance (in cs), Fo, and peak intensity of (a) mále bøtten, (b) málebøtten, (c) mále bøtte (fém), and (d) male bøtten (grøn), and the differences a-b, a-c, b-c, and a-d in Standard Danish. See further introduction to App. III-V. [1]

	Duration				Distance	Fo	Intensity
	ma:lə	a:	bød	ø	a:–ø	ma:lə ø ə n ɛ œ	a ø ɛ
NR a	32.6	15.6	30.1	10.5	35.7		— —
b	29.6	15.3	25.1	8.7	32.6		— —
c	32.2	15.9	21.2	7.8	33.3		— — —
d	26.5	11.9	31.6	10.5	31.3		— —
a-b	3.0*	0.3	5.0*	1.8*	3.1*	+	+
a-c	0.4	-0.3	8.9*	2.7*	2.4*	+	+?
b-c	-2.6*	-0.6	3.9	0.9	-0.7	0	-
a-d	6.1*	3.7*	-1.5	0	4.4*	+	+?
PH a	26.9	13.4	25.1	8.3	30.8		— —
b	27.3	13.2	20.5	7.2	27.6		— —
c	26.3	13.0	22.3	7.2	29.8		— —
d	24.1	12.9	24.0	8.0	28.6		— —
a-b	-0.4	0.2	4.6*	1.1	3.2*	+	+
a-c	0.6	0.4	2.8*	1.1	1.0	+	+*
b-c	1.0	0.2	1.8*	0	-1.2	0	+
a-d	2.8*	0.5	1.1	0.3	2.2*	+	+*
EF a	28.8	14.6	24.6	7.4	30.9		— —
b	26.2	12.6	18.8	5.3	27.5		— —
c	28.1	13.9	17.4	5.2	29.1		— — —
d	24.9	11.5	24.7	7.0	28.4		— —
a-b	2.6*	2.0*	5.8*	2.1*	3.4*	+	+
a-c	0.7	0.7	7.2*	2.2*	1.8	+	+
b-c	-1.9	-1.3	1.4	0.1	-1.6	(+)	+
a-d	3.9*	3.1*	-0.1	0.4	2.5*	+	+

[1]) ɛ and œ(in *fem* and *grøn*) are not included in the comparison.

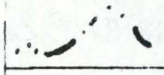
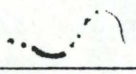
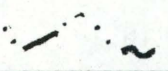
continued

(Appendix IV,7, continued)

	Duration				Distance	Fo	Intensity
	ma:lə	a:	bød	ø	a: – ø	ma:lə ø ə́ ɛ́ ɲ́ œ́	a ø ɛ
OT a	30.7	16.1	30.6	11.0	35.4		
b	28.9	13.8	24.9	8.4	31.6		
c	29.4	15.9	24.4	8.5	33.8		
d	25.6	12.6	29.1	9.7	30.4		
a-b	1.8	2.3*	5.7*	2.6*	3.8*	+	-
a-c	1.3	0.2	6.2*	2.5*	1.6	+	-
b-c	-0.5	-2.1*	0.5	-0.1	-2.2	0	-
a-d	5.1	3.5*	1.5	1.3*	5.0*	+	+
SR a	28.8	14.1	26.6	8.7	32.6		
b	29.3	13.6	25.9	9.7	31.6		
c	29.4	14.1	21.3	7.6	30.8		
d	26.4	12.1	24.4	7.7	30.1		
a-b	-0.5	0.5	0.7	-1.0	1.0	+	+
a-c	-0.6	0	5.3*	1.1	1.8*	+	+*
b-c	-0.1	-0.5	4.6*	2.1*	0.8	+	+*
a-d	2.4*	2.0*	2.2	1.0	2.5*	+	+*
IE a	30.1	15.7	37.7	14.3	34.8		
b	31.0	16.1	30.1	11.3	34.1		
c	31.5	16.8	27.1	8.6	34.9		
d	26.8	13.8	31.9	11.1	31.0		
a-b	-0.9	-0.4	7.6*	3.0*	0.7	+	+
a-c	-1.4	-1.1	10.6*	5.7*	-0.1	+	+ ?
b-c	-0.5	-0.7	3.0*	2.7*	-0.8	(+)	-
a-d	3.3*	1.9	5.8*	3.2*	3.8*	+	+

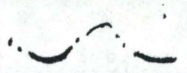
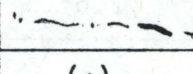
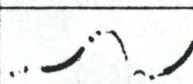
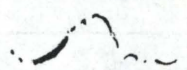
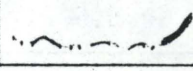
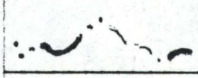
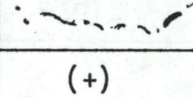
Appendix IV,8

Duration and distance (in cs), Fo, and peak intensity in (a) lámme lår and (b) lámmelàr, and the difference a-b, in Standard Danish. See further introduction to App. III-V.

	Duration				Distance	Fo	Intensity	
NR	lɑmə	ɑ	lɒ:ʔ	ɒ:ʔ	ɑ – ɒ:ʔ	lɑməlɒ:ʔ	ɑ	ɒ:ʔ
a	29.3	13.6	28.1	16.4	20.1		–	–
b	29.4	13.4	23.6	15.6	17.3		–	–
a-b	-0.1	0.2	4.5*	0.8	2.8*	+	-	
PH								
a	29.8	12.3	25.3	17.4	16.9		–	–
b	27.7	11.9	21.9	15.8	14.6		–	–
a-b	2.1	0.6	3.4*	1.6*	2.3*	+	+	*
EF								
a	26.9	10.3	24.1	18.4	16.6		–	–
b	25.1	9.6	19.8	15.5	14.9		–	–
a-b	1.8	0.7	4.3*	2.9*	1.7*	+	+	
OT								
a	32.5	13.2	27.1	18.5	20.3		–	–
b	29.4	12.1	23.2	16.0	17.5		–	–
a-b	3.1*	1.1	3.9*	2.5*	2.8*	+	+	

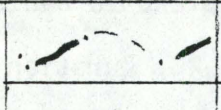
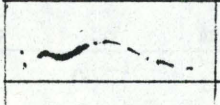
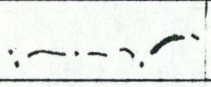
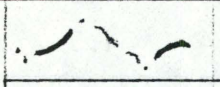
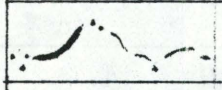
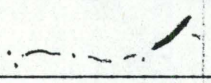
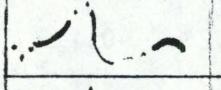
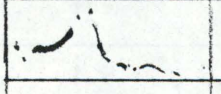
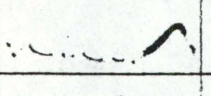
Appendix IV,9

Duration and distance (in cs), Fo, and peak intensity in (a) várme apparát, (b) vármeapparàtet, and (c) varme apparátet (óp), and the differences a-b and a-c in Standard Danish. See further Introduction to App. III-V.

	Duration					Distance	Fo	Intensity
NR	vɑ:m	ɑ:	əɑbɑ	ʁɑ:ʔ	ɑ:ʔ	ɑ:-ɑ:ʔ	vɑ:məɑ ɑʁɑ:ʔð	ɑ: ɑ ɑ ɑ:ʔ
a	26.2	17.9	14.4	19.6	15.3	40.2		— - —
b	24.2	16.7	11.2	16.5	12.8	37.7		— - —
c	24.8	16.4	13.1	20.1	15.9	37.8		— - —
a-b	2.0*	1.2	3.2*	3.1*	2.5*	5.5*	(+)	+
a-c	1.4	1.5	-1.9	-0.7	-0.6	2.4	+	-
PH								
a	27.9	14.7	18.6	18.2	12.8	45.1		— - — —
b	26.4	14.5	18.8	17.3	12.4	43.9		— - - —
c	25.7	14.8	19.9	20.1	14.4	45.6		— - — —
a-b	1.5	0.2	-0.2	0.9	0.4	1.2	+	+
a-c	2.2*	-0.1	-1.3	-1.9*	-1.6	-0.5	+	+ ?
EF								
a	25.3	15.1	19.8	17.5	13.1	44.5		— - - —
b	25.8	15.0	21.7	15.8	11.6	47.0		— - - —
c	22.3	13.1	23.3	18.3	13.7	45.6		— - - —
a-b	-0.5	0.1	-1.9	1.7	1.5	-2.5	(+)	+
a-c	3.0	2.0*	-3.5*	-0.8	-0.6	-1.1	+	0

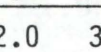
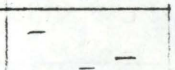
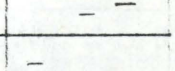
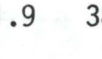
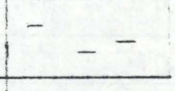
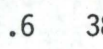
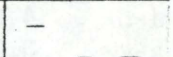
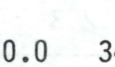
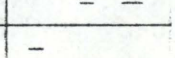
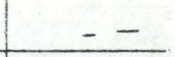
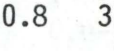
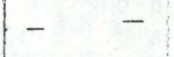
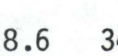
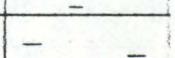
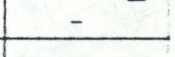
continued

(Appendix IV,9, continued)

	Duration					Distance	Fo	Intensity
OT	vɑ:m	ɑ:	əɑbɑ	ʁɑ:ʔ	ɑ:ʔ	ɑ:-ɑ:ʔ	vɑ:məɑ ɑʁɑ:ʔð	ɑ: ɑ ɑ ɑ:ʔ
a	26.3	16.2	23.1	20.9	16.6	47.9		— - _ —
b	24.5	14.4	19.1	17.0	11.6	43.6		— - - —
c	25.1	13.6	19.6	22.6	16.8	44.1		— _ - —
a-b	1.8	1.8	4.0	3.9*	5.0*	4.3*	(+)	-
a-c	1.2	2.6*	3.5*	-1.7	-0.2	3.8*	+	+
SR								
a	24.9	14.6	19.0	17.4	13.4	42.9		— - _ —
b	25.8	14.8	18.8	16.6	13.2	42.6		— - _ —
c	25.7	14.0	19.4	19.1	14.8	43.4		— _ —
a-b	-0.9	-0.2	0.2	0.8	0.2	0.3	0	+
a-c	-0.8	0.6	-0.4	-1.7	-1.4	-0.5	+	+
IE								
a	33.8	17.9	24.1	27.2	20.8	56.8		— - _ —
b	32.3	16.9	22.1	19.6	16.2	51.5		— - _ —
c	30.9	16.4	23.8	25.4	19.2	54.1		— _ - —
a-b	1.5	1.0	2.0	7.6*	4.6*	5.3*	+	+*
a-c	2.9*	1.5	0.3	1.8	1.6	2.7*	+	+*

Appendix IV,10

Duration and distance (in cs), Fo, and peak intensity in (a) mís forstår, (b) mísforstår, and (c) mís forstår (spøg), and the differences a-b, a-c and b-c in Standard Danish. See further Introduction to App. III-V.

	Duration					Distance		Fo	Intensity
NR	is	i	fɒ	sdɒ:?	ɒ:?	i-ɒ	i-ɒ:?	mi ɒ ɒ:?	i ɒ ɒ:?
a	13.6	6.0	13.4	28.3	16.3	22.0	39.0		
b	14.1	7.4	12.8	25.4	14.1	21.9	38.3		
c	13.5	6.4	14.4	18.3	6.6	22.5	39.7		
a-b	-0.5	-1.4*	0.6	2.9*	2.2*	0.1	0.7	0	-
a-c	0.1	-0.4	-1.0	10.0*	9.7*	-0.5	-0.7	(+)	-
b-c	0.6	1.0	-1.6*	7.1*	7.5*	-0.6	-1.4	(+)	+?
PH									
a	13.5	6.3	11.6	27.7	14.8	21.6	38.0		
b	13.3	6.2	10.7	22.9	12.1	20.0	34.8		
c	13.9	5.8	11.8	23.5	12.1	20.9	36.2		
a-b	0.2	0.1	0.9	4.8*	2.7*	1.6	3.2*	(+)	+?
a-c	-0.4	0.5	-0.2	4.2*	2.7*	0.7	1.8	(+)	+
b-c	-0.6	0.4	-1.1*	-0.6	0	-0.9	-1.4	0	+
EF (A)									
a	13.3	5.6	12.0	24.1	12.7	20.8	37.3		
b	11.9	5.3	11.8	20.8	10.1	18.6	34.3		
c	13.4	5.6	12.4	17.9	6.4	20.9	37.3		
a-b	1.4*	0.3	0.2	3.3*	2.6*	2.2*	3.0*	(+)	+*
a-c	-0.1	0	-0.4	6.2*	6.3*	-0.1	0	0	+*
b-c	-1.5*	-0.3	-0.6	2.9*	3.2*	-2.3*	-3.0*	+	+

continued

(Appendix IV,10, continued)

	Duration					Distance		Fo			Intensity		
EF (B)	is	i	fɒ	sdɒ:?	ɒ:?	i-ɒ	i-ɒ:?	mi	ɒ	ɒ:?	i	ɒ	ɒ:?
b	12.8	5.3	11.9	20.7	11.1	21.1	34.3						
c	13.8	5.5	13.2	18.3	8.3	23.7	37.0						
b-c	-1.0	-0.2	-1.3	2.4*	2.8*	-2.6*	-2.7*		+			+	
OT													
a	17.7	8.6	13.4	28.6	15.8	24.7	44.1						
b	13.7	7.5	13.3	24.4	11.8	20.5	39.6						
c	17.3	8.3	13.4	22.1	9.8	24.5	42.9						
a-b	4.0*	1.1	0.1	4.2*	4.0*	4.2*	4.5*		(+)			0	
a-c	0.3	0.3	0	6.5*	6.0*	0.2	1.2		+			+ ?	
b-c	-3.6	-0.8	-0.1	2.3*	2.0	-4.0*	-3.3*		0			+	
SR													
a	16.6	6.9	13.9	25.6	14.3	25.2	41.8						
b	14.3	7.4	12.3	27.3	16.0	21.6	37.5						
c	17.0	6.1	15.0	26.5	14.5	26.3	44.2						
a-b	2.3*	-0.5	1.6*	-1.7	-1.7*	3.6*	4.3*		(+)			+*	
a-c	-0.4	0.8	-1.1	-0.9	-0.2	-1.1	-2.4		+			+*	
b-c	-2.7	1.3	-2.7*	0.8	1.5	-4.7*	-6.7*		(+)			+*	
IE													
a	20.4	9.1	15.2	38.0	20.3	20.5	29.6						
b	20.4	8.6	15.3	38.3	20.7	19.6	28.1						
c	21.2	8.9	15.7	33.1	15.7	20.9	29.7						
a-b	0	0.5	-0.1	-0.3	-0.4	0.9	1.5		+			+*	
a-c	-0.8	0.2	-0.5	4.9*	4.6*	-0.4	-0.1		(+)			+*	
b-c	-0.8	-0.3	-0.4	5.2*	5.0*	-1.3	-1.6		+			- ?	

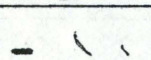
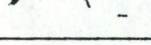
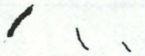
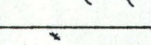
Appendix IV,11

Duration (in cs), Fo, and peak intensity in (a) útỳske and (b) Herrenhútiske, and the difference a-b in Standard Danish. See further Introduction to App. III-V.

	Duration						Fo			Intensity		
NR	u	t	h	y/i	sg	thysg/tisg	u	y/i	ə	n	y/i	ə
a	6.7	3.3	11.4	7.7	5.4	34.4						
b	6.6	2.7	4.6	5.3	5.1	24.5						
a-b	0.1	0.6	6.8*	2.4*	0.3	9.9*		+			+*	
PH												
a	7.3	4.4	8.1	6.9	12.4	31.8						
b	6.9	3.6	2.6	5.7	12.6	24.4						
a-b	0.4	0.8	5.5*	1.2	-0.2	7.4*		(+)			+*	
EF												
a	5.0	5.0	7.4	6.4	11.9	30.7						
b	5.8	4.6	2.8	6.2	12.6	26.1						
a-b	-0.8	0.4	4.6*	0.2	-0.7	4.6*		(+)			+	

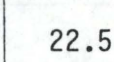
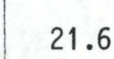
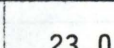
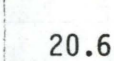
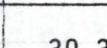
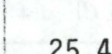
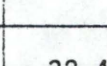
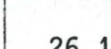
Appendix IV,12

Duration (in cs), Fo, and peak intensity in (a) útỳske and (b) polítiske, and the difference a-b in Standard Danish. See further Introduction to App. III-V.

	Duration						Fo	Intensity
OT	u/i	t	h	y/i	sg	thysg/tisg	u/i y/i ə	u/i y/i ə
a	8.0	6.1	7.3	9.4	12.9	35.7		
b	8.9	5.9	0	5.8	13.5	25.2		
a-b	-0.9	0.2	7.3*	3.6*	-0.6	10.5*	+	+*
SR								
a	8.4	7.2	6.9	7.0	13.1	34.4		
b	6.7	4.4	4.5	6.5	11.7	25.5		
a-b	1.7	2.8*	2.4*	0.5	1.4	8.9*	+	0
IE								
a	-	6.8	10.4	10.9	17.5	45.7		
b	9.8	3.8	1.8	8.4	14.4	28.3		
a-b		3.0*	8.6*	2.5*	3.1*	17.4*	+	-

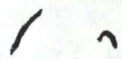
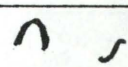
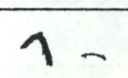
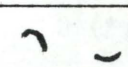
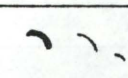
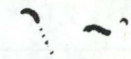
Appendix V,1

*Duration and distance (in cs), Fo, and peak intensity in (a) sød súppe and (b) sødsùppe, read by Jutlandish dialect speakers. D = dialect, RSD = Regional Standard Danish. * means significance at the 1% level, (*) at the 5% level. Each measure is the average of 6-8 tokens. See further Introduction to App. III-V.*

West Jutl.		Duration			Distance	Fo	Intensity
		søð?	sob	o	o – ø	ø o	ø o
BT D	a	21.1	25.0	9.4	22.5		– _
	b	22.3	21.9	9.2	21.6		– _
a-b		-1.2	3.1*	0.2	0.9	(+)	+
BT RSD	a	23.1	25.7	9.8	23.0		– _
	b	21.3	25.7	9.4	20.6		– _
a-b		1.8(*)	0	0.4	2.4*	+	-
JD D	a	31.5	36.3	9.4	30.3		– –
	b	27.5	33.3	9.8	25.4		– _
a-b		4.0(*)	3.0(*)	-0.4	4.9(*)	+	+*
JD RSD	a	32.3	29.7	10.0	32.1		– –
	b	25.6	25.4	8.4	26.1		– _
a-b		6.7*	4.3*	1.6	6.0*	+	+*

continued

(Appendix V,1, continued)

		Duration			Distance	Fo	Intensity
North Jutl.		søð?	sob	o	o – ø	ø o	ø o
PN D	a	39.8	32.3*	13.3	39.9		– –
	b	34.3	25.9	12.6	31.1		– –
a-b		5.5*	6.4*	0.7	8.8*	+	+*
East Jutl.							
PM D	a	23.9	19.1[1])	8.2	25.0		– –
	b	22.8	15.9	6.7	22.2		– –
a-b		1.1	3.2*	1.5*	2.8*	+	-
PM RSD	a	22.3	25.1	10.3	22.0		– –
	b	22.1	21.4	8.9	19.9		– –
a-b		0.2	3.7*	1.4	2.1*	+	+
LH RSD	a	25.2	20.8[1])	11.0	25.5		– –
	b	25.9	18.4	10.2	23.2		– –
a-b		-0.7	2.4	0.8	2.3(*)	0	+(*)

[1]) Only *so* could be measured.

Appendix V,2

Duration and distance (in cs), Fo, and peak intensity in (a) mát lámpe[1] and (b) nátlàmpe, read by Jutlandish dialect speakers. See further caption to App. V,1.

West Jutl.		Duration at[2]	lam(b)[3]	a	ɑ	Distance a – ɑ	Fo na	Fo lam	Intensity a	Intensity ɑ
BT D	a	15.2	18.3	8.2	6.7	21.6			–	–
	b	14.6	19.1	9.3	7.2	22.0			–	–
a-b		0.6	-0.8	-1.1	-0.5	-0.4	(+)		+	
BT RSD	a	15.2	27.6	9.5	11.4	21.4			–	–
	b	13.9	27.6	9.8	10.6	20.7			–	–
a-b		1.3	0	-0.3	0.8	0.7	+		-	
TA D	a	20.0	27.8	-	8.0	27.4			–	–
	b	20.8	26.6	-	8.2	28.6			–	–
a-b		-0.8	1.2		-0.2	-1.2	(+)		+(*)	
TA RSD	a	17.3	28.1	8.8	9.7	26.5			–	–
	b	16.3	28.3	8.3	9.6	25.1			–	–
a-b		1.0	-0.2	0.5	0.1	1.4	(+)		+	
EA D	a	24.6	25.4	-	9.6	32.8			–	–
	b	24.9	23.2	-	8.9	31.8			–	–
a-b		-0.3	2.2		0.7	1.0(*)	0		+	
EA RSD	a	17.8	38.3	11.6	11.5	30.1			–	–
	b	17.2	36.0	10.8	10.9	28.2			–	–
a-b		0.6	2.3	0.8	0.6	1.9	0		+	

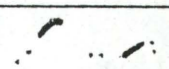
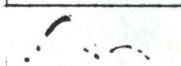
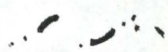
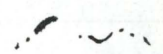
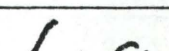
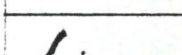
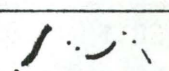
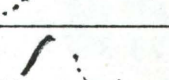
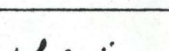
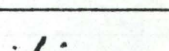
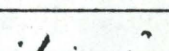
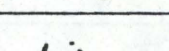
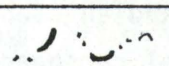
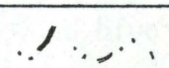
[1]) In the dialect the comparison was made between *den mátte lámpe* and *nátlàmpe*, since *matte* [maˀd̥] and *nat* [naˀd̥] have West Jutlandish stød, but not *mat*. There is also ˀ in [lɑmˀb̥].

[2]) The initial consonant of *nat* could not be delimited.

[3]) Only *lam* could be measured for EA,D.

continued

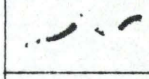
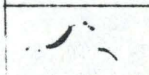
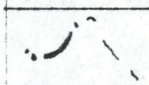
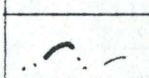
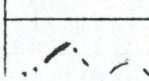
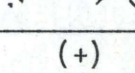
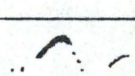
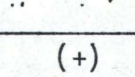
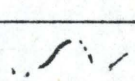
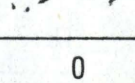
(Appendix V,2, continued)

		Duration				Distance	Fo	Intensity	
		at	lɑm(b)[1]	a	ɑ	a − ɑ	na lɑm	a	ɑ
JD D	a	22.8	34.4	9.6	7.3	32.4		—	—
	b	16.4	33.6	8.8	8.2	26.7		—	—
	a-b	6.4*	0.8	0.8	-0.9	5.7*	+		+
JD RSD	a	21.4	29.6	9.6	9.1	28.6		—	—
	b	22.1	27.6	9.9	9.3	28.1		—	—
	a-b	-0.7	2.0	-0.3	-0.2	0.5	+		+
North Jutl.									
PN D	a	22.1	34.8	11.1	12.9	36.1		—	—
	b	21.5	31.4	11.2	12.8	32.9		—	—
	a-b	0.6	3.4	-0.1	0.1	3.2	+		+*
PN RSD	a	18.5	32.5	10.3	10.4	28.8		—	—
	b	19.8	33.3	10.4	9.6	29.8		—	—
	a-b	-1.3	-0.8	-0.1	0.8	-1.0	+		+
East Jutl.									
PM D	a	13.3	18.8	6.6	6.0	20.3		—	—
	b	14.1	18.2	7.5	6.3	20.6		—	—
	a-b	-0.8	0.6	-0.9	-0.3	-0.3	+		-
PM RSD	a	13.6	25.9	6.9	7.8	20.3		—	—
	b	14.4	24.5	7.6	7.8	20.1		—	—
	a-b	-0.8	1.4(*)	-0.7	0	0.2	+		-
LH RSD	a	14.7	27.2	8.1	9.2	23.9		—	—
	b	15.4	26.7	8.0	9.7	23.6		—	—
	a-b	-0.7	0.5	0.1	-0.5	0.3	(+)		+

[1]) Only *lɑm* could be measured for PN(D) and LH.

Appendix V,3

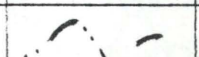
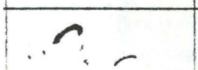
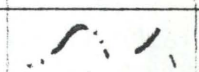
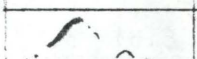
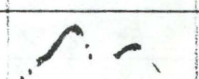
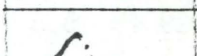
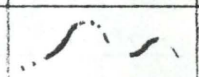
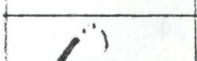
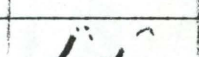
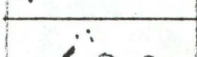
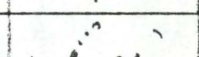
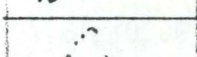
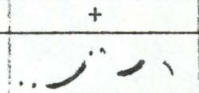
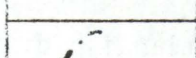
Duration and distance (in cs), Fo, and peak intensity in (a) mâle bøtten and (b) mâlebøtten, read by Jutlandish dialect speakers. See further caption to App. V,1.

West Jutl.		Duration ma:l(ə)[1]	bød	a:	ø	Distance a: – ø	Fo ma:l(ə)ø(n)	Intensity a: ø
BT D	a	26.4	22.6	14.5	7.5	28.7		– –
	b	22.8	16.0	11.5	6.1	24.3		– –
a-b		3.6*	6.6*	3.0*	1.3	4.4*	+	+
BT RSD	a	28.3	25.0	14.8	8.7	30.8		– –
	b	24.3	19.4	12.3	6.0	26.6		– –
a-b		4.0*	5.6*	2.5*	2.7*	4.2*	+	-
TA D	a	28.4	29.4	15.6	7.8	29.6		– –
	b	27.4	24.8	14.4	8.8	26.1		– –
a-b		1.0	4.6*	1.2	-1.0	3.5(*)	(+)	+*
TA RSD	a	30.1	34.3	13.1	9.3	32.3		– –
	b	27.9	31.7	12.9	9.3	29.6		– –
a-b		2.2*	2.6*	0.2	0	2.7*	(+)	-
EA D	a	36.0	30.9	-	9.6	36.3		– –
	b	35.7	30.9	-	8.0	35.2		– –
a-b		0.3	0		1.6	1.1	(+)	+*
EA RSD	a	38.6	31.7	20.4	9.7	41.9		– –
	b	36.1	30.0	18.7	9.2	38.6		– –
a-b		2.5*	1.7(*)	1.7(*)	0.5	3.3*	0	+*

[1]) In West Jutlandish dialect the definite article is a proclitic [ɛ]: ['mɔ:l ɛ 'bød] [ɛ 'mɔ:l,bød].

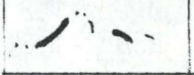
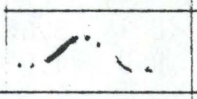
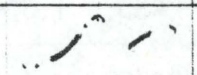
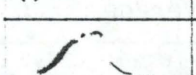
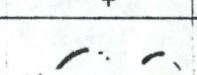
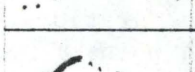
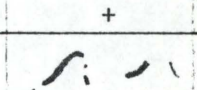
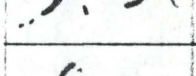
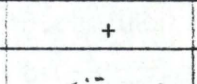
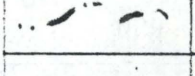
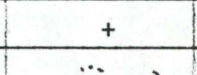
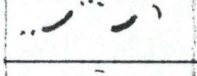
continued

(Appendix V,3, continued)

		Duration				Distance	Fo	Intensity
		ma:l	bød	a:	ø	a: – ø	ma:l(ə)ød(n)	a: ø
JD D	a	31.8	31.2	-	9.4	32.1		— —
	b	29.9	24.7	-	8.0	28.2		— —
a-b		1.9	6.5*		1.4	3.9*	+	+*
JD RSD	a	33.4	30.8	16.4	8.4	30.9		— —
	b	32.3	26.3	16.5	7.5	26.3		— —
a-b		1.1	4.5*	-0.1	0.9	4.6*	+	+*
North Jutl.								
PN D	a	35.6	28.8	-	10.1	36.1		— —
	b	35.8	28.1	-	10.5	34.0		— —
a-b		-0.2	0.7		-0.4	2.1	+	+*
PN RSD	a	38.9	32.4	18.6	10.3	41.9		— —
	b	39.4	26.4	17.1	8.9	37.4		— —
a-b		-0.5	6.0(*)	1.5	1.4(*)	4.5(*)	+	+
East Jutl.								
PM D	a	32.4	21.9	10.6	7.9	23.7		— —
	b	31.5	19.2	9.7	7.4	21.6		— —
a-b		0.9	2.7*	0.9	0.5	2.1*	+	0
PM RSD	a	25.9	22.1	11.0	8.4	27.4		— —
	b	25.0	19.8	10.5	6.9	25.7		— —
a-b		0.9	2.3*	0.5	1.5*	1.7*	+	0
LH RSD	a	31.6	29.0	15.9	10.0	35.3		— —
	b	30.8	25.6	14.9	10.3	33.0		— —
a-b		0.8	3.4*	1.0	-0.3	2.3*	+	+(*)

Appendix V,4

Duration and distance (in cs), Fo, and peak intensity in (a) mále bøtten and (b) málebøtten, read by Funish dialect speakers. See further caption to App. V,1.

Funish		Duration				Distance	Fo	Intensity
		ma:l	bød	a:	ø	a: - ø	ma:l(ə)ø ɳ	
MA	a	22.8	17.2	10.3	5.5	22.9		– –
	b	23.9	17.0	9.5	5.3	26.3		– –
a-b		-1.1	0.2	0.8	0.2	-3.4	+	+*
LA	a	27.4	22.3	12.0	6.5	22.3		– –
	b	26.9	21.8	12.9	6.0	21.8		– –
a-b		0.5	0.5	-0.9	0.5	0.5	+	+*
HV	a	38.1	30.9	19.2	7.6	40.2		– –
	b	35.4	30.3	16.6	9.8	34.3		– –
a-b		2.7	0.6	2.6(*)	-2.2	5.9*	+	+*
IP	a	40.0	35.9	19.5	8.8	45.8		– –
	b	40.6	29.1	17.0	9.6	43.1		– –
a-b		-0.6	6.8	2.5(*)	-0.8	2.7	+	+
EK	a	33.9	27.9	14.6	7.4	35.3		– –
	b	30.1	24.7	13.4	6.3	33.0		– –
a-b		3.8*	3.2*	1.2	1.1	2.3(*)	+	+(*)
EH	a	28.6	21.3	11.6	7.1	28.1		– –
	b	26.9	19.6	10.5	7.2	27.0		– –
a-b		1.7	1.7(*)	1.1	-0.1	1.1	+	0

Appendix V,5

*Reduction in duration (in cs) of the first member of compounds compared to the first word of a sequence of two separate words with main stress and the same segmental structure, read by Jutlandish dialect speakers. D = dialect, RSD = Regional Standard Danish. * indicates significance at the 1% level, (*) at the 5% level. There were 6-8 readings of each word.*

		BT	TA	EA	JD	PN	PM	LH	average
'søð?ˌsobə	D	-1.2	-	-	4.0(*)	5.5*	1.1	-	2.4
	RSD	1.8(*)	-	-	6.7(*)		0.2	-0.7	2.0
'ma:ləˌbødə	D	3.6*	1.0	0.3	1.9	-0.2	0.9	-	1.3
	RSD	4.0*	2.2*	2.5*	1.1	-0.5	0.9	0.8	1.6
'nadlambə	D	0.6	-0.8	-0.3	6.4*	0.6	-0.8	-	1.0
	RSD	1.3	1.0	0.6	-0.7	-1.3	-0.8	-0.7	-0.1
	average	1.7	0.9	0.8	3.2	0.8	0.3	-0.2	1.1\1.3

Appendix V,6

Reduction in duration (in cs) of the second member of compounds compared to the second word of a sequence of separate words with main stress and the same segmental structure, read by Jutlandish speakers. See further caption to App. V,5.

		BT	TA	EA	JD	PN	PM	LH	average
'søð?ˌsobə	D	3.1*	-	-	3.0(*)	6.4*	3.2*		3.9
	RSD	0			4.3*		3.7*	2.4	2.6
'ma:ləˌbødə	D	6.6*	4.6*	0	6.5*	0.7	2.7*		3.5
	RSD	5.6*	2.6*	1.7(*)	4.5*	6.0*	2.3*	3.4*	3.7
'nadlambə	D	-0.8	1.2	2.2	0.8	3.4	0.6		1.2
	RSD	0	-0.2	2.3	2.0	-0.8	1.4	0.5	0.6
	average	2.4	2.0	1.6	3.5	3.1	2.3	2.1	2.4\2.1

Appendix V,7

Reduction of the distance (in cs) between the start of the first vowel and the vowel with secondary stress in compounds compared to the distance between the vowels in a sequence of two words with main stress and (practically) the same segmental structure, read by Jutlandish speakers.

		BT	TA	EA	JD	PN	PM	LH	average
'søð?ˌsobə	D	0.9			4.9*	8.8*	2.8*		4.4
	RSD	2.4*			6.0*		2.1*	2.3	3.2
'ma:ləˌbødə	D	4.4*	3.5(*)	1.1	3.9(*)	2.1	2.1*		2.9
	RSD	4.2*	2.7*	3.3*	4.6*	4.5(*)	1.7*	2.3*	3.3
'nadˌlɑmbə	D	-0.4	-1.2	1.0(*)	5.7*	3.2	-0.3		1.3
	RSD	0.7	1.4	1.9	0.5	-1.0	0.2	0.3	0.6
average		2.0	2.0	1.8	4.3	3.5	1.4	1.6	2.4\2.6