

## SEGMENT DURATION IN DANISH WORDS IN DEPENDENCY ON HIGHER LEVEL PHONOLOGICAL UNITS

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This paper presents data concerning differences in segment duration in Standard Danish due to syllable number, position in the utterance and (based on a very restricted material) syntactic boundaries and word boundaries. It is shown that the tendency to shortening of stressed vowels according to number of following syllables which has been found in many languages, is not valid for Danish, which, on the contrary, has vowel lengthening in disyllables of the type CVC<sub>ə</sub> compared to monosyllables. The historical and dialectal background of this phenomenon is discussed. It is further shown that Danish has final lengthening, although of less magnitude than e.g. English, and that word boundaries seem to be of limited importance, except for the vowel lengthening in disyllables.

### I. INTRODUCTION

For many years it has been accepted as a general rule that the more sounds (or syllables) a phonological unit contains, the shorter are its individual segments. This rule is found, in different wordings, in the textbooks of classical phonetics published around 1900. Jespersen (1897-99, p. 508, and again 1914) quotes Rask for the observation that vowels in monosyllables like Danish *far* are longer than in disyllables like *fare* and Sweet for the remark that the diphthong in *tail* is longer than in *tailor*. He adds himself the Danish examples *fa'en* (a shortened form of *fanden*, which may, however, be disyllabic), *fane* and *fanejunker*. Jespersen explains the difference by assuming that the longer a series of sounds the speaker is going to produce, the more he tends to increase his tempo, and he mentions the frequent shortening of the first member of compounds in the historical development of Danish

and English as a result of this tendency.

Sievers (1901) formulates the rule by saying that the more syllables a measure or rhythmic foot ("Sprechtakt") contains the shorter are the individual syllables. He gives the examples *heil*, *heilig*, *heilige*, *heiligere* and *fahl*, *fahle*, *fahlere* and mentions that the shortening is particularly clear in long vowels.

Some of the first measurements were undertaken by E.A. Meyer. He compared a large number of monosyllables and disyllables, both for English (1903) and German (1904) and stated that the vowel is shorter in disyllables.

In the following years similar differences were found for a number of languages, e.g. Hungarian (Meyer and Gombocz 1909 (cit. Elert 1964) and Tarnóczy 1965 (cit. Lehiste 1970), Spanish (Navarro Tomás 1916 and Menzerath and Oleza 1928 (cit. Elert 1964)), Lappish (Äimä 1918), Swedish (Öhman 1961) and Dutch (Nooteboom 1972), so that it looks as if it might be a universal phenomenon. In general the rule has been formulated in terms of vowel length in words of one, two and three syllables; but as most of the older studies were based on isolated words, it was not possible to decide whether the relevant higher unit is the word, the foot, the tone group or the utterance, or whether they all, to a smaller or larger degree, play a role, perhaps in a hierarchical manner.

Since the end of the sixties an increasing number of studies have been concentrated on this problem and on the differences of duration due to the position within the unit (e.g. "final lengthening"), and various explanations have been proposed and discussed. Most of these studies are based on English, Swedish and Dutch material, and the most important contributions have been made by Ilse Lehiste and Klatt for English, Lindblom for Swedish, and Nooteboom for Dutch. Lindblom and Klatt have attempted to set up mathematical formulas permitting to predict segment durations in different surroundings, e.g. for the purpose of speech synthesis.

In the beginning of the period the word was at the center of interest. Lehiste (1970) quotes some earlier investigations and concludes that in some languages the word as a whole has a certain duration that tends to remain relatively constant, involving a decrease of the duration of the segmental sounds when their number increases (see also Malmberg 1944). In Lehiste (1971) it is shown that the words *steady*, *skiddy* and *skitty*, said in isolation, are considerably shortened compared to *stead*, *skid*, *skit*. It is emphasized that all sounds, not only the vowels, are shortened. These examples present an extreme case. Not only is the stem shorter in the disyllables, but the whole word, including *-y* is shorter (which seems to be mainly due to the fact that *d* is flapped in the disyllables). Generally, disyllables are somewhat shortened, but not to the extent that the whole word is equal to or even shorter than the corresponding monosyllable.

Lindblom (1968) and Lindblom and Rapp (1971 and 1973) investigated nonsense words of the type *da:d*, *dá:dad*, *dá:dadad*, *dadá:d*, *dadadá:d* and found a shortening of the stressed vowel depending on the number of added weak syllables. In 1971 the differences are explained on the basis of a power law derived from the tendency to constant word length. Lindblom and Rapp observed that preceding syllables shorten the duration of the stressed vowel much less than following syllables. This was also found by Nooteboom (1972a) for a comparable material spoken by Dutch subjects, and by Lehiste (1975); i.e. final syllables remain long. Moreover, the difference between mono- and disyllabic words was found to be much larger than that between disyllabic and trisyllabic words (in Lehiste 1975 the latter shortening is very small and non-significant). There is thus a close relation to the phenomenon of final lengthening, i.e. the tendency to lengthen the final word, and particularly the final syllable in prepausal position. This relationship is taken into account in Lindblom's model (1973) and has led him to a new explanation (1976): the 'short term memory' explanation, which is based on the assumption that in speech production the words to be pronounced are stored in a buffer of restricted capacity: the more units entering the buffer the more are those already there compressed, until a certain minimum limit is reached. There will thus be more compressing due to following syllables than to preceding syllables, and the last syllable need not to be compressed. (According to Lindblom 'final lengthening' should therefore be termed 'non-final shortening'). This is quite an appealing theory. However, it does not seem to apply as well to shortening on a higher level, i.e. to the shortening of words (not syllables) according to their position. In sentences with repetition of nonsense words of the types *da:d*, or *dadá:d* (Lindblom et al., 1976) there was more shortening of the last word due to an increasing number of preceding words than of the first word due to an increasing number of following words. There was a clear difference only between final and non-final position, not decreasing duration according to the distance from the end, and the difference was small for *dá:dadad*. Real words, like *dag*, *dagen* and *Dagobert* presented approximately the same pattern, but *Dagobert* did not show any difference at all according to added words. It has also been shown by Kohler et al. (1982) that it does not matter whether you add one or two stressed words after a given word in a sentence (the test words were *Seide* and *Seite*); and Lehiste (1980a) showed that the length of the frame may be important for the duration of the test word but not its place in the beginning or the end of a frame (apart from the prepausal position). Lehiste (1973) also found a lengthening of the last foot in sentences consisting of four feet, but no difference between the preceding feet. This is probably the reason why Lindblom supposes the capacity of the buffer to be rather small (about 3 syllables according to his example (1976, p. 54)).

Others consider 'final lengthening' to be real lengthening. Klatt (1976) explains it as a deceleration of motor activity at the end of an utterance. Lyberg (1979, 1981) thinks that

final lengthening is due to the fact that the extensive Fo contour in final position requires a certain duration of the last sonorant. Umeda (1972) has made a similar proposal.

However, a somewhat less pronounced lengthening has often been found within the utterance at syntactic boundaries. In American English publications this is called phrase final lengthening, whereas Lyberg uses the term 'phrase' in the sense of 'utterance'. Such lengthening is observed by Klatt (1975 and 1976), by Klatt and Cooper (1975), and by Oller (1973). Oller found that even combinations of attributive adjective and noun, where no break should be expected, show lengthening of the stressed syllable when it is word final, at least for nonsense adjectives like *the babáb apple is on the table* compared to *the bábab apple ...*, and concludes that the word boundary is of importance. It might, however, also be the two stresses coming closely after each other in *the babáb ápple* and thus the rhythmic foot (or measure) that is decisive. Klatt and Cooper (1975) found influence by both phrase and word boundaries. - In the interior of the sentence, however, no particular Fo contour should be expected. Thus the Fo contour does not explain everything, and Bannert (1982a and 1982b) has adduced evidence from Swedish and German against any decisive influence of the Fo contour on duration.

Lyberg further maintains that the difference according to syllable number in the word is only found in utterance final position (due to the Fo contour), and that opposite findings are due to the use of nonsense words. But in his own examples the *a* of *Dagobert* is shorter than that of *dag* and *dagen* in all positions, and *dagen* is shorter than *dag* for one of the three subjects.

Various others have also found differences according to syllable number outside the final position. It appears from Oller's graphs (1973) that the difference in duration of the stressed *a* in *bab*, *bábab* and *bábabab* is also found within the sentence at syntactic boundaries and even in attributive position. Klatt and Cooper (1975) have shown the same for real words: *deal* has a longer [i:] than *dealer*, and *fish* a longer [ɪ] and [ʃ] than *fishing* medially in a short sentence. Elert (1964) also found differences between the vowels of monosyllables and disyllables medially in Swedish sentences. These shortenings can hardly be explained by Lindblom's model either.

Lindblom's words were not pronounced finally, but in the short frame 'say ... again', and in various other cases the words were also spoken in frames, e.g. Klatt 1973.

Harris and Umeda (1974) object that words in frames are said in a specific mode. Since the sentences do not give any information to the listener, the rhythm is mechanical, whereas in connected speech semantic importance and syntactic structure overrule the mechanical phonetic features, so that in connected speech no difference according to syllable number

is found. It may be true that in connected speech these differences are overruled more or less by other factors, but that does not mean that the tendency does not exist; it only means that there is an interplay of various factors, and to single out one individual factor you have to use sentences of a similar type. It is true that speakers may tend to make a pause after the test word in a frame or to give it a particular prominence, but this is not necessarily done. Lehiste's finding (1980a) that the length of the frame influences the test word seems to show that the test word has been integrated into the sentence.

In any case, the examples of differences in other than final positions and particularly the results of Klatt and Cooper (1975) do not permit a simple reduction of the rule concerning syllable number to utterance final position or to final position in a frame.

What is still problematic is the role of the word versus the foot. A tendency to equal length of consecutive feet or - to put it differently - to equal distance between stressed syllables (i.e. isochrony) has often been maintained for English. It has been shown by Lehiste (see, e.g., her summaries 1977, 1980b and 1982) and by others, that isochrony is mainly a perceptual phenomenon, but a certain tendency can also be found in production. Lehiste (1972) showed that in the type *speed kills*, the word *speed* has a longer stem and a longer stressed vowel than in the type *speed increased*. Kohler et al. (1982) found a shortening effect of a following syllable in the foot ('...Seite täglich...' compared to '...Seite bestimmt...'), but he thinks that the word boundary may have a supporting effect. Lehtonen (1974) gives examples from Finnish where the word division is without influence. Elert (1964) assumes that the measure is more important than the word boundary. But of course, isochrony does not explain the differences in isolated words. Donovan and Darwin (1979) remark that the perceptual illusion can be considered as a perceptual compensation for the deviations from an intended isochrony disturbed by different types and number of syllables.

Lehiste (1972) observes that in the type *the stick fell* the word *stick* is shortened just as much (in fact more) than in *sticky* compared to the isolated word *stick*, and that in *the stick is broken* the word *stick* is of the same duration as in *stickiness*. She concludes that there is no clear difference between morpheme boundaries and syntactic boundaries, in other words, the word unit is not important. As far as I can see, her material only proves that there is reduction in both cases, not that it is of the same extent, for the positions are different: The isolated words *sticky* and *stickiness* are in final position, whereas this is not the case in *the stick fell* and *the stick is broken*, so that here shortening due to non-final position (another stressed word following) is not separated from the effect of syllable number. In order to prove definitely that word boundaries are irrelevant, one should compare phrases like *the sleepy farmer*, *sleep refreshes*, *the sleepy professor*, *sleepiness stops it*, etc.

## II. SOME CHARACTERISTIC FEATURES OF THE DANISH PROSODIC SYSTEM

The Danish simplex word of the central native vocabulary consists of a stressed syllable with full vowel followed by 0-2 (rarely 3) unstressed syllables with schwa. Derivatives and compounds normally have secondary stress on the second member and full vowels. Compounds can be formed very freely. Words with prefixes generally have stress on the stem, and foreign words may be stressed on any syllable and have full vowels in unstressed syllables. This is just as in German. But the Danish syllables with schwa are perceptually weaker than in German, and the [ə] is often very short and may disappear completely in colloquial speech, particularly after sonorants. However, it usually leaves a lengthening of the consonant, and generally the number of syllables is perceptually preserved, also because at least part of the pitch movement is preserved. In the present material only one of the subjects (who has a Jutlandish dialectal background) has apocope finally in the frame, e.g. [dann] for [danə] and even [bast] for [bastə]. The other subjects may have apocope in the first member of compounds like *malekasse*. In word final position in frames the duration of [ə] is usually 3-5 cs.

Vowel quantity is phonologically relevant in Danish, and it has quite a considerable functional load in words of two and three syllables, e.g. [mi:lə/milə]. There is hardly any difference in vowel quality between short and long equivalents except for short and long [a][o] and [ɔ]. Postvocalic consonants do not show any difference of duration after long and short vowels (Fischer-Jørgensen 1964 and Riber Petersen 1973).

Almost all monosyllables and final stressed syllables with a long vowel and most monosyllables with a short vowel + sonorant consonant have 'stød', i.e. a specific accent (transcribed [ʔ]) which in its typical form is characterized acoustically by a drop in intensity and  $F_0$  often ending in creaky voice in the latter half of the long vowel or the beginning of the consonant after a 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' (Riber Petersen 1973, see also Smith 1944). Thus comparing the duration of long Danish vowels in monosyllabic and disyllabic words would mean comparing words with and without stød, and that would give an unclear picture because for most speakers the stød has a shortening effect on the vowel. Stød is, however, found in many disyllables ending in *-er -el -en*, and in a few inflected forms in *-e*, so that mono- and disyllables with long vowels and stød can be compared, but generally the segmentation makes difficulties because of the creaky voice which may continue into the following consonant. Monosyllables with short vowel and sonorant consonant also make difficulties because of the stød, but there is a small number of words of this type without stød.

Monosyllables with a long vowel without *stød* are extremely rare. The word *far*, mentioned by Rask, is a concentrated form of *fader*. But since Rask's time final *r* has been vocalized and assimilated to [a:], so that the pronunciation is now [fa:], and a comparable disyllable *fare* is pronounced [fa:q], where no segmentation is possible. Moreover, the words *lagde* and *sagde* may be monosyllabic [la:, sa:], particularly with weak stress, but they may also perceptually have a trace of a second syllable. In the speech of the younger Copenhagen generation one may hear long [a:] and [v:] without *stød*, due to an assimilation with a following *r*, e.g. *stork* [sdv:g]. Finally, monosyllables with long vowel without *stød* are found as first member of compounds. But most old compounds of this type have shortened the vowel, and many more recent compounds have varying length of the first member, so that it is difficult to find reliable examples. This leaves us with the possibility of comparing monosyllables and disyllables with short vowel, and moreover, as Danish has no voiced obstruents (except *v*, which is not found after short vowel), they can be compared only before voiceless consonants and sonorants. According to experiences from other languages, the differences are, however, most obvious for long vowels and before voiced consonants.

Thus it seems as if Danish is not a particularly good choice for this type of investigation. However, it may be an interesting choice, because some earlier more restricted measurements seem to indicate that it might present an exception both to the rule of shortening in disyllables and to the rule of final lengthening. In a paper on sound duration and place of articulation (1964) I mentioned in passing that all eight subjects had a longer vowel in disyllables than in monosyllables. However, the word type was rather specific: nonsense words with high vowel followed by a stop consonant and preceded by the same stop consonant or by [h], thus e.g. [bib bibə] spoken in a quick series [bib, did, gig], etc. This was rather far from natural speech. It might be worth while trying real words. As for final lengthening, Holtse (1977) found that the words *læs, læsse, læssene* and *læse, læselig, læsende, læsesal, læsesale* (plus some still longer words) spoken by himself nine times each, partly finally in the frame *det kaldes...* ('it is called...') and partly in the frame *det kaldes... denne gang* ('it is called ... this time'), did not show any difference in vowel length in the two frames (there was a difference of only about 1 cs for the word *læssene*). He concludes that it would be worth while investigating a larger corpus in order to find out whether there is really no final lengthening in Danish. This would not be very surprising. Lindblom relates final lengthening to the nuclear stress rule (final lengthening being the more general phenomenon (1978 and Lindblom et al. 1976)). But Danish has no general nuclear stress rule, and there is no sentence accent on the last lexically stressed word in neutral sentences as is the case in Swedish, English and German. In neutral sentences Danish has equal stress on the stressed words (see Thorsen 1980). This, by the way, may be related to the fact that Danish makes a clear distinction between equal stress and 'uniting stress', e.g. *han læser romanen* 'he reads the novel'

and *han læser románer* 'he reads novels', *han går i vándet* 'he walks in the water' and *han går i vándet* 'he goes swimming' (see, e.g., Rischel 1980 and 1982).

As for the difference between the stressed vowels in disyllabic and trisyllabic words, Holtse (1977) showed on the basis of a large corpus consisting of nonsense words of the type CVCə and CVCəCə(Cə) in frame sentences that the vowel in trisyllabic words is, on the average, shorter than the vowel in disyllabic words. The difference is small (generally less than 1 cs) and there are exceptions, but due to the extensive material the tendency comes out clearly.

### III. INFORMANTS, MATERIAL AND MEASUREMENTS

The basic data used in this investigation were recorded by seven main informants, five male and two female. They are all phoneticians or dialectologists. (For measurements of small differences of duration it is an advantage to use speakers who are accustomed to read silly sentences without hesitation.) They have all lived in Copenhagen for several years and speak Standard Danish (SD) but with different dialectal background.

- NR, born 1942; spent his childhood in Gl. Holte, North of Copenhagen; he has lived in Copenhagen since 1964 and speaks "Advanced Standard Copenhagen Danish" (ASC).
- EF, born 1911 in Nakskov, Lolland; spent her childhood in Faaborg, Funen, has never spoken Funish but learnt a conservative SD from her parents, which is now modified by influence from ASC; has lived in Copenhagen since 1929.
- PH, born 1947 in Nakskov, Lolland; has lived in Copenhagen since 1966, speaks SD with a slight tint of Lolland regional language. He has a relatively weak stød.
- OT, born 1928 in Aars, Himmerland in Jutland; has spoken Jutlandish urban dialect as a child; he has lived in Copenhagen since 1943 but has a slight Jutlandish accent, particularly in the rhythm.
- NK, born 1915 in Odense, Funen; has lived there until he came to Copenhagen in 1944. He speaks SD with a perceptible Funish accent.
- BJ, born 1946; spent his childhood near Kolding, Jutland at the boundary between the West- and East-Jutlandish dialect areas. He spoke dialect with his playmates and regional standard language with his parents. He has lived in Copenhagen since 1952. He speaks SD with a perceptible Jutlandish accent, particularly in the rhythm.



IE, born 1926 in Vrinsted, Salling, Jutland; has spoken urban dialect as a child. Her SD has a very clear Jutlandish background. She has, e.g., consistent apocope. She has lived in Copenhagen since 1945.

I have, on purpose, chosen informants with a varied dialectal background in order to see how general the characteristic features of their segment durations are. All have the Copenhagen pitch contour with low stressed syllables and a jump up to the first post-tonic syllable (see Thorsen 1980), at least when the syllable belongs to the same word, but the last four have a somewhat different contour in compounds.

The material read by these seven informants consisted in (1) the nonsense words *mam, mámam, mámamam, mamám, mamamám*, spoken finally in the frame *han sagde ...* [han sa:] ('he said ...'), (2) real words with different syllable number spoken in the frame *han sagde ... fem (to) gange* ('he said ... five (two) times') (in a few cases, for one subject *han sagde ... een gang* (i.e. 'once')). Many of the words were also spoken finally in the frame *han sagde ...*; (3) small sentences of the type *han så sine sønner* ('he saw his sons'), *hans sønner kommer* ('his sons are coming'). More details are given in the relevant sections. All three types were mixed in four different randomizations. It turned out not to be a good idea to mix the nonsense words with the other words because they stood out as special, and were sometimes spoken with extra emphasis or speed. The subjects were asked to read the sentences in a neutral tone and in a constant tempo without internal pauses. Most of them succeeded, but one often made a small pause after the test word in the frame 'he said ... five (two) times', and one gave the test word a certain degree of emphasis. The list was repeated twice, so that there are 8 examples of each word for each speaker, in a few cases 10. Most words were spoken in one session, but a smaller part was read in another session. Only words from the same session are compared. Some sentences were only read by four subjects, a few by three, and one subject read a number of extra sentences.

The sentences were recorded on a semi-professional tape recorder in a sound-treated room at the Institute of Phonetics, Copenhagen University.

A more restricted material was recorded by 16 informants, all living outside of Copenhagen and speaking various rural or urban dialects or types of regional standard Danish (RSD). There were three from Zealand, seven from Funen, and six from Jutland. The informants were:

(a) Zealand

ET, born 1894 in Dragør on Amager, where she has spent her whole life. She speaks the coastal North Zealand dialect.

KH, born 1910 in St. Havelse, North Zealand, about 40 km North-west of Copenhagen. He has spent some years in

Jutland but has now for several years lived in his native village. He speaks dialect with his friends.

OR, born 1909 in Nordrup; is now living in Bjeverskov, and has spent all his life in a rather narrow area on the border between the North- and South Zealand dialect area in Eastern Zealand near Køge.

(b) Funen

IP, born 1914; has spent her whole life in Vissenbjerg in the West Funish dialect area.

HV, born 1933 in Haastrup in the westernmost corner of the East Funish dialect area. He has lived in Haastrup only and speaks an old-fashioned and genuine dialect.

MA, born 1960 in Frørup, on West Funen; has lived in Frørup only, or in the close vicinity of Frørup. He speaks South-West Funish dialect.

LA, born 1956 in Frørup (MA's sister); lived in Frørup until 1976, since then in Copenhagen, but she speaks dialect at home.

EK, born 1932 in Odense and still living there; speaks urban dialect, not too far from the Odense RSD.

EA, born 1932 in Nyborg; has lived in Odense since 1936. Speaks the same dialect as EK.

HC, born about 1910 in Svendborg; has lived in Odense for many years, but still has Southern Funish features, e.g. generally no stød.

(c) Jutland

LH, born 1946 in Århus, where she still lives. Speaks a typical Århus regional standard (e.g. with rather fronted [a]).

BT, born 1940 in Uldum in the South-Eastern corner of the West Jutlandish dialect area; has spoken urban dialect as a child and still speaks it occasionally. She has lived in Århus since 1962 but speaks Copenhagen Standard language, which she has learnt from teachers and friends.

TA, born 1948 in Villerslev in South Thy in Northwestern Jutland; has lived in Århus since 1967 but still speaks the dialect.

EA, born 1951 in Mors, speaks West Jutlandish like TA. She has lived in Århus since 1970.

JD, born 1914 in Vridsted in Fjends Herred South of Skive, i.e. in the West Jutlandish dialect area; studied in Copenhagen, but has lived in Århus since the forties. She still cultivates her dialect.

PN, born 1910 in Børglum, Vendsyssel, still uses his dialect. He now lives close to Århus.

The four latter informants all speak rural dialects and a regional Jutlandish standard language (not specifically the Arhus type).

The dialectal speakers read short sentences containing partly the same words as those read by the speakers from Copenhagen. The five bilingual Jutlandish speakers read the same sentences in dialect and in their standard language.

Two more informants read a few sentences:

SR, born 1940 in Hjerting, South Jutland; spoke dialect as a child and still speaks it when visiting his family. His SD has a clear Jutlandish rhythm. He has lived in Copenhagen since 1960.

PM, born 1946 in Himmerland, Jutland; spoke dialect only until he was 10 and still speaks it when going to see his family; his SD has a perceptible Jutlandish tone. He has lived in Copenhagen since 1967.

The tape recordings of the Zealandish dialect speakers were made in their private homes, using a transportable tape recorder. The Funish recordings were made partly in the homes of the informants, partly at the Institute of Linguistics in Odense, and (in the case of IP) at the Institute of Phonetics in Copenhagen. The recordings of the Jutlandish speakers were all made on a Nagra tape recorder at the Institute for the Jutlandish Language and Culture at the University of Arhus.

All the tape recordings were transferred to mingograms in the Institute of Phonetics in Copenhagen, each recording combining a duplex oscillogram, and Fo-curve, and two intensity curves (one high fidelity, one highpass filtered at 500 Hz).

The segmentation was made by hand with an accuracy of 5 ms. Generally my uncertainty did not exceed  $\pm 2.5$  ms, but there were exceptions: In the words [pla:ʔn, pla:ʔnɔ], [a:ʔ] and [n] could not be delimited for two of the four speakers who read these words, because the creaky voice continued into the consonant. The West Jutland stød also gave some difficulties. The most difficult problem, however, was the delimitation of utterance final sounds. In final stops only the closure was measured. This did not give any problems for the main informants from Copenhagen. However, for the dialect speakers it was often problematic to locate the release, e.g. after the West Jutlandish stød, where the stops were unaspirated, and for some of the Funish speakers. In the case of [s] the noise ends rather abruptly, and the few cs of uncertainty do not matter since the consonant is very long. A real problem arises for final vowels and nasals because they generally fade out gradually. For the main informants two measures were used for final [n]: (1) the point where the vibrations stop or get almost invisible (this point is somewhat arbitrary), (2) the point where the unfiltered intensity curve starts decreasing abruptly, the highpass filtered intensity curve has almost reached zero, and the Fo curve changes from rise to fall.

This point, which (according to a few control spectrograms) corresponds to a point where only the fundamental is left, is generally well defined for four of the seven main informants, whereas for the other three the criteria do not always coincide.

The point where voicing ends gives almost the same duration for the latter three subjects, but this does not correspond to perception. Two have perceptually a normal Danish final [n], whereas the third has a conspicuously long [n]. (It may also be of importance that her [n] is of rather high intensity and keeps this high level till the end.) But choosing the point where the highpass filtered curve reaches zero gives very short [n] for some other subjects. A solution to this problem would require a special investigation. The point where voicing ends has been used in the graphs of figure 1, but the consequences of a different delimitation have been mentioned in the text. For the dialect speakers the problems with final [m] and [n] were even worse. In various cases the delimitation was given up. The dialect speakers also gave more problems because they did not read the sentences as fluently as the main informants. Corresponding problems arise for final vowels, but they have been excluded from this investigation.

The boundary between a vowel and a following consonant was placed where the intensity curve and the  $F_0$  curve decrease abruptly, except for vowel plus [s], where the boundary was placed at the start of the high frequency noise of [s]. This exception was made because it was the only reliable point in the cases of vowel with stød before [s], and there was a number of words of this type. But it means that the indications of vowel duration before [s] are about 2 cs longer than they would have been using the normal criterion.

The significance of the differences was tested by means of the Mann-Whitney U-test and in some cases by the usual t-test, according to the type of distribution.

In the following sections the words are given in phonetic transcription. Initial consonants are of peripheral interest only for the investigation. The only postvocalic consonants used in the examples are [b, d, g] (written [b d g] for typographical reasons) and [s] [m] [n]. [b d g s] are referred to as "obstruents" or as "voiceless consonants" (the two designations being synonymous in this case), [m] and [n] as "sonorant consonants". In the historical section (IV B) the term "obstruents" or "voiceless consonants" also covers *f*, and the term "sonorants" *l, m, n, ð, r* and the semivowels *w* and *j*.

## IV. RESULTS

## A. INFLUENCE FROM NUMBER OF SYLLABLES

As mentioned in section II, Holtse (1977) found a tendency to shorten the stressed vowel in trisyllabic words of the type CVCəCə in comparison with disyllabic words. This tendency is confirmed by the present material. The following words were compared: [<sup>1</sup>sænr/<sup>1</sup>sænrənə], [<sup>1</sup>basdə/<sup>1</sup>basdəðə] (read by 4 and 6 informants, respectively, both in final and in medial position in the frame), [<sup>1</sup>danə/<sup>1</sup>danəðə], [<sup>1</sup>basə/<sup>1</sup>basənə] (read by 5 and 6 informants, respectively, in medial position); moreover [<sup>1</sup>misə/<sup>1</sup>misəðə] and [<sup>1</sup>lagə/<sup>1</sup>lagəðə], read by one informant both medially and finally. This amounts to 29 individual averages, each comprising 8 tokens. 23 (or 79%) of the averages have a longer vowel in the disyllabic word. The difference is, however, small (0.5 cs on the average), and it is only significant in 2 of the 29 cases. It is slightly larger in final than in medial position in the frame (0.8 and 0.4 cs, respectively). The two informants who took part in Holtse's investigation had a difference of 0.8 cs in the present investigation, which is in agreement with his own results. An example with long vowel and stød [<sup>1</sup>plɑ:ʔnr/<sup>1</sup>plɑ:ʔnrənə] showed the same difference (0.7 cs). There is no difference in the following consonant, and the initial consonant is only insignificantly shortened in the trisyllabic words (0.3 cs).

As for the difference between monosyllables and disyllables, a graphic display is given in figures 1-2. The vowel differences are displayed in the left column and the differences in the following consonant of the same words in the right column. There was no consistent difference in the initial consonant.

The words were either spoken finally in the frame (marked (fin.) in the graphs) or medially (marked (med.)), in most cases in medial position in the frame, in some cases, however, medially in short sentences (this is the case for the words [sæn, sænr, plɑ:ʔn, plɑ:ʔnr, mad, madə, phag, thagəðə]). In the case [phag/thagəðə] the pair is not minimal, and [phag] was the first member of a compound; but NR, who also read [thag/thagə] in identical sentences, had practically the same difference in the two cases. The consonant difference has been left out for the pair [phag/thagəðə] because the delimitation of [g] was too uncertain, and because the surroundings are not identical.

It appears clearly from the graphs that in the type CVCə/ɒ the vowel is longer in disyllables than in monosyllables, the grand mean of the difference being 3.2 cs. This is true of 69 (= 96%) out of 72 individual averages, each comprising 8 tokens, and in 65 (or 90%) of the cases the difference is significant at the 1% level. The three counterexamples belong to the pair [bas/basɒ]. Disyllables with the weak vowel [ɒ] (orthographically *-er*), which is longer than [ə], seem to have less lengthening of the stem vowel, the [a] of [basɒ] being significantly shorter than the [a] of [basə]; similarly, the [a] of [mana] is significantly shorter than the [a] of [manə]. The vowel [i] is less length-

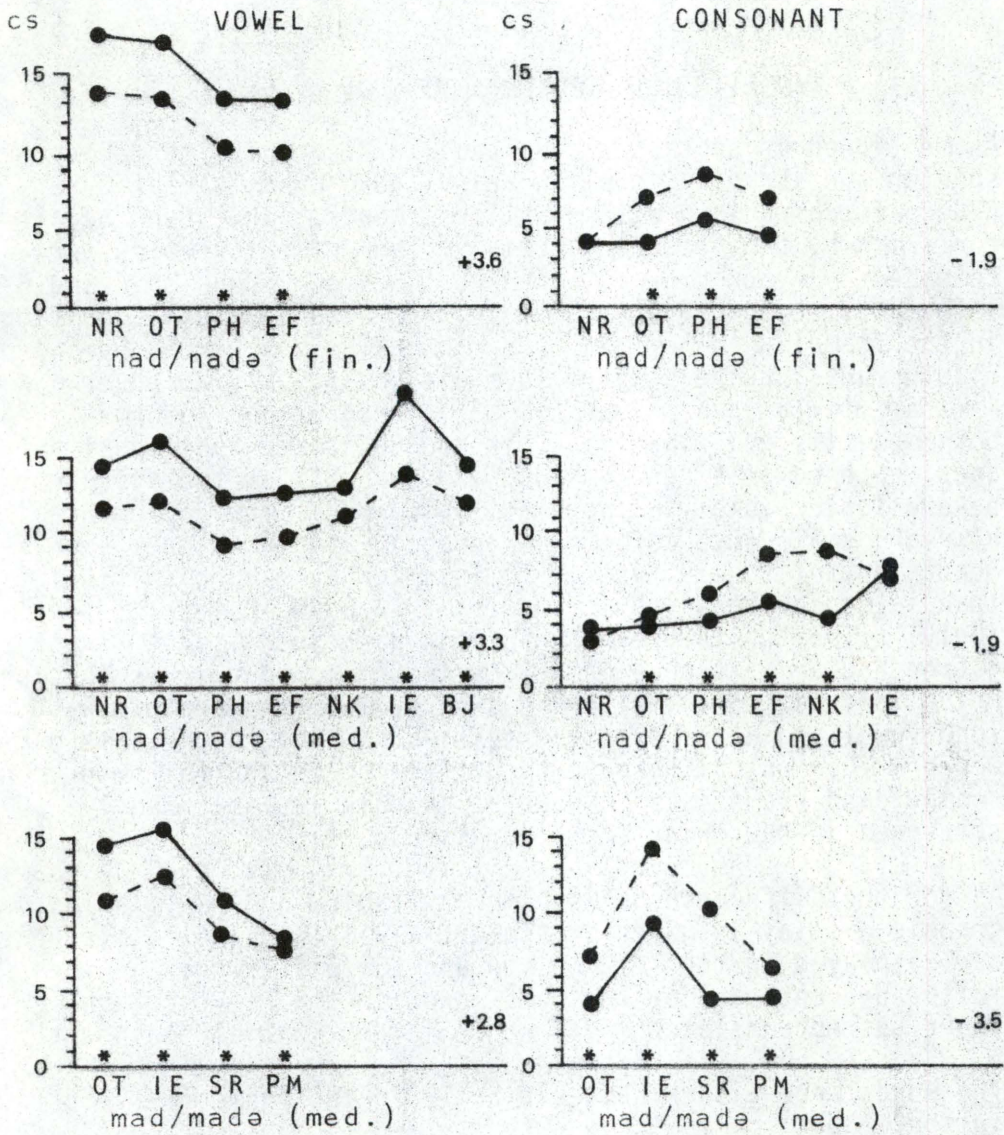


Figure 1

Duration of short vowel and following consonant in Danish disyllables (●—●) compared to monosyllables (●---●) in final (fin.) and medial (med.) position. The speakers are indicated by initials along the base line. (In a few cases there are two recordings of the same speaker.) Stars indicate that the difference is significant at the 1% level. The average difference (in cs) is given in the lower right-hand corner of the single graphs. Subject IE is not included in the average of the consonants.

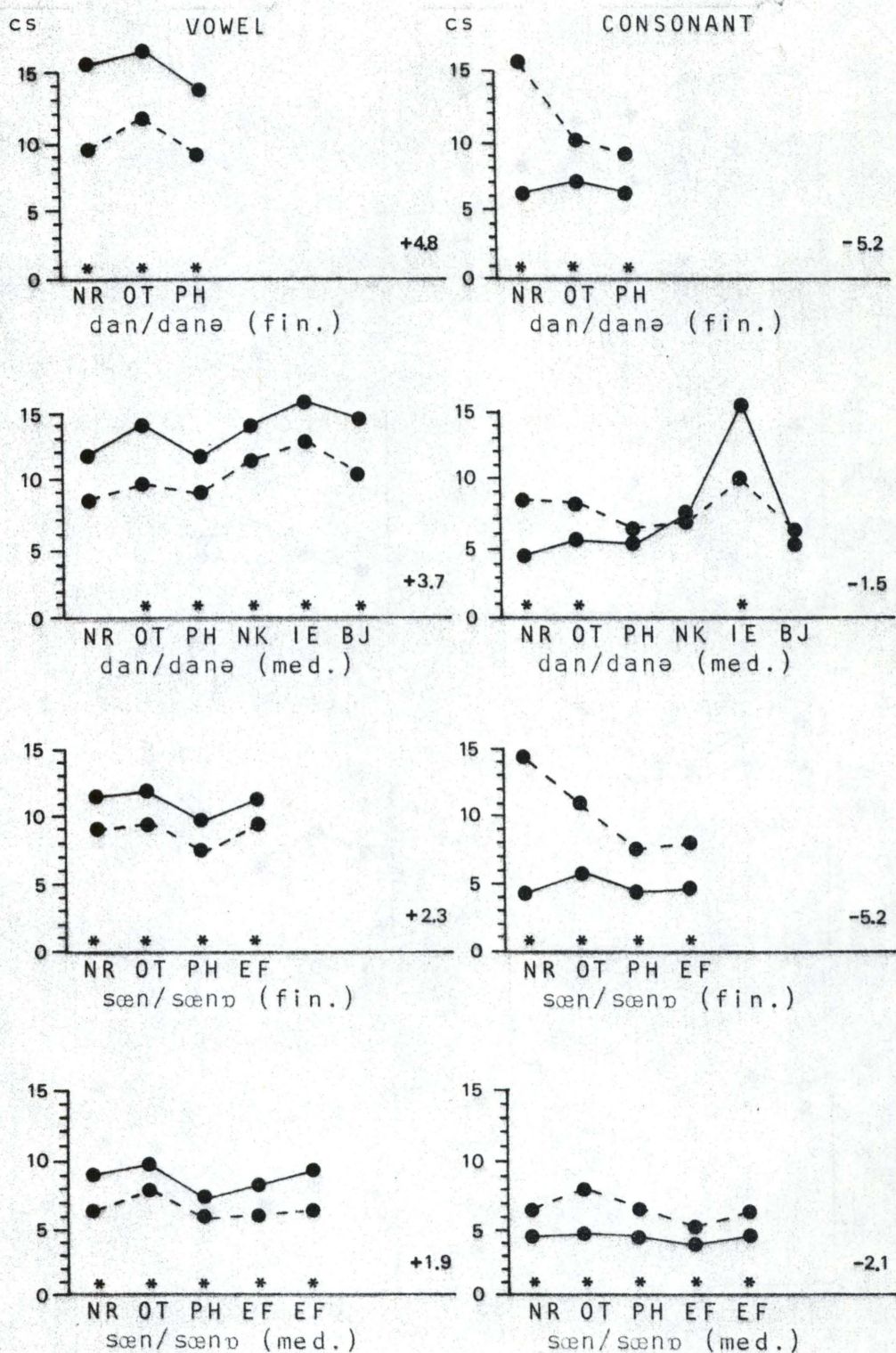


Figure 1, continued

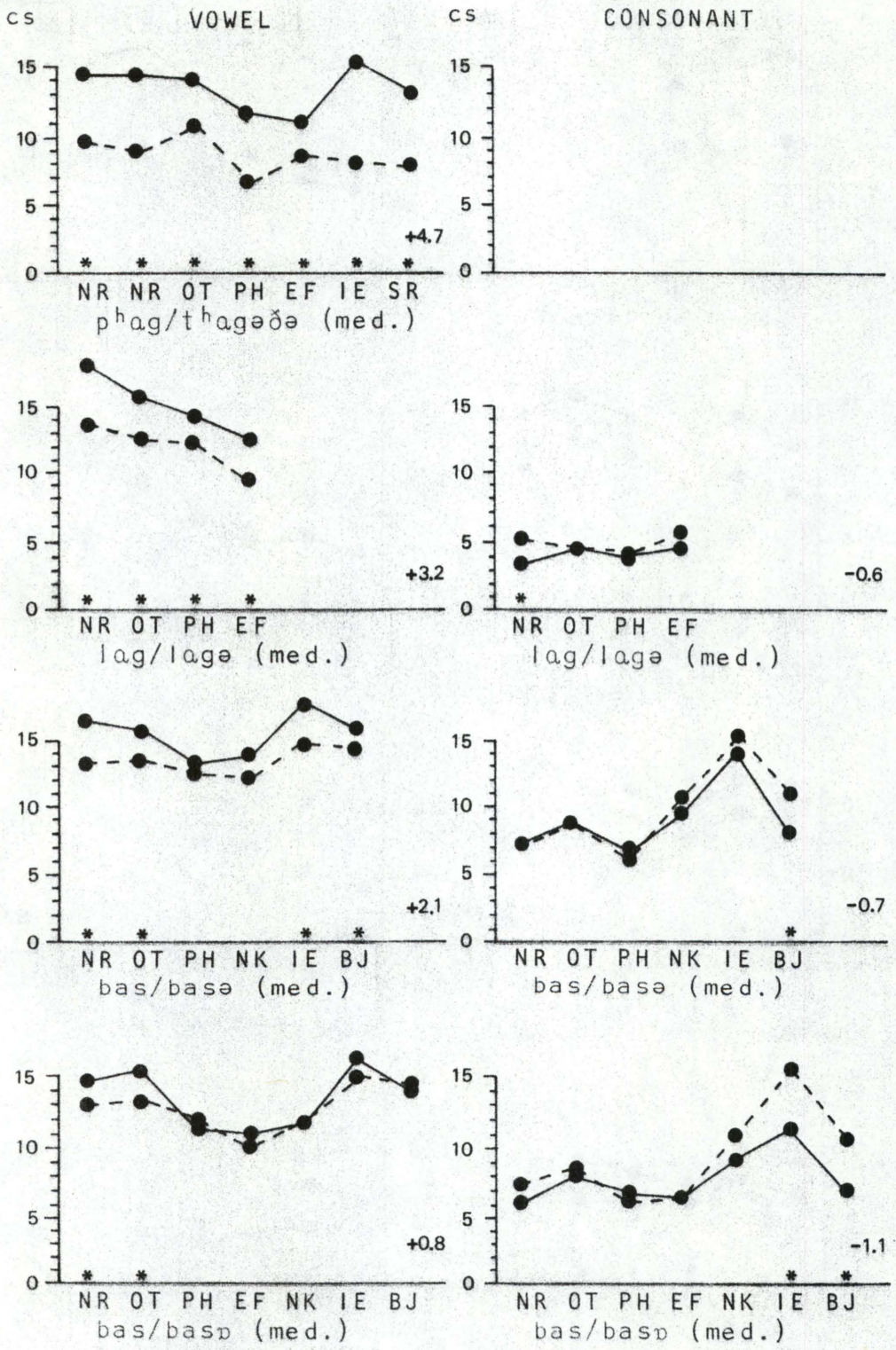


Figure 1, continued



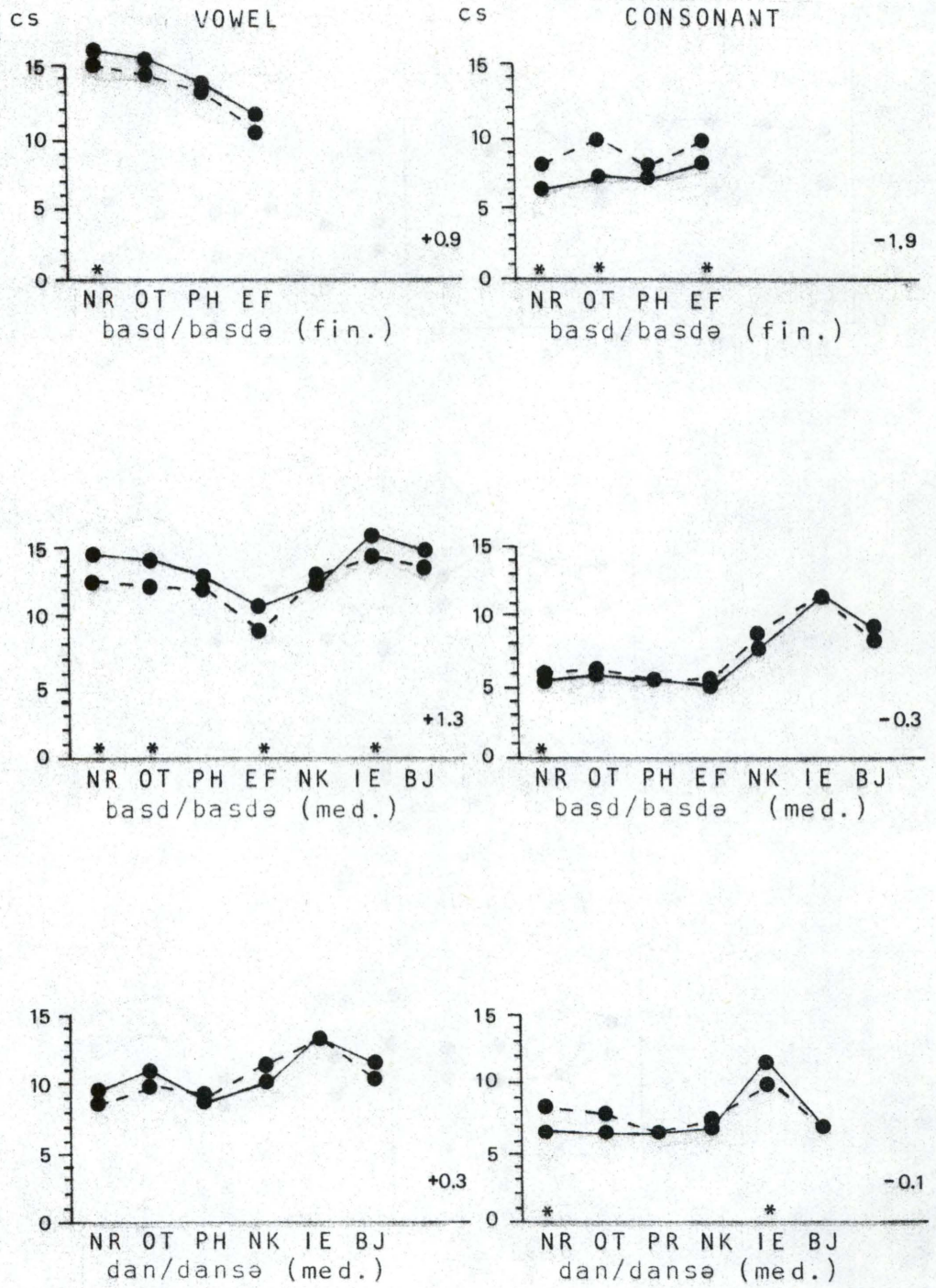


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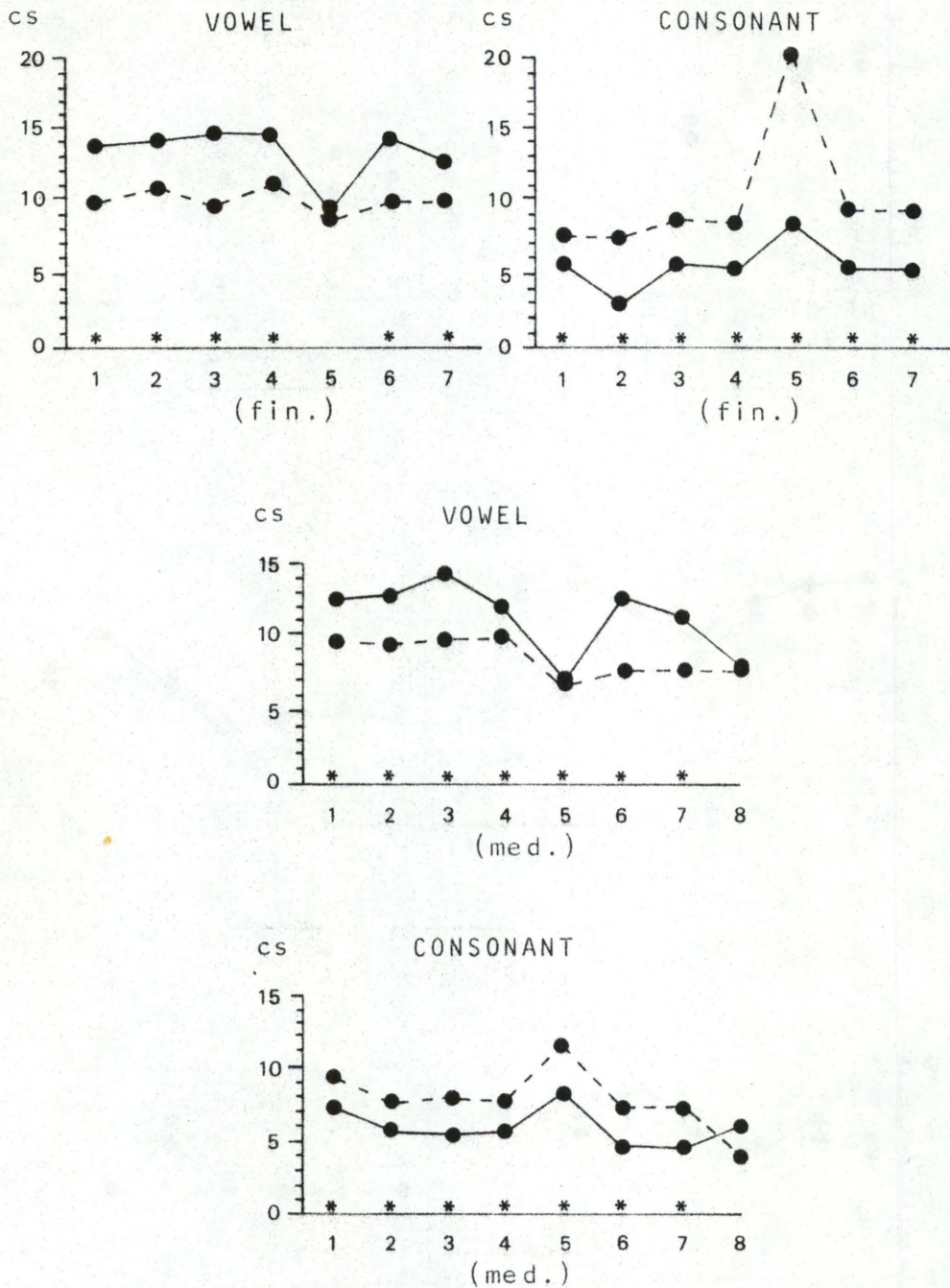


Figure 2

Duration of short vowel and following consonant in Danish disyllables (●—●) compared to monosyllables (●---●) in final (fin.) and medial (med.) position. Speaker EF (extra examples). Stars indicate that the difference is significant at the 1% level. Word pairs: 1. [lad/'ladə], 2. [mu<sup>1</sup>lad/mu<sup>1</sup>ladə], 3. [lag/'lagə], 4. [pho<sup>1</sup>lag/pho<sup>1</sup>lagə], 5. [mis/'misə], 6. [man/'manə], 7. [man/'mana], 8. [man/'mansə]

ened than [a] and [œ], and the difference is not significant (see figure 2, No. 5). High vowels have generally been found to have less clear differences. Therefore [a] was chosen in most word pairs in this investigation. But the significance of the difference for high vowels as well has been demonstrated in my 1964-paper. The difference is of only slightly larger magnitude finally than medially (0.3, 1.1 and 0.4 cs in three comparable pairs of sentences).

In words of the type CVCC(ə), represented by two pairs [basd/basdə] and [dan/dansə], there is less lengthening of the vowel in the disyllabic word (0.8 cs). The vowel is lengthened in 14 (= 82%) of the 17 individual averages, but the difference is only significant in 5 (= 30%) of the pairs. Moreover, one speaker read the pair [man/mansə] (figure 2, No. 8). Here the disyllable had a small non-significant lengthening of the [a]. In [dansə] and [mansə] there is, of course, also an extra [s]. ([dansə] was compared to [dan] instead of [dan?s] because the latter word has stød.)

In contradistinction to the vowel the following consonant is shortened in disyllables, the average being 1.4 cs in medial position and 3.7 cs in final position in the utterance. The subject IE has been left out in these averages because she has apocope and thus (in three out of seven cases) a particular lengthening of the consonant in disyllables.

In final position shortening is found in 22 (= 96%) out of 23 individual averages, the difference being significant in 21 (= 91%) of the cases. In medial position the shortening is found in 40 (= 79%) out of 51 individual averages, and it is significant in 26 (= 51%) of the cases.

The shortening in final position varies according to the consonant. The fricative [s] (see figure 2, No. 5) is very long finally, and the relative shortening in the disyllable therefore considerable. Four speakers who read the word [bas] in final position also had an extremely long final [s]. There is also a relatively large difference for the consonant [n]. But here the delimitation is dubious. It was made where voicing stops. If it had been made where the high-pass filtered intensity curve reaches zero, the difference would have been 1-2 cs instead of 5.4 cs. The closure of stop consonants is not much longer in final position in the utterance, but the aspiration (which has not been included in the measurement) is longer. - Since the vowel is lengthened and the following consonant shortened in disyllables, there is no consistent difference between the stems of monosyllables and disyllables.

In the nonsense words [mam] and ['mamam] all speakers had a longer stressed [a] in ['mamam], but the difference was only 0.7 cs and only significant for two of the seven speakers.

For long vowels without stød the only examples were the compounds ['lɔ:nɪtha:ʔyp/'lɔ:næ,khasə] read by seven informants, and [mɔ:lɪsgɪ:və/mɔ:læɪsgɪ:və] read by one informant.

These words showed a lengthening of the vowel in the disyllabic first member of the compound of 3.3 cs.

The addition of a weak derivative suffix like [-li] has very little influence on the vowel of the stem. Seven speakers read the word ['nadli] in the same frame as [nad], and none of them had any significant difference in the duration of the vowel. The average was 0.3 cs shortening. One speaker read the derivatives ['sænli, 'manli, 'misli] finally and medially in the frame. There was no difference in vowel length between these words and the corresponding simplex words. There is thus neither lengthening nor shortening of the vowel in these cases.

In compounds with secondary stress on the last member the vowel of a monosyllabic first stressed member is consistently shortened compared to the simplex word in the same frame. But the shortening is of very small magnitude. In ['nad<sub>1</sub>lambə] read by seven informants the first [a] was shortened compared to [nad] by 0.9 cs on the average, and the shortening was only significant for one speaker. In the word ['dan<sub>1</sub>fɔs] read by seven informants the first vowel was shortened by 1.0 cs, and the difference from the simplex word was significant for three speakers. The compounds ['mis<sub>1</sub>lyð?] and ['man<sub>1</sub>fɔl?g] read by one informant, showed significant but modest shortenings of 1.5 and 1.4 cs, respectively.

With a disyllabic first member the shortening of the vowel of the stressed first member is somewhat more pronounced. In ['nadə<sub>1</sub>fɔsd], read by seven informants, the [a] was shortened by 2.1 cs compared to [nadə], and the difference was significant for five speakers. In ['danə<sub>1</sub>vɑŋ?], also read by seven informants, the first [a] was shortened by 2.0 cs compared to the word [danə], and the shortening was significant for six speakers. In ['misə<sub>1</sub>kʰad] and ['manə<sub>1</sub>faɪ?] read by one informant, the first vowel was significantly shortened (1.4 and 2.6 cs, respectively). However, in spite of these shortenings the [a] of ['danə<sub>1</sub>vɑŋ?] is still significantly longer than the [a] of ['dan<sub>1</sub>fɔs], and the [a] of ['nadə<sub>1</sub>fɔsd] significantly longer than the [a] of ['nad<sub>1</sub>lambə], irrespective of the number of syllables in the whole word. This means that it is the type CVCə which has vowel lengthening compared to the type CVC. It is not a simple question of syllable number.

Words with long vowel and stød behave differently. Four subjects read the words [pla:ʔn, pla:ʔnɔ] in final position and in two different positions medially. It was only possible to delimit [a:ʔ] and [n] for two of the four speakers. They did not have any consistent difference in the vowel. All had, however, a significant shortening in the disyllable of the combined segments [a:ʔn] of [pla:ʔnɔ] in final position, but no consistent difference medially in the sentence. The pair [ma:ʔs/ma:ʔsɔ] was read by four informants. One had a non-significant shortening of the vowel in the disyllabic word, the other three had no difference. The pair [kʰa<sup>1</sup>la:ʔs/kʰa<sup>1</sup>la:ʔsɔ] was read in final and medial position by one

speaker. In both cases the vowel was significantly shortened in [k<sup>h</sup>a<sup>1</sup>la:ʔsɔ]. Moreover, the pair [sbi:ʔs/sbi:ʔsɔ] was read by four informants finally, by seven medially in a frame, and by four in short sentences. The result is shown in figure 3. It appears from the graphs that the vowel is shortened in the disyllabic word in 13 out of 15 individual averages (87% of the cases), and the difference is significant in 10 averages (67%). The consonant [s] is shortened drastically in the disyllabic word when the words are in final position in the utterance, otherwise only slightly. The difference is significant in final position, but medially in four averages only, and the significant differences go both ways.

On the whole, this word is in accordance with the tendency known from other languages. None of the words with stød have any significant lengthening of the vowel in disyllables.

According to Lindblom, the addition of preceding syllables does not influence the stressed vowel as much as the addition of following syllables. This was investigated for eight Danish word pairs: [nad/go<sup>1</sup>nad] and [lad/mu<sup>1</sup>lad], both read in medial position in a frame by six speakers, [bad/de<sup>1</sup>bad], read in final position by four speakers, and moreover the following pairs read by one informant, both in medial and final position: [lad/mu<sup>1</sup>lad], [ladə/mu<sup>1</sup>ladə], [lag/p<sup>h</sup>o<sup>1</sup>lag], [lagp/p<sup>h</sup>o<sup>1</sup>lagp], [sbi:ʔs/be<sup>1</sup>sbi:ʔs], [sbi:ʔsɔ/be<sup>1</sup>sbi:ʔsɔ], [la:ʔs/k<sup>h</sup>a<sup>1</sup>la:ʔs]. There were thus 30 individual averages. The vowel of the stem is practically of the same duration in all pairs, thus neither lengthened nor shortened. For the following consonant there is a slight tendency to shortening, but the average is only 0.5 cs and the difference is never significant. The initial consonant is, however, shortened by the addition of a prefix. This is true of 86% of the averages, and the difference is significant in 57% of the cases, the grand mean being 1.7 cs.

Moreover, the vowel of the preceding word in the frame (the [a:] of [sa:]) has been measured in 21 pairs, and it was shortened in all cases, the difference being significant in 67% of the individual averages. The grand mean was 2.3 cs. The word [sa:] ('said') has relatively weak stress in this position. In one pair where a stressed word precedes [en<sup>1</sup>lɔ:s<sup>1</sup>bad/en<sup>1</sup>lɔ:ʔs<sup>1</sup>de<sup>1</sup>bad] this preceding word was shortened for three of four speakers, in two cases significantly, but one shortened the [ɔ:ʔ], one the [s], and one all three sounds. The subject who did not shorten the preceding word had a significant shortening of the initial [b]. Two other subjects has small shortenings of the [b].

In the nonsense words [mæn] and [ma<sup>1</sup>mam] there was no difference in the stressed vowel, but the second [m] in [ma<sup>1</sup>mam] was shortened by all subjects (and significantly so by five of the seven speakers), the grand mean being 2.2 cs.

The fact that the addition of a weak prefix shortens the preceding word seems to indicate that rhythmically the weak syllable belongs to the preceding foot, irrespective of the word

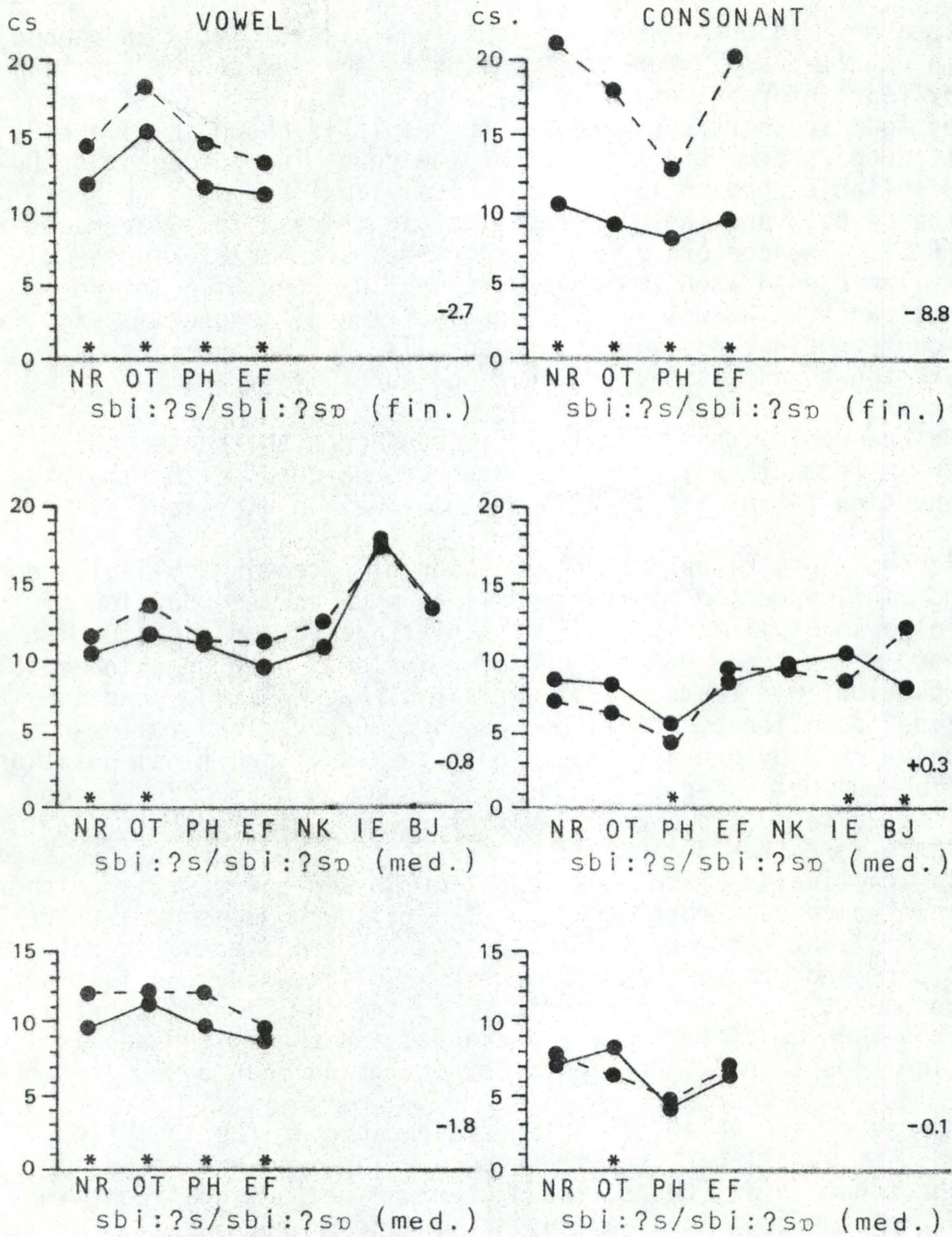


Figure 3

Duration of long vowel with stød and following consonant in the disyllabic word [sbi:ʔsɔ] (●—●) compared to the monosyllabic word [sbi:ʔs] (●---●) in final (fin.) and two different medial (med.) positions. See further the legend to figure 1.

boundaries (as is the case with the pitch contour of Danish stress groups (Thorsen 1980)). The fact that the initial consonant of the stem is shortened might be taken as an indication that stress starts with the vowel. However, it should be mentioned that although the addition of a following weak syllable does not generally influence the initial consonant, the addition of a syllable with secondary stress does shorten the initial consonant in the examples measured in this investigation, although less so than the addition of a preceding weak syllable (0.9, 1.1, 1.5 and 0.6 cs for the words [<sup>1</sup>dan<sub>1</sub>fɔs], [<sup>1</sup>danə<sub>1</sub>vɑŋʔ] [<sup>1</sup>nadə<sub>1</sub>fɔsd] and [<sup>1</sup>nad<sub>1</sub>lambə], respectively, compared to 1.7 cs for the type [mu<sup>1</sup>lad]).

#### B. DISCUSSION OF THE BACKGROUND OF THE VOWEL LENGTHENING IN DANISH DISYLLABLES,

The lengthening of the vowel in disyllables which has been demonstrated in the preceding section is, though consistent, not of a very large magnitude. It should, however, be audible in most cases. Zwirner (1938) found that the JND for short vowels in natural words is between 2 and 3 cs. When the difference reaches 3 cs, the discrimination is 100% correct. Rossi (1972) made discrimination experiments with 23 listeners judging the isolated vowel *a*. He found a difference limen of 3.3 cs for short vowels. Klatt and Cooper (see Klatt 1975) found a minimum JND of 2.5 cs for the vowel *i* in English "dealer" in various sentence environments. Reinholt Petersen (1975) found correct discrimination at a difference of 2.0 cs with short vowels in a synthetic word. However, in normal conversation comparable mono- and disyllables rarely occur at close intervals, and since the difference is not phonologically relevant, it is generally not observed. For Standard Danish it has not been observed by phoneticians either. Nevertheless, the difference is of interest, in the first place because it is in direct contradiction to the tendency to shorten vowels in disyllables, which has been considered to be rather universal, and in the second place because it may signal an ongoing development, which may even in the future create phonological relevance due to the increasing tendency to apocope in modern Standard Danish.

It is therefore worth while raising the question why Danish differs from other languages on this point. Put in this simple form the question can probably never be answered, but it might be possible to throw some light on the development by looking for other characteristic phonetic features of Danish with which the lengthening might have some connection, viz. by investigating whether it may have a connection with (1) the tendency to apocope, or (2) the weakening of intervocalic consonants, or (3) particular *F<sub>0</sub>* contours.

In order to be able to give some very preliminary answers to these questions, it is necessary to look at some features of Danish sound history and dialectology.

Around 1100-1300 the Danish phonological system underwent a series of important changes. Vowels of unstressed syllables were weakened to [ə] in all dialects, except that *i* was retained in a number of cases in Jutlandish and *a* was generally retained in Skåne and Bornholm. In Jutland this weakening continued and entailed complete loss of final unstressed vowels. Loss is documented in manuscripts as early as 1300, and there are many examples in the 14th century (Ringgaard 1963). (In the dialects of the Danish islands a similar development started considerably later.) In approximately the same period as the weakening and subsequent loss of unstressed vowels one also finds a lengthening of short vowels before single consonants. This lengthening took place in all dialects with weakened unstressed vowels. Skautrup (1944) formulates the rule as a lengthening in open syllable (thus in disyllables) with a number of secondary analogical lengthenings in monosyllabic words. This is the generally accepted view. But Aage Hansen (1962) finds evidence for quite a number of early lengthenings in monosyllables as well. These lengthenings were in part given up later in the Standard language, particularly before *m*, *n*, *s* and *ð*. A third general development taking place in the same period is the weakening of post-vocalic stops, *p t k* being weakened to *b d g* and subsequently to fricatives, with somewhat varying results in different dialects. It is tempting to assume a connection between these different developments. Skautrup (1944) attempts a common explanation, assuming that a stronger concentration of energy on the first syllable of the word has resulted in (1) weakening of the following unstressed syllable, (2) weakening of the post-vocalic consonant, and (3) lengthening of the stressed vowel. This is a very attractive hypothesis, but it is of course difficult to prove whether it is correct. Skautrup sets up the following chronological order: (1) weakening of unstressed syllables (around 1100), (2) weakening of *ptk* (12th century), (3) vowel lengthening in open syllable (around 1250), (4) shortening of geminated consonants (1300-1350). He bases his chronology mainly on spellings in old manuscripts. Cases of weakened unstressed vowels are, e.g., (according to Skautrup) documented as early as 1100 on runic stones, and around 1300 unstressed vowels are generally written *e* and *æ*. Lengthening is documented around 1300 by writing of double vowels. However, this chronology is very uncertain. Quantitative changes are only very sporadically rendered in writing. Moreover, observations of modern ongoing sound change make it quite probable that these changes may have been going on more or less simultaneously for a very long time, and with variations according to individual habits, tempo and style. But there may have been some mutual support among them. The only dating which seems quite safe is the placement of the reduction of geminates after vowel lengthening, since the latter took place only before ungeminated consonants.



The Jutlandish apocope did not cause general merger of monosyllables and disyllables. In some Southern Jutlandish dialect areas the two types were - and still are - kept completely apart by means of different word tones (corresponding to the word tones in Swedish and Norwegian). Moreover, in former disyllables both vowel and consonant have been lengthened; in words with a long vowel it is mainly the vowel that lengthens, in words with a short vowel plus a sonorant consonant it is mainly the consonant, and in words with a short vowel plus a voiceless obstruent it is both (see Bjerrum 1948). Thus we find an allophonic vowel lengthening in disyllables which is quite appreciable: According to Bjerrum the lengthening before voiceless consonants is, on the average, 3.8 cs for short vowels and more for long vowels. Moreover, she finds that the old disyllabic word has two dynamic peaks.

Traces of word tone differences have also been found in other parts of the Jutland dialect area, e.g. on Anholt and Djursland (Nielsen 1959), and in Thy in Northern Jutland combined with lengthening (Nielsen, ms.).

In the rest of Jutland (except for a small area in the South) old disyllables and monosyllables with long vowel or with short vowel before long sonorant consonant are kept apart by the fact that the monosyllabic words have developed *stød* (except for some types with sonorant plus obstruent). This is also assumed to have taken place around 1200. The problem of merger is thus reduced to the case of short vowels followed by short sonorants and voiceless obstruents.

In the northernmost dialects (Vendsyssel) there is a clearly audible lengthening of short vowels in almost all old disyllables which have undergone apocope, so that no merger takes place.

In the Western Jutlandish dialects, including the Western part of Slesvig in Southern Jutland (covering about two thirds of the whole area), monosyllabic and former disyllabic words with short vowel plus stop consonant (and sonorant plus stop consonant) are kept apart by means of the so-called West Jutland *stød*, which - in contradistinction to the normal *stød* - occurs in old disyllabic words before *ptk* (originating from old geminates) after short vowel or sonorant consonant. It consists of a glottal closure at the start of the stop consonant (see Ringgaard 1960a) and is reminiscent of the glottal stop found in many types of British English, particularly in North-Eastern dialects, in words like *not*, *better*, etc.

In former disyllables with short vowel before sonorant consonant (as well as in former disyllabic words with long vowel) there is, according to Ringgaard (1959 and 1963) "dynamic circumflex", probably combined with a certain allophonic lengthening. Thus there is only merger in the types with short vowel before voiceless fricative (*s* and *f*), and even in this type the Northern West Jutlandish dialects make a distinction due to lengthening of the vowel in old disyllables.

It is thus in Eastern Jutlandish dialects only, and in a small area in the South, that a considerable amount of merger has taken place (Jensen 1944). Here all monosyllables and former disyllables with short vowel plus voiceless obstruent or short sonorant (thus without *stød* in the monosyllabic word) have merged. But this is a relatively recent development. The old grammarian Høysgaard (1747) mentions lengthening of a final sonorant in former disyllabic words having an optional pronunciation without [ə]. Lengthening of final sonorants in old disyllables is also documented for Samsø in the 19th century (Ringgaard 1960c). Moreover, in Himmerland, in the Northern part of the East Jutlandish area, the older generation has still retained the lengthening in words with sonorant. Molbæk Hansen (1980) has undertaken an instrumental investigation of the pronunciation of the older generation and he found a difference in duration which was distributed over vowel and consonant, but mainly concentrated on the consonant. In his own speech he maintains to have complete merger. However, in a recording of his pronunciation of the words [k<sup>h</sup>an] (= Standard Danish *kan*) and [k<sup>h</sup>an] (= Standard Danish *kande*), placed in similar positions in utterances, I found a significant difference of 1.9 cs in the final consonant. This is an interesting example of the phenomenon that a speaker may make a difference which he cannot hear himself, if it has lost its social value.

It can thus be stated generally that on top of the old vowel lengthening in (preferably) open syllable, Jutlandish dialects have a number of phonological and allophonic length differences between monosyllables and old disyllables. It has been generally assumed that these length differences have been developed as a compensation for the apocope. However, Ringgaard (1959) observes that the sonorant consonants were in many cases originally long, so that they simply remained long, supported by the circumflex, and as for the vowel lengthening in open syllable he assumes that it has preceded the apocope, since we know from Swedish and Norwegian dialects that apocope generally starts after long syllables. He seems to assume that originally short sonorant consonants have also been lengthened before the apocope, so that all syllables were long. Here again the developments seem to be connected, but the chronology is uncertain. (General surveys of Jutlandish dialects are found, e.g., in Ringgaard 1971 and Nielsen 1959.)

There are certain parallelisms between the vowel lengthening in disyllables in Standard Danish found in the present investigation and these older lengthenings. Like the old lengthening the recent lengthening was preferably found in open syllable (e.g., very little lengthening in [basdə] and [dansə]) and before a weak second syllable, not before derivative endings or second members of compounds, and to a limited degree before [ɐ], which is slightly heavier than [ə] (cp. that the old vowel lengthening did not take place before derivatives and parts of compounds either; on the contrary, we here find shortenings, cf. Old Norse *félagr*, modern Danish *fællig*).

It is more problematic whether the recent lengthening is connected with the apocope, i.e. if it matters whether the unstressed syllable is weakened or totally disappearing.

The dialects of the Danish islands did not, like the Jutland dialects, have apocope in medieval times, but there has been an increasing tendency to apocope during the last 200 years or so.

In older descriptions of Funish dialects apocope is mentioned after sonorants (e.g. Rask, ed. 1938) and Jacobsen (1885, ed. 1929). In more recent descriptions forms with apocope are mentioned as the normal forms in all cases, but it is always possible to pronounce the [ə], cf., e.g., Andersen's description of Eastern Funish (1958), based on informants born 1838-66). Final sonorants are lengthened in cases of apocope, but no lengthenings of vowels are reported. On the contrary, in Eastern Funish Andersen (1958) has found lengthening of short vowels in monosyllables, not in disyllables (except for a particular class of monosyllables with high vowels), and he demonstrates this convincingly by instrumental means.

In Zealand elision of [ə] seems to be more general than in Funish (Ejskjær 1971). Descriptions from the end of the last century report a number of retained endings, but also apocope, and there seems to have been general facultativity in many dialects (Brink and Lund 1975). In more recent descriptions some dialects, e.g. in East Zealand (Ejskjær 1970) are reported to have almost obligatory apocope. Larsen (1971) also found obligatory apocope in West Zealand.

The Copenhagen pronunciation is mainly based on North Zealand dialects. In Copenhagen, both in the lower and the higher norm, there is an increasing tendency to apocope, which seems to have started later than the apocope in the surrounding Zealand dialects.

Brink and Lund emphasize that loss of [ə] in the dialects of the Danish islands and in Copenhagen is a quite different phenomenon from the Jutlandish apocope. In the first place the Jutlandish apocope is an old development, which has not been productive for many centuries, so that new forms with [ə] have developed (e.g. from *-ig*, *-er*, *-et*), whereas in the islands it is a recent development, and there is still facultativity. In the second place, the process is quite different. In Jutland it is a real apocope, i.e. loss of final [ə] but not of medial [ə]. In the dialects of the islands it starts as a loss of medial [ə] with lengthening of neighbouring sounds and general preservation of the number of syllables. It is particularly early in the endings [əl, ən, əð] developing into syllabic [l̩, n̩, ð̩] (they therefore prefer to call it "ə-assimilation"), and loss in final position is late. They have followed the development of the Copenhagen pronunciation by listening to gramophone records of informants born in the period 1840 (in one case 1816) to 1955. Assimilations occur

earlier after sonorant consonants than after obstruents and earlier medially than finally. In sentence final position it is rare after voiceless consonants, and even informants born in the forties of this century have more often [ə] than apocope in this position.

As for accompanying lengthenings a preceding sonorant consonant is normally lengthened both in the dialects of Zealand and in Copenhagen, but Larsen (1971) also reports cases of lengthening of the preceding vowel. In the case of voiceless consonants there are conflicting reports. Some Zealandish informants, particularly informants from West Zealand, consider monosyllabic and disyllabic words to have merged in this case, whereas others, particularly informants from Eastern Zealand, state that there is a difference. Larsen (1971) has measured segment durations for two informants, one from West Zealand and one from South East Zealand. The former has a weak tendency to lengthen the vowel before sonorant consonants, but hardly any significant difference. The latter has a clear tendency to lengthening before sonorant consonants, and a weak, non-significant tendency to lengthening before voiceless consonants. However, for the dialects in North Zealand and for the lower sociolect in Copenhagen lengthenings have been reported by various observers. Andersen (1954) mentions a general lengthening of short vowels in the Copenhagen dialect. Brink and Lund (1975) have noticed facultative lengthening of short vowels in the lower sociolect of Copenhagen during the period investigated. But according to their examples this lengthening is not restricted to open syllables. Their observations for this sociolect are, however, based on six informants only and some notes from the end of the last century. They suppose that this lengthening is now on its way into the higher sociolect, but apart from the diphthong [ai] they only quote the word [frægə]. They further advance the hypothesis that facultative lengthening may also have been found earlier in the higher norm, because they have observed some cases in the speech of the author Karen Blixen, who spoke a very oldfashioned Danish. Again, several of the examples are from closed syllables. These lengthenings may, however, be stylistically conditioned.

Aage Hansen (1956) states that in Zealand and in the lower sociolect of Copenhagen there is a tendency to lengthen short vowels (particularly open vowels) in open syllable. He quotes a number of examples before *b d g f*, and a single example before *n*. There is also lengthening of vowel before [v] plus obstruent, the [v] being assimilated to the vowel, and in this case the lengthening takes place in closed syllables as well.

On the whole, lengthening in the lower Copenhagen sociolect is clearly audible, and according to my own impression and that of various colleagues, it is most obvious in open syllable. Molbæk Hansen (personal communication) has recorded sentences with 16 comparable word pairs with long and short vowels from seven speakers of this sociolect (all in open syllables in disyllables). There is great variation according to speaker and

phonetic structure of the words. The tendency to lengthening is most pronounced for low vowels before stops, particularly [g]. According to a survey I have had occasion to see, there are at least seven cases where the duration of the short vowel exceeds 90% of the duration of the long vowel, and there are various cases above 80%.

In a recent recording of an informant ST, speaking the same sociolect (though not a very extreme variant) I found the following percentual values for the relation between short and long vowels: [basə/ba:sə] 90%, [vegə/ve:gə] 82%, [sdɔgɪ/sdɔ:gɪ] 78%, [mɔdɪ/mɔ:dɪ] 72%. These percentual relations may be compared with Bundgaard's measurements of vowel duration in Advanced Standard Copenhagen (ASC) (1980). As an average of four speakers, pronouncing nonsense words ([bVbə] with varying vowels) in a frame, he gets 71%. Holtse (1977) found a relation of 67% for three speakers using a somewhat more conservative norm. (For vowels of the same degree of opening their results are practically identical.) In a material from 1974 I found a percentage of 71 for [a/a:] without much difference between somewhat older and younger speakers. For the most open vowels Bundgaard's percentual values are higher (for [a/a:] and [ɑ/ɑ:] 78% and for [ɔ/v:] 80%). These values are not very different from those found by Molbæk Hansen and myself for the lower sociolect. Probably the absolute values are also of importance for the impression of lengthening. Bundgaard's longest short vowels (before -b) are about 14 cs, ST's short [a] in [basə] has a duration of 21.6 cs and the [ɛ] [vegə] 21.8 cs. That is very much for a short vowel. Molbæk Hansen's informants reach similar values for open vowels (but before [l] the short [a] may reach similar durations, also in the Copenhagen Standard language). What is of more direct interest in this connection is, however, whether there is also a difference between mono- and disyllables in this sociolect. That cannot be seen in Molbæk Hansen's data. The differences for my informant ST are given in table I compared to the average differences of similar words for the main informants.

Table I

Differences in cs between vowel durations in disyllables and monosyllables for speaker ST (each average representing 8 tokens) compared to roughly comparable average differences for the main informants (see figure 1). (m) = medial position, (f) = final position.

ST		cs	main informants	
(m)	mad/madə	2.9	(m)	mad/madə 2.8
(m)	smɔd/mɔdɪ	5.9	(m)	nad/nadə 3.3
(f)	sdɔg/sdɔgɪ	4.3	(m)	p <sup>h</sup> ag/t <sup>h</sup> agəðə 4.2
(f)	veg/vegə	8.1	(m)	lag/lagə 3.2
(f)	bas/basə	4.0	(m)	bas/basə 2.1
(m)	sæn/sænɔ	2.0	(m)	sæn/sænɔ 1.9

All differences are significant. It appears from table I that ST has a clear difference between monosyllables and disyllables, showing that the lengthening in the lower Copenhagen sociolect is somewhat more pronounced in disyllables. Her absolute differences are somewhat larger than those of the main informants (particularly for [ɛg]). The percentual lengthening in disyllables is very variable since her vowel durations differ much. The average is 40.5%, which can be compared to the percentage of the main informants, which is 30.5, i.e. slightly lower. This means that an influence from the lower sociolect on the higher sociolect is not excluded, but it may, of course, be a parallel development. - ST had no loss of final [ə] except after [ŋ].

I have also made recordings of three dialect speakers in various parts of Zealand. The word pairs used were: [mad/madə], [sæn/sænɒ], [tʰag/tʰagə], [ˈlan, kʰɒd/ˈlanə, pla:yə], [bas/basə], [mis/misə] and [lasd/lasdə]. The first two pairs were placed medially and finally in short sentences, the third only medially, and the others only finally. The sentences were read six times each. This gave very diverging results.

KH (St. Havelse, 40 km Northwest of Copenhagen, has consistent apocope. He has no difference whatsoever between vowels in mono- and disyllables before obstruents. There was no difference in the following consonant either, except that the [s] of [bas] was longer than the [s] of [bas(ə)]. In the words with nasals, however, he had lengthening, in the former disyllables [kʰɒm(ə)] and [lan(ə)] both of the vowel and of the consonant, in [sænɒ] of the vowel only (with a non-significant shortening of the consonant). The lengthenings are quite appreciable here: [ɔ] 2.3 cs, [m] 2.8 cs (total lengthening 5.1 cs), [a] 3.7 cs, [n] 3.3 cs (total lengthening 7.0 cs). [sænɒ] has a lengthening of 3.7 cs of the vowel in final position and 2.3 cs in medial position. - This is more than for the other informants. The situation is reminiscent of the situation in Himmerland for the old generation, except that there is less evidence for the lengthening in the type [sænɒ]. Only one of Molbæk Hansen's informants had lengthening in [kʰanɒ] compared to [kʰan]. Molbæk Hansen has, however, found a tendency to lengthening of the vowel in other examples. He has himself a lengthening of the vowel in [kʰanɒ] but not in the former disyllable [kʰan(ə)]. - What may have happened in KH's dialect is that the apocope (or ə-assimilation) has come first; [ə] has been assimilated to the voiced sequence in [kʰɒmə] and [lanə] but has been lost without traces after obstruents. Then the vowel lengthening has reached the dialect, lengthening [sænɒ], and perhaps [kʰɒm(ə)] and [lan(ə)] still more, whereas the former disyllables of the type [basə] - which are now normal monosyllables - are not affected by the lengthening in open syllable.

A second informant was OR (from Bjeverskov, about 40 km South of Copenhagen). He had apocope (except in reading), and he showed a consistent though weak and non-significant tendency to lengthen the vowel in former disyllables but not in the

actual disyllable [sœnɐ]. The only significant vowel lengthening was in [lan(ə)] (3.7 cs). In the latter word as well as in [kʰɔm(ə)] he had a significant lengthening of the consonant.

Thus these recordings did not show any particular lengthening. However, in order to study the relations to Copenhagen speech, it might be more profitable to look at the dialects of North East Zealand. The problem is that the dialects in this area have almost disappeared. I had, however, an opportunity to make a recording in Dragør on Amager (which belongs to the specific coastal Øresund dialect area and is situated about 10 km from Copenhagen). The informant ET has still retained her dialect. She has very clear lengthening of vowels in disyllabic words: 8.4 cs in [madə] in final position, and 4.4 cs medially; 5.7 cs in [lanə], 2.2 cs in [misə], 2.3 cs in [basə] and 2.7 cs in [lasdə]. The lengthening is significant in all averages and more pronounced than in comparable words read by the main informants. She did not have any apocope. Since there was noise on the tape, the vowels before [g] and [n] could not always be measured exactly, but the lengthenings were obvious. I have also listened to a tape recording of continuous speech by the same speaker recorded by Jan Katlev. Here I was not always able to hear the lengthenings before obstruents, but before sonorants they were obvious, particularly in the case of [ɔ] and [ɛ]. In a number of cases I was inclined to identify them with normal, long vowels.

Since it turned out to be difficult to find informants, I listened to a number of older tape recordings of North Zealand dialects undertaken by the Institute of Danish Dialectology in Copenhagen. OA (Uvelse), EO (Tisvilde) and KP (Karlebo) had hardly any audible lengthenings. Their pronunciation was rather close to the standard language. LH (Snostrup) and NJ (Græse) had audible lengthening of short vowels in some disyllabic words, both with obstruents and sonorants, but there were also counterexamples. LH (Stenløse) had more consistent lengthening in disyllables (and not in monosyllables). I noticed six cases with obstruents and seven with sonorants (the recording was relatively short). In the case of sonorants either the vowel or the sonorant was lengthened. He had inconsistent apocope. Finally, KJ (Gilleleje) had very clear and consistent vowel lengthening in almost all disyllables (not in monosyllables). I listed about 25 examples and very few counterexamples. He did not have apocope (this may be a case of coastal dialect).

Although this material is very limited, I think that some preliminary conclusions can be drawn:

- 1) A number of dialect speakers, particularly in the North Eastern part of Zealand, have vowel lengthening in disyllabic words, and it is very probable that there is a connection between this lengthening and the lengthenings found in Copenhagen speech (both in the lower and in the higher sociolect).
- 2) The lengthening may be connected with the weakness of unstressed syllables in Danish (as argued above), but there is no evidence for any connection with the tendency to apocope.

On the contrary: KH, who had consistent apocope, did not have any lengthening in the words with obstruents which had undergone apocope, only in those that were still disyllabic. OR, who had normal, but not consistent apocope, had a slight lengthening. EP (Dragør) and KJ (Gilleleje), who had very clear lengthenings in open syllable, did not (KJ practically not) have apocope. Moreover, the main informants, who had vowel lengthening, did not use apocope in the recordings, although they read the sentences rather quickly, except now and then in the first member of compounds like [ma:læk<sup>h</sup>asə]. (However, in normal conversation they would often have cases of apocope. It is, e.g., quite common in my own conversational speech, also after obstruents.) The only exception was IE, who had consistent apocope in the recordings, even finally after obstruents. But that is evidently Jutlandish influence.

Thus, both the loss of final [ə] and the lengthening of vowels in open syllables may be connected with the weakness of the unstressed syllables (this is obvious for the apocope), but the two phenomena (apocope and lengthening) do not seem to be directly interconnected, at least not in Zealand.

(3) There is some evidence for a connection with the weakening of the following consonant: Danish intervocalic consonants are generally weak and short, and the lengthening seems to be particularly pronounced before [g], which has a very weak closure so that the delimitation often makes difficulties. Sometimes there is no closure at all. Molbæk Hansen's Copenhagen informants showed a particular tendency to lengthenings before [g]. The same was true of my Copenhagen informant ST (who, however, had very much lengthening before [s] as well). [-ag] has the largest difference in medial position for the main informants.

Now, if the vowel lengthening in open syllable is a specific North Zealand-Copenhagen feature, one may wonder why the informants NK, IE and BJ, who have an audible Funish and Jutlandish background, have exactly the same lengthenings as the other speakers. It might simply be because they have spent many years in Copenhagen, but the possibility cannot be excluded that the lengthening is supported by tendencies in the Funish and Jutlandish dialects. It has already been mentioned above that there are many types of lengthenings in different Jutlandish dialects.

In order to throw some light on this question, I made a number of recordings of Funish and Jutlandish dialect speakers who, as in the other cases, read small sentences containing the words to be compared in similar positions.

For the Funish speakers the results were rather heterogeneous. Table II gives a survey of the differences in vowel duration between monosyllables and disyllables for different speakers. [sæn/sænrɔ] occurred medially in the sentences, the other words finally.



Table II

Differences in vowel duration (in cs) between disyllables and monosyllables for Funish speakers.  
 - indicates shorter duration in disyllables, stars indicate that the difference is significant at the 1% level. The transcription is given in Standard Danish. Apocope is indicated by +ap. or -ap. for the individual speakers. D means "Dialect", RSD means "Regional Standard Danish".

	MA	LA	HV	IP	EK	EH	HC
	Frørup	Frørup	Haastrup	Vissen- bjerg	Odense	Odense	Odense/ Svendborg
	D	D	D	D	RSD	RSD	RSD
	+ap.	+ap.	+ap.	+ap.	-ap.	-ap.	-ap.
mad(ə)	0.1	0.8	1.7*	0.2	1.1	2.5*	1.9
mad							
snog(ə)	0.3	1.6	1.9*	1.5*	0.4	0.8	
snog							
k <sup>h</sup> ɛb(ə)	0.2	3.0*		2.7*			
k <sup>h</sup> ɛb							
t <sup>h</sup> og(ə)				-0.4			1.1
t <sup>h</sup> og							
soenɔ	0.1	0.7	1.0	1.8*	-0.3	0.8	0.5
soen							
k <sup>h</sup> ɔm(ə)	-2.0*	-1.7	1.4	4.1*	2.8*	0.8	
k <sup>h</sup> ɔm							
bas(ə)	0.9	4.3*	0.0	2.4*	2.3*	0.9	
bas							
lasd(ə)				2.0*			
lasd							

MA and LA are young dialect speakers from Frørup. Frørup lies just South of the boundary between East and South Funish, but as far as vowel durations is concerned it belongs to the Eastern Funish area described by Andersen (1958). As mentioned above, he found differences in vowel duration which were the exact opposite of what has been found in Zealand. Except for a small class of words with high vowels, disyllables had shorter vowels (and a higher tone) than monosyllables. This distinction has evidently not been retained in the youngest generation, except for [k<sup>h</sup>ɔm(ə)], where MA has a significant shortening of the vowel, and LA has a clear tendency to shortening. Apart from this word, MA (who has spent all his life in Frørup) has no difference at all, whereas LA, who has attended the secondary school in the neighbouring town and studied in Copenhagen for six years, has a consistent tendency to lengthening in disyllables, although generally with very small and non-significant differences except for [k<sup>h</sup>ɛb(ə)] and [bas(ə)] which have a significant lengthening of the vowel. These lengthenings are probably due to influence from the Copenhagen standard, particularly when her speech is compared with that of MA (her younger brother). Both speakers have apocope.

More interesting is the general tendency to vowel lengthening in disyllables found for the older genuine dialect speakers HV and IP. IP is from West Funen (Vissenbjerg), HV from the westernmost point of the East Funish dialect (Haastrup). They have spent all their life in their native villages, and it is not very probable that their vowel lengthenings should be due to influence from the standard language. The differences are significant in most cases for IP, but only in two cases for HV. Moreover, IP's lengthenings do not follow the general pattern. She has more lengthening before *s* and *n* than before *d* and *g*, whereas the main informants had the opposite distribution. IP has apocope, whereas HV used full forms.

The remaining three informants, EK, EH and HC, are all from Odense (the main town on Funen) and speak urban dialect very close to the regional standard language (RSD). HC has spent the first part of his life in Svendborg on South Funen and has no *stød*. The other two have spent almost all their life in Odense and were described to me as typical Odense speakers. They all have a weak, and rarely significant tendency to lengthening in disyllables, which may be due to influence from Standard Copenhagen speech, but which may also, particularly in view of the lengthenings found for the dialect speakers HV and IP, be an independent tendency. - In any case, it is possible that the speaker NK, who is from Odense, has had some tendency to lengthenings before he came to Copenhagen.

The four dialect speakers have consistent apocope, whereas the urban speakers did not have apocope. As for the following consonants, their duration is very irregular, the only consistent feature being that the four dialect speakers have a considerable lengthening of the [m] in the former disyllable [k<sup>h</sup>ɔm(ə)] (4.5 - 7.2 cs). For the other three speakers [m] could not be measured exactly. The informants from Odense, who did not have

apocope, had a large difference in the [s] of [bas/basə] which was utterance final in [bas]. The dialect speakers with apocope had a long [s] in both cases.

For the Jutlandish speakers a survey of differences in vowel duration is given in table III. All test words were placed medially in the sentence in this case. ([dan] and [danə] were said in the compounds ['dan,fɔs] and ['danə,bro:ʔy]. The word [basə] turned out not to be a dialect word and was not read by all informants.)

LH is from Århus, the main town in Jutland, and speaks the regional standard Danish (RSD). She was described to me as a typical Århus speaker. She has consistent and significant vowel lengthening in all disyllables of the type CVCə (with the exception that it is not significant in [basə]). She has non-significant lengthening in [dansə] and none in [lasdə]. This is in complete agreement with what was found for the main informants, of which five cannot have been influenced by a possible Jutlandish standard. LH's lengthenings can hardly be due to the situation in the surrounding East Jutlandish dialects since there is merger in all cases in these dialects. And an allophonic difference is not very probable when all types without stød have merged, also the words with sonorants. (By mistake I did not make any recording of East Jutlandish dialects.) It is therefore very probable that the Århus standard is influenced by the Copenhagen standard on this point. The Copenhagen standard is now spreading rapidly (Brink and Lund 1975).

The other five speakers are bilingual. They speak both dialect and standard Danish. Except for BT they keep the tonal pattern of their dialect unchanged when speaking standard Danish. PN speaks Northern Jutlandish dialect (he is from Vendsyssel), the others speak Western Jutlandish. TA is from Thy, EA from Mors, and JD from Fjends Herred, just South of Salling. They have West Jutland stød in [tʰa?gɔ] and in the former disyllables [tʰa?g] and [ma?d]. All have consistent apocope in their dialect, but not syncope in [danəbroʔy]. I had expected BT to speak Eastern Jutlandish, but she turned out to come from the West Jutlandish area, just beyond the dialect boundary between East- and West-Jutlandish. Whereas the others speak rural dialects, she speaks an urban dialect, which is influenced from the standard language on various points. She has learnt her standard Danish (SD) from non-Jutlandish teachers and friends and, in contradistinction to the others, she keeps dialect and SD completely apart as far as the tonal movement is concerned.

A glance at the RSD (Regional Standard Danish) columns in the table shows that all have (generally significant) vowel lengthening in the CVCə type with very few exceptions (TA has no lengthening in [sɔ:ɔ] and [danə], BT not in [basə] and [basɔ]). There is generally no lengthening in the CVCCə type. PN has

Table III

Difference in vowel duration (in cs) between disyllables and monosyllables for Jutlandish speakers. - indicates shorter duration in disyllables, stars indicate significance at the 1% level. The transcription is given in Standard Danish. Apocope is indicated by +ap. or -ap. for the individual speakers. D means "Dialect", RSD means "Regional Standard Danish". Speakers are indicated by initials.

	LH		BT		TA		EA		JD		PN	
	Århus RSD		UIDum D	SD	Thy D	RSD	Mors D	RSD	Fjends D	Herrød RSD	Vendsyssel D	RSD
mad(ə) mad	-ap.		+ap.	-ap.	+ap.	-ap.	+ap.	-ap.	+ap.	-ap.	+ap.	-ap.
	3.3*	0.4	3.4*	0.1	0.8		-2.4*	1.2	0.3	3.5*	5.8*	2.6
t <sup>h</sup> ag(ə) t <sup>h</sup> ag	2.5*	1.9*	5.4*	0.2	2.7*		-0.8	6.0*	0.2	4.6*	5.0*	3.1
t <sup>h</sup> agto t <sup>h</sup> ag	3.0*	3.5*	2.4*	2.2*	2.2*		2.3*	3.0*	1.5	4.1*	3.0*	4.3
sænto sæn	1.8*	0.6	1.5*	0.5	0.0		2.8*	2.5*	3.9*	1.8*	0.4	1.4
k <sup>h</sup> om(ə) k <sup>h</sup> om	1.9*	1.5*	1.3	2.1*	1.9*		1.6*	3.4*	2.3*	6.3*	5.0*	4.1
danø dan-	1.6*	0.8	1.2*	0.4	-0.6		-0.5	1.2	3.2*	2.7*	2.8*	3.1
dans(ə) danʔs	1.8	0.6	2.2*	-0.1	0.5		0.8	1.4*	-0.2	-0.1		
bas(ə) bas	1.8	0.5	0.1		-1.8*		1.7					
baso bas	1.2*	1.3	-0.5	-0.4	2.3*							
lasd(ə) lasd	-0.7	-0.6	-0.6	6.0*	0.8		0.3	-0.6	0.2	0.6	5.4*	0.4

only made four recordings of the RSD words. That is why the differences are not significant at the 1% level, but he has no overlapping between mono- and disyllables. For the other informants six examples of each word have been measured.

A comparison between the lengthening in the dialect and the RSD of the informants shows some interesting differences. PN has vowel lengthening in old disyllables with apocope, as should be expected for his Vendsyssel dialect. The lengthening before sonorant in [k<sup>h</sup>ɔmə] is not in agreement with Jensen's description of the dialect (1897-1903) but, as pointed out to me by the specialists in Århus, Jensen had been led astray by Marius Kristensen's theories on this point (PN should not, however, have long vowel in [t<sup>h</sup>agɔ]. This must be an analogy from the infinitive [t<sup>h</sup>agə] (dial. [t<sup>h</sup>a:g])). One should thus expect agreement between PN's dialect and his RSD in most of the words. It is, however, worth while noticing that he does not transfer his dialectal (phonological) lengthening in the old disyllable [lasdə], nor his dialectal lack of (allophonic) lengthening in [sænɔ] to his RSD speech. TA, EA and JD have no lengthening in their dialect in vowels before stops (which have West Jutland stød), except for [t<sup>h</sup>agɔ], but they do have lengthening in the corresponding words in their RSD (BT also has lengthening in [t<sup>h</sup>agə] in her dialect). TA, who has lengthening in the old disyllable [lasdə] in his Thy dialect, as should be expected, does not transfer this lengthening to his RSD.

Finally it can be stated that there is no general vowel lengthening in actual disyllables in the dialects (except for JD). TA, PN and BT have no significant lengthening in [sænɔ], TA and EA have no lengthening in [danə]. All have, however, a longer vowel in [t<sup>h</sup>agɔ] than in [t<sup>h</sup>ag]. This may be due to the weakness of the medial [g]. It is, however, of some interest to notice that BT, TA, EA and JD have a longer [a] in [t<sup>h</sup>agɔ] (i.e. [t<sup>h</sup>a?gɔ]) than in [t<sup>h</sup>agə] (i.e. [t<sup>h</sup>a?g]) in their dialect, whereas the relation is reversed in their RSD, in agreement with the relations in the Copenhagen standard.

It is thus very clear that the speakers do not simply transfer their dialectal lengthenings or lack of lengthening to their RSD speech. Their RSD is a different norm, which is in accordance with the Århus RSD of LH and which was found to be very close to and probably in general influenced by the Copenhagen standard. The lengthenings found in the speech of the main informants IE and BJ from Jutland may thus simply come from their Jutlandish RSD, only enhanced by their stay in Copenhagen.

As for the following consonant, LH has shortening in disyllables in accordance with the Copenhagen standard, and the same is true in almost all cases of the RSD of the other speakers. In the dialect recordings it was very often impossible to measure the duration of the consonant after West Jutland stød, because the stop is unaspirated and sometimes not exploded, and as for [g] in [t<sup>h</sup>a?g] it was sometimes replaced by a creaky voice

stød. The [n] of [sœnɔ] and the [n] of [danə] were shortened. The [m] of [k<sup>h</sup>ɔm] could not always be measured. It was somewhat lengthened by PN, TA and EA in the disyllable, but not by JD. The vowel was always lengthened.

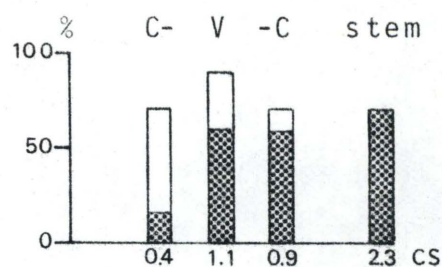
The final problem raised was whether there could be any connection between the lengthening in open syllable and the particular North Zealand and Copenhagen pitch contour. In Copenhagen ASC the stressed syllable has a relatively low pitch followed by a jump or glide up to the first posttonic syllable, with the following unstressed syllables moving gradually down to the next stressed syllable. This has been thoroughly investigated and described by Thorsen (e.g. 1980). And the higher pitch on the unstressed syllables has also been observed for the dialects of North Zealand. It is mentioned by Andersen (1954) and discussed in detail by Kroman (1947). This contour seems to be relatively recent in the higher sociolect of Copenhagen. It is not mentioned by Jespersen (1897-99 and later), nor by Bo (1933). Arnholtz (1939-40) mentions it as a recent development (I have, however, heard this contour used regularly by Copenhagen standard speakers born in the eighties of the last century). All main informants of this investigation have this pitch contour (although the speakers from Funen and Jutland, IE, BJ, NK (and partly OT) do not use it in compounds). The same is true of the Copenhagen speaker ST and of the Zealandish dialect speakers who had general vowel lengthening in disyllables, as well as the Jutlandish speaker BT. It is not generally so that the pitch movement in the stressed syllable is particularly extensive; it may be rather level, but the preparation of the jump up might be expected to require some time. However, the vowel lengthening is just as consistent in the RSD of the Jutlandish speakers, and apart from BT they all have the normal Jutlandish pitch contour with high (generally) rising pitch on the stressed syllable and low falling pitch on the following unstressed syllables (see Thorsen and Jul Nielsen (1982) for a preliminary investigation); and BT, who has the Copenhagen contour in her RSD and the Jutlandish contour in her dialect, does not generally have more lengthening in her RSD than in her dialect. The speaker KH (Zealand) who had vowel lengthening in actual disyllables had a pitch contour corresponding to the one found for the Jutlandish speakers. There is thus no necessary causal relation between the two phenomena.

### C. FINAL LENGTHENING

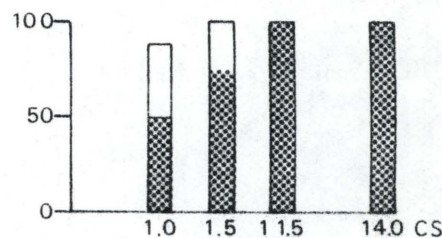
A number of words were placed both in final and medial position in the utterance, in most cases finally and medially in the frames [han sa:] and [han sa: ... t<sup>h</sup>o? gaŋə], some also in small sentences. Frames and sentences are not distinguished in the survey given in this section, since the differences were small. They will be compared in section D. A survey of the results is given in figure 4.

A. Monosyllables

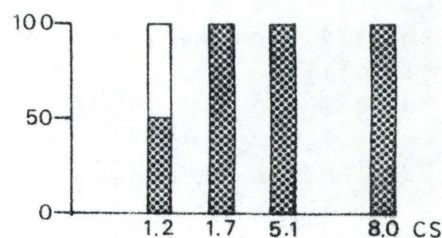
<sup>1</sup>CV+stop N=10  
 nad(5) lag(1)  
 lad(1)  
 mu<sup>1</sup>lad(1) p<sup>ho</sup>lag(1)



<sup>1</sup>CV+s N=8  
 bas(7)  
 mis(1)



<sup>1</sup>CV+sd N=4  
 basd(4)



<sup>1</sup>CV+nas. N=14  
 sœn(7)  
 dan(6)  
 man(1)

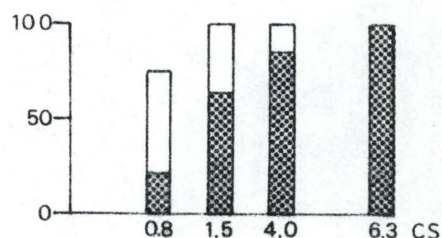
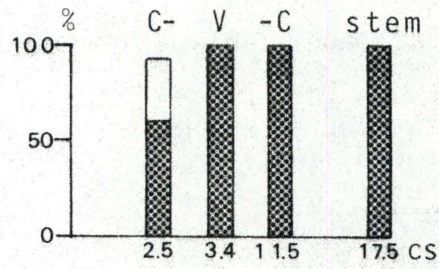


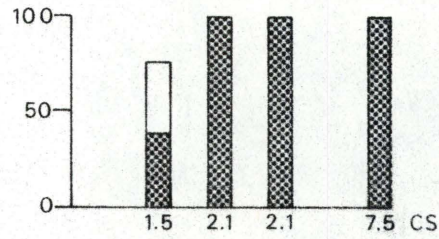
Figure 4

Duration of different word types in utterance final and medial position. The numbers in parenthesis after the single words indicate the number of pairs of averages. (The following sounds could not be delimited: the initial [s] of [sœn(v)] (6 averages), the [a:ʔ] and [n] of [p̄la:ʔn(v)] (2 averages), and [l] and [ə] of [ma:lə] (2 averages). N should be reduced accordingly for these sounds; in these cases the difference for the stem is not = the sum of the differences for the individual sounds.) The columns indicate the percentage of averages in which there is lengthening in final position (C- (initial consonant(s)), V (vowel), -C (final consonant(s)), and stem). The hatched area is the percentage of significant differences. The average difference in cs is given below each column.

<sup>1</sup>CV: ?+s            N=15  
 la: ?s(1)  
 k<sup>h</sup>a<sup>1</sup> la: ?s(1)  
 sbi: ?s(12)  
 be<sup>1</sup> sbi: ?s(1)

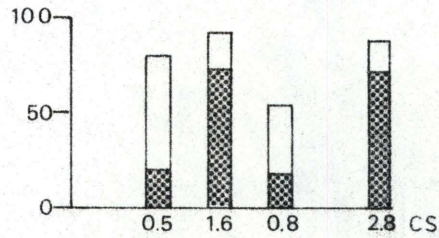


<sup>1</sup>CCV: ?+n            N=8  
 pla: ?n(8)

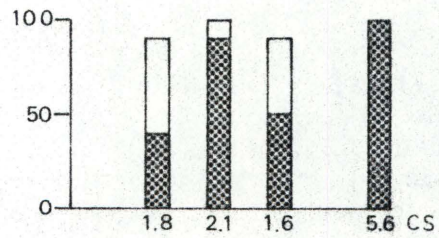


B. Disyllables

<sup>1</sup>CVC(C)ə/v            N=26  
<sup>1</sup>nadə(4)            <sup>1</sup>sænrə(7)            <sup>1</sup>mi sə(1)  
<sup>1</sup>ladə(1)            <sup>1</sup>danə(3)            <sup>1</sup>basdə(4)  
 mu<sup>1</sup>ladə(1)            <sup>1</sup>manə(1)  
<sup>1</sup>lagə(1)            <sup>1</sup>mana(1)  
 p<sup>h</sup>o<sup>1</sup>lagə(1)            <sup>1</sup>mansə(1)



<sup>1</sup>CV: ?səp            N=10  
 k<sup>h</sup>a<sup>1</sup> la: ?səp(1)  
<sup>1</sup>sbi: ?səp(8)  
 be<sup>1</sup> sbi: ?səp(1)



<sup>1</sup>CCV: ?nəp            N=8  
<sup>1</sup>pla: ?nəp(8)

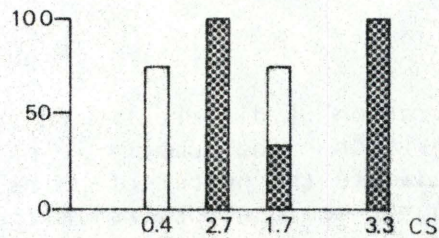
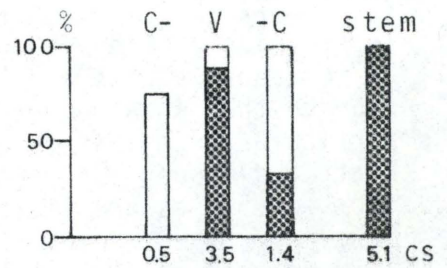


Figure 4, continued

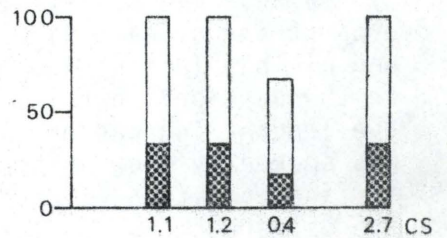


<sup>1</sup>CV:Cə N=8  
<sup>1</sup>ma:lə(4)  
<sup>1</sup>ma:sə(4)

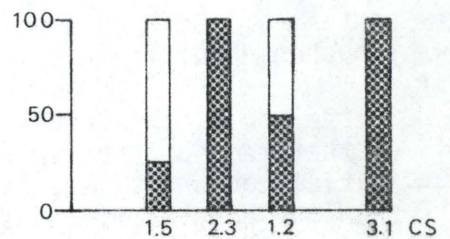


C. Trisyllables

<sup>1</sup>CVC(C)əCə N=7  
<sup>1</sup>sænɒnə(4)  
<sup>1</sup>lɑgəðə(1)  
<sup>1</sup>mi səðə(1)  
<sup>1</sup>basðəðə(1)

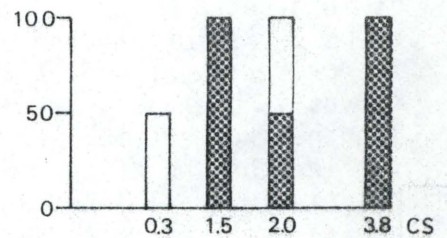


<sup>1</sup>CCV: ?nɒCə N=4  
<sup>1</sup>plə ?nɒnə(4)



D. Derivatives

<sup>1</sup>CVCl i N=4  
<sup>1</sup>nadli(1)  
<sup>1</sup>sənli(1)  
<sup>1</sup>manli(1)  
<sup>1</sup>misli(1)



E. Compounds

<sup>1</sup>CVC- N=7  
<sup>1</sup>CVCə-  
<sup>1</sup>nad | pʰɔdə(1) | nadə | frɔsd(1)  
<sup>1</sup>lɑg | fa:və(1) | manə | fal?(1)  
<sup>1</sup>man | fɔlg(1) | misə | kʰad(1)  
<sup>1</sup>mis | lyð?(1)

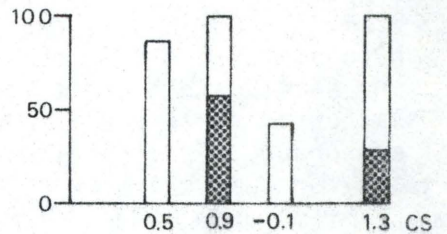


Figure 4, continued

It appears clearly from the figure that Danish does have final lengthening. However, the lengthening of the vowel (about 1.5 cs for short vowels and 3.5 cs for long vowels) is less pronounced than in a number of examples from other languages, particularly English (see, e.g., Lehiste 1972, Oller 1973, Klatt and Cooper 1975, Cooper and Danly 1981), where differences of 5-8 cs are frequent.

As mentioned in section I, Holtse (1977) did not find any difference in recordings of his own speech. His words [lɛs] and [lɛ:sə] can be compared to the words [bas] and [ma:sə] of the present investigation. [bas] was spoken by seven subjects, and all had lengthening of the vowel in final position (1.5 cs on the average), but for two subjects, one of them PH (Holtse), the lengthening was only 0.8 cs and non-significant. [ma:sə] was spoken by four subjects. All had lengthening of the vowel in final position (3.6 cs on the average). For one subject the difference was non-significant, but PH had a significant lengthening of 2.4 cs. In his own experiment Holtse seems to have spoken very quickly and with almost no pause between the sentences. Both he and the other subjects have a considerable lengthening of final [s].

On the whole, the lengthening is distributed over all sounds of the stem, but the vowel is always lengthened more than the initial consonant, and in polysyllables it is lengthened more than the postvocalic consonant (the only exceptions are the derivatives in [-li], where particularly [n] is lengthened before the voiced [l]). In monosyllables the final consonant is lengthened more than the vowel, this is particularly true of [s]. As for [n] the indications in the figure are based on the criterion of end of voicing. If drop of the intensity curves is used as a criterion, only 50% of the examples have lengthening, and the average is only 0.8 cs instead of 4.0; the lengthening of the stem is reduced correspondingly. The relatively small lengthening of final stops (0.9 cs) is partly due to the fact that most examples were only spoken by one subject (EF) who used the frame [han sa: ... 'ʔe:ʔn 'gɑŋʔ] for words ending in stops, whereas the others used [han sa: ... 'femʔ 'gɑŋə] in this case. The word [ʔe:ʔn] starting with a hard attack has evidently caused a lengthening of the preceding stop so that the final consonant of the word in medial position in the frame is almost as long as the utterance final consonant. For the other subjects, the difference is 1.5 cs, and for some extra examples spoken by EF in the frame [han sa: ... femʔ gɑŋə] the difference is of the same order.

In disyllables the final [ə] is also lengthened. It has not been included in the survey because of the problematic delimitation. When the criterion for the end of the vowel is end of voicing the difference will be 3-4 cs, when the criterion is drop of the intensity curves it will be only 1 cs, or even less.

It might be hypothesized that the difference in duration between words in the frame *han sagde ...* and in the frame *han sagde ... to gange* might be due to the length of the frame and

not to the final vs. medial position of the test word (cp. that Lehiste (1980a) found a difference in the duration of the test word according to the length of the frame). But this explanation cannot be applied to the words *søn*, *sønner*, *sønnerne* and *plan*, *planer*, *planerne*, which were placed in sentences of the type *han så sin søn* - *hans søn kommer* and *man frømmer hans plan* - *hans plan frømmes*. And in these sentences, which were spoken by 3 and 4 subjects, respectively, the differences were at least as great as in the examples in frame sentences.

The finding mentioned in section I, viz. that it does not matter whether one or two stressed words are added (cp. Lindblom et al. 1976 and Kohler et al. 1982), was confirmed by the sentences *han lod Spies rejse* 'he let Spies go' and *han lod Spies rejse sagen* 'he let Spies bring the matter up', spoken by one subject. All the segments of *Spies*, [s b i: s], have almost exactly the same length in the two sentences. However, the words *bast*, *baste* and *bastede* placed in the frames *han sagde ... fem gange* and *han sagde ... igen* were shorter in the first frame, and the difference was significant for *bast* and *baste*. The difference was mainly in the *s*, and in *bast* the shortening might be due to the three-consonant group *stf*, but this explanation cannot be applied to *baste*.

#### D. SYNTACTIC BOUNDARIES AND WORD BOUNDARIES

The sentences were not constructed specifically for the investigation of syntactic boundaries, but a few sentences can be compared from this point of view. The boundary between the test word and the following adverbial of the frame (*two (five) times*) may be expected to be more pronounced than the boundary between subject and verb in the sentence. This expectation is borne out by the measurements. The word *Spies* in *han sagde Spies to gange* is significantly longer than *Spies* in the sentence *mon Spies kommer?* ('I wonder whether Spies is coming?') for all three subjects (3.2 cs), and it is significantly longer for one of the three subjects than in *mon Spies betaler?* ('I wonder whether Spies will pay'). For one subject it was possible to compare *han sagde Spies to gange* with *han lod Spies rejse* ('he let Spies go'). Again, there was a significant difference (1.6 cs). - Moreover, the word *spiser* ('eats') was significantly longer for three subjects in *han sagde spiser to gange* compared to *han spiser bøffen* ('he eats the beefsteak') (3.9 cs). - In all cases the words *spis* and *spiser* were still longer in utterance final position, so that three steps of duration according to sentence structure can be observed.

A larger number of examples were constructed with the purpose of comparing the importance of the word unit with the rhythmic foot. However, Danish is not well suited for this purpose. In English you might ask whether *stick* is shortened more in *a sticky surface* than in *the stick is broken*, but in Danish the former word type ('(C)CVCV) has lengthening of the vowel (see section IV A). One may, however, ask whether this lengthening

is confined to the word. For this purpose a comparison was undertaken between the sentences *hans søn er kómmet* [hans 'sœn ə 'kʰɔmɛð] 'his son has arrived' and *hans sønner kómmet* [hans 'sœnɔ 'kʰɔmʔɔ] 'his sons arrive'. In the sentences *hans søn kómmet* and *hans sønner kómmet* the vowel of *søn* had been found to be significantly shorter than the vowel of *sønner* (1.7 cs). But in *søn er ..* [sœn ə] vs. *sønner* [sœnɔ] the difference is reduced to 0.5 cs for the same four subjects, and it is not significant (in another recording by one subject it is 0.9 cs). Thus there seems to have been influence across the word boundary. However, in a different pair: *mon min læk er for týnd?* [mon min 'læɡ ə fɔ 'tʰɔnʔ] 'I wonder whether my varnish is too fluid' and *han vil lække sit bræv* [han ve 'læɡə sid 'bæʔy] 'he will seal his letter' the difference was preserved. In the sentences *han sagde læk tó gånge* and *han sagde lække tó gånge* the [a] of *lække* had been found to be 4.4 cs longer than the [a] of *læk* for one subject. The same subject had a difference of 3.0 cs in the two sentences with *læk er* [læɡ ə] and *lække* [læɡə], and four subjects all had a significant difference (3.3 cs). Thus, although a certain influence across the word boundary can be observed, this boundary is not irrelevant.

In order to see whether shortenings of Danish words are more pronounced when a following weak syllable belongs to the word itself or not, one must compare disyllables and trisyllables or words with *stød*. The trouble is that in these cases the shortenings are not consistent medially in the sentence. There is no consistent difference between the durations of the vowel [œ] in *hans sønner kómmet* and *hans sønner betáler* nor between *hans sønner kómmet* and *mon sønnerne kómmet*. Therefore one does not find any difference either between *hans sønner betáler* and *mon sønnerne kómmet*.

For the word [sbi:ʔs] there is a significant shortening (for all four subjects) both when a syllable is added to the word (*mon Spies kómmet* vs. *han spiser bøffen*) and when it belongs to the following word (*mon Spies kómmet* - *mon Spies betáler*), but two subjects have a greater difference in the first case, and two in the second case.

In the pairs *hans pláner frémnes* vs. *plánerne frémnes* and *hans pláner frémnes* vs. *hans pláner forkástes* one subject similarly had a difference in both pairs, but of the same magnitude, so that there was no clear difference between *hans pláner forkástes* and *mon plánerne frémnes*. The others had no clear differences at all.

In the sentences *hans plán frémnes* vs. *hans pláner frémnes* and *hans plán frémnes* vs. *hans plán forkástes* three subjects had more shortening in the second pair, thus more shortening in *plán forkástes* than in *pláner frémnes*, i.e. more shortening when the weak syllable belonged to the following word.

Thus these examples do not support the assumption that there is more shortening within the word.

Finally one can investigate whether the addition of more heavy syllables shorten the stem more when they belong to the same word (e.g. in compounds) than when they are separate words. As mentioned in section IVA the first member of a compound is shortened compared to the simplex when they stand in the same frame, e.g. *han sagde m lekassee t  g nge* vs. *han sagde m le t  g nge*. Four subjects had a significant shortening of both the vowel (2.7 cs) and the whole first member of the compound (*m le* 4.2 cs) compared to the simplex *m le*. (Similar shortenings were found in four other compounds with disyllabic first member, whereas the shortening is less pronounced in monosyllabic first members.) However, when the words are placed in sentences of equal length: *han vil m le k ssen nu* [han ve 'ma:l  'khasn 'nu] 'he will paint the box now' vs. *han tog m lekassen med* [han t'ho 'ma:l ,khasn 'með] 'he took the painting box along', then the shortening of the [a:] in the compound is only 0.5 cs and the shortening of the first member is only 1.5 cs, the differences being significant for only 2 of 7 subjects. Similarly, in the sentences *hendes g s br nder d rligt* [hen s 'gas 'b  n?n 'd :lid] 'her gas burns badly' and *hendes g sbr nder s der* [hen s 'gas, b  n?n 'so:ðn] 'her gas jet is sooty' there is only a very small and non-significant shortening of the first member of the compound. These sentences were spoken by 4 subjects. Four similar pairs of sentences spoken by one of the subjects who had shortening in *m lekassee* showed no shortening of the vowel in the first part of the compound, but in three cases this subject had some shortening of the first member as a whole.

This probably means that the sentence length or the length of the foot ([ 'ma:l ,khas ] vs. [ma:l ]) in the frame sentences has had more influence than the word unit.

## V. CONCLUSIONS

The following conclusions can be drawn from the Danish material presented here:

- (1) Shortening of stressed vowels according to the number of following syllables in the word is not a universal. It is not valid for Danish disyllables of the type CVC , which, on the contrary, have a significant lengthening of the vowel compared to the corresponding monosyllabic words. This lengthening is also found medially in sentences and in first members of compounds, but the first member of compounds is somewhat shortened compared to a simplex word in the same frame. Trisyllabic words of the type CVCVC  have a slight shortening of the stressed vowel compared to disyllables. Vowels in words of the type CVCC  (*danse*) are only slightly lengthened. There is no lengthening of vowels with st d. It is the syllabic type which is decisive. The postvocalic consonant in the words of the type CVC  is, however, shortened compared to the monosyllabic words. Not a single standard or dialectal speaker had longer vowels in monosyllables with short vowel.

The vowel lengthening in disyllables seems to have originated in the North Eastern dialects of Zealand close to Copenhagen. It is argued that there is no connection between this lengthening and the tendency to apocope. Nor is there any evidence for a causal relation between the lengthening and the specific North Zealand-Copenhagen pitch contour, although it is an attractive hypothesis. But it is probable that there is a connection with the weakness of Danish unstressed syllables including the intervocalic consonants. It may thus be considered as a lengthening in open syllable like the old medieval vowel lengthening. A tendency to lengthening was found in a West Funish dialect, though not consistently, and there was a slight tendency in the Odense regional standard. The Jutlandish dialects were not found to have general lengthening of vowels in CVCə disyllables; but there was lengthening in all the West- and North-Jutlandish dialects investigated, in the word [tʰ<sub>o</sub>gɔ] (before the weak consonant [g]) and in the apocopated originally disyllabic word [kʰ<sub>o</sub>m(ə)]. The Jutlandish regional standard language, however, has consistent lengthening. This is probably due to the rapidly increasing influence from the Copenhagen Standard language.

- (2) Danish has final lengthening, i.e. lengthening of utterance final words of at least one to three syllables. The lengthening is distributed over the segments, but is more pronounced in the vowel than in the initial consonant. Final consonants in monosyllables, particularly the consonant *s*, may be lengthened considerably. In polysyllables the postvocalic consonant is less lengthened than the vowel. The lengthening is significant but of less magnitude than in English, generally from 1 to 3 cs for the vowel.
- (3) There are also examples of 'phrase final lengthening', i.e. different durations according to the syntactic break.
- (4) There is very little evidence that word boundaries play a role except for the lengthening of short vowels in disyllables.

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## REFERENCES

- Abrahams, H. 1960: "Kvantitet ved vestjysk stød", *Sprog og Kultur* 22, p. 105-111
- Äimä, F. 1918: *Phonetik und Lautlehre des Inarilappischen II*, *Mémoires de la Société Finno-ougrienne* 43
- Andersen, P. 1947: Review of Kroman, *Danske Folkemaal* 15, p. 102-113
- Andersen, P. 1954: "Dansk Fonetik", *Nordisk Lærebog for Talepædagoger I*, p. 308-353
- Andersen, P. 1958: *Fonemsystemet i østfynsk* (Copenhagen)
- Arnholtz, A. 1939-40: "Talekunstens og talelærens udvikling og stilling i Danmark", *Nordisk Tidsskrift for Tale og Stemme* 4, p. 82-98
- Bannert, R. 1982a: "An Fo-dependent model for duration?", *Reports from Uppsala University, Department of Linguistics* 8, p. 58-80
- Bannert, R. 1982b: "Temporal and tonal control in German", *Working Papers* 22, Lund, p. 1-26
- Bjerrum, M. 1948: *Felstedmaalets tonale Accenter*. *Humanistiske Studier III*, (Århus)
- Bo, A. 1933: *Tonegangen i Dansk Rigsmål*. *Studier fra Sprog- og Oldtidsforskning* Nr. 164
- Brink, L. and Lund, J. 1975: *Dansk rigsmål 1-2* (Copenhagen)

- Bundgaard, M. 1980: "An acoustic investigation of intrinsic vowel duration in Danish", *Ann. Rep. Inst. Phon. Univ. Copenhagen* 14, p. 99-120
- Carlson, R., Granström, B., Lindblom, B. and Rapp, K. 1972: "Some timing and fundamental frequency characteristics of Swedish sentences: Data, rules, and a perceptual evaluation", *Speech Transm. Lab., Quart. Prog. and Status Rep., Royal Inst. Techn. Stockholm* 4, p. 11-19
- Chlumský, N. 1928: *Česká kvantita melodie a přízvuk* (French summary: La quantité, la mélodie et l'accent d'intensité en tchèque) (Prague)
- Cooper, W.E. and Danly, M. 1981: "Segmental and temporal aspects of utterance-final lengthening", *Phonetica* 38, p. 106-115
- Donovan, A. and Darwin, C.J. 1979: "The perceived rhythm of speech", *Proc. 9th Int. Congr. Phon. Sc., vol. II*, p. 268-274
- Ejskjær, I. 1954: *Brøndum-målet, Udvalg for Folkemaals Publikationer, Serie A, Nr. 10*, (Copenhagen)
- Ejskjær, I. 1970: *Fonemsystemet i østsjællandsk*, (Copenhagen)
- Elert, C.C. 1964: *Phonologic studies of quantity in Swedish*, (Stockholm: Almqvist & Wiksell)
- Espegaard, A. 1972-74: *Vendsysselsk Ordbog*, (Hjørring)
- Fischer-Jørgensen, E. 1955: "Om vokallængde i dansk rigsmål", *Nordisk Tidsskrift for Tale og Stemme* 15, p. 33-56
- Fischer-Jørgensen, E. 1964: "Sound duration and place of articulation", *Zeitschrift für Phonetik, Sprachwissenschaft und Kommunikationsforschung* 17, p. 175-207
- Hansen, Aa. 1956: *Udtalen i moderne dansk*, (Copenhagen)
- Hansen, Aa. 1962: *Den lydlige udvikling i dansk. I. Vokalismen* (Copenhagen)
- Hansen, P. Molbæk 1980: *Længdeforhold i himmerlandske en- og tostavelsesord*, (unpublished manuscript)
- Harris, M.S. and Umeda, N. 1974: "Effect of speaking mode on temporal factors in speech: Vowel duration", *J. Acoust. Soc. Am.* 56, p. 1116-1118
- Holtse, P. 1977: *Variationer i vokallængde på dansk*, Unpublished Prize Essay, University of Copenhagen
- Høysgaard, J. 1747: *Accentuered og Raisonnered Grammatica* (Copenhagen)



- Iivonen, A. 1974: "On the dependency of sound duration on word length in isolated words", (English summary of Finnish paper) (*Virittäjä*), p. 150-151
- Jacobsen, P. 1929: *Mundarten i Flemløse sogn* (ed.: Andersen, P.) (Copenhagen)
- Jensen, E. 1944: *Houlbjergmålet, Udvalg for Folkemaals Publikationer, Serie A, Nr. 6* (Copenhagen)
- Jensen, J.M. 1897-1903: *Et Vendelbomåls lyd- og formlære, Universitets-Jubilæets danske Samfund*, (Copenhagen)
- Jespersen, O. 1897-99: *Fonetik*, (Copenhagen)
- Jespersen, O. 1914: *Lehrbuch der Phonetik*, (Leipzig)
- Jespersen, O. 1922: *Modersmålets fonetik* (2nd edition), (Copenhagen)
- Klatt, D.H. 1973: "Interaction between two factors that influence vowel duration", *J. Acoust. Soc. Am.* 54, p. 1102-1104
- Klatt, D.H. 1975: "Vowel lengthening is syntactically determined in a connected discourse", *J. Phonetics* 3, p. 139-140
- Klatt, D.H. and Cooper, W.A. 1975: "Perception of segment duration in sentence context", *Structure and Process in Speech Perception* (eds.: Cohen, A. and Nooteboom, S.), p. 69-89
- Klatt, D.H. 1976: "Linguistic uses of segmental duration in English: Acoustic and perceptual evidence", *J. Acoust. Soc. Am.* 59, p. 1208-1221
- Kohler, K.J., Krützmann, U., Reetz, H. and Timmermann, G. 1982: "Sprachliche Determinanten der signal-phonetischen Dauer", *Arbeitsberichte 17, Institut für Phonetik, Universität Kiel*, p. 1-48
- Kroman, E. 1947: *Musikalsk Akcent i Dansk*, (Copenhagen)
- Larsen, J. 1971: "Det sjællandske tostavellesord", *Studier i dansk dialektologi og sproghistorie*, p. 193-206
- Lehiste, I. 1970: *Suprasegmentals*, (Cambridge, Mass.)
- Lehiste, I. 1971: "Temporal organization of spoken language", *Form and Substance* (eds.: Hammerich, L., Jakobson, R. and Zwirner, E.) (Copenhagen)
- Lehiste, I. 1972: "The timing of utterances and linguistic boundaries", *J. Acoust. Soc. Am.* 51, p. 2018-2024

- Lehiste, I. 1973: "Rhythmic units and syntactic units in production and perception", *J. Acoust. Soc. Am.* 54, p. 1228-1234
- Lehiste, I. 1975: "Some factors affecting the duration of syllabic nuclei in English", *Proc. 1st Salzburg Conf. on Ling.*, (ed.: Drachmann, G.), p. 81-104
- Lehiste, I., Olive, J.P. and Streeter, L.A. 1976: "The role of duration in disambiguating syntactically ambiguous sentences", *J. Acoust. Soc. Am.* 60, p. 1199-1202
- Lehiste, I. 1977: "Isochrony reconsidered", *J. Phonetics* 5, p. 253-263
- Lehiste, I. 1980a: "Interaction between test word duration and length of utterance", *The Melody of Language*, (eds.: Waugh and Schooneveld) (Baltimore), p. 169-176
- Lehiste, I. 1980b: "Phonetic manifestation of syntactic structure in English", *Ann. Bull. Res. Inst. Logopedics and Phoniatrics, Tokyo* 14, p. 1-27
- Lehiste, I. 1982: "The role of prosody in the internal structure of a sentence", ms. to be published in *Proc. 13th Int. Congr. Ling.* (Tokyo)
- Lehtonen, J. 1974: "Word length and sound durations", English summary of Finnish paper (Virittäjä), p. 160
- Lindblom, B.E.F. 1968: "Temporal organization of syllable production", *Speech Transm. Lab., Quart. Prog. and Status Rep., Royal Inst. Techn. Stockholm* 2-3, p. 1-5
- Lindblom, B. and Rapp, K. 1971: "Reexamining the compensatory adjustment of vowel duration in Swedish words", *Speech Transm. Lab., Quart. Prog. and Status Rep., Royal Inst. Techn. Stockholm* 4, p. 19-25
- Lindblom, B. and Rapp, K. 1973: *Some temporal regularities of spoken Swedish, Papers from the Institute of Linguistics, University of Stockholm, Publication* 21
- Lindblom, B., Lyberg, B. and Holmberg, K. 1976: "Durational patterns of Swedish phonology. Do they reflect short-term motor memory processes?", *Department of Phonetics, Institute of Linguistics, Stockholm University*
- Lindblom, B. 1978: "Final lengthening in speech and music", *Nordic Prosody* (eds.: Gårding, E., Bruce, G. and Bannert, R.), *Travaux de l'Institut de Linguistique de Lund* XIII, p. 85-101
- Lyberg, B. 1977: "Some observations on the timing of Swedish utterances", *J. Phonetics* 5, p. 49-59

- Lyberg, B. 1979: "Final lengthening - partly a consequence of restrictions on the speed of fundamental frequency change", *J. Phonetics* 7, p. 187-196
- Lyberg, B. 1981: *Temporal Properties of Spoken Swedish, Monographs from the Institute of Linguistics, University of Stockholm* 6
- Malmberg, B. 1944: *Die Quantität als phonetisch-phonologischer Begriff. Lunds Universitets Årsskrift, N.F. Avd. 1 Bd. 41, Nr. 2*
- Meyer, E.A. 1903: *Englische Lautdauer, Skrifter utgifna av Kungl. Humanistiska Vetenskapssamfundet i Uppsala, vol. VIII*
- Meyer, E.A. 1904: "Zur Vokaldauer im Deutschen", *Nordiska Studier tillegnade Adolf Noreen*, p. 347-356
- Navarro Tomás, T. 1916: "Cantidad de las vocales acentuadas", *Revista de filología española* 3, p. 387-408
- Nielsen, N.A. 1959: *De jyske dialekter*, (Copenhagen)
- Nielsen, N.A. *Musikalsk circonflex på Hanstholm* (unpublished manuscript)
- Nooteboom, S.G. 1972a: *Production and perception of vowel duration*, (Utrecht)
- Nooteboom, S.G. 1972b: "The interaction of some intra-syllable and extra-syllable factors acting on syllable nucleus durations", *Inst. Perc. Res., Ann. Prog. Rep.* 7 (Eindhoven), p. 30-39
- Nooteboom, S.G. 1973: "The perceptual reality of some prosodic durations", *J. Phonetics* 1, p. 25-45
- Öhman, S. 1961: "Syllabic function of vowel length", *Speech Transm. Lab., Quart. Prog. and Status Rep., Royal Inst. Techn. Stockholm* 1/1961, p. 7-9
- Oller, D.K. 1973: "The effect of position in utterance on speech segment duration in English", *J. Acoust. Soc. Am.* 54, p. 1235-1247
- Petersen, N. Reinholt 1975: *Undersøgelse af identifikation og diskrimination af vokallængde*, (unpublished MA-thesis)
- Petersen, P. Riber 1973: "An instrumental investigation of the Danish 'stød'", *Ann. Rep. Inst. Phon. Univ. Copenhagen* 7, p. 195-234
- Rask, R. 1938 (ed.): *De fynske Bønders Sprog*, (ed.: Andersen, P.) (Copenhagen)

- Rietveld, A.C.M. 1975: "Untersuchung zur Vokaldauer im Deutschen", *Phonetica* 31, p. 248-258
- Ringgaard, K. 1959: "Når tostavellesord bliver enstavelses", *Sprog og Kultur* 21, p. 39-51
- Ringgaard, K. 1960a: *Vestjysk stød*, (Århus)
- Ringgaard, K. 1960b: "The problem of merger", *Nordic Journal of Linguistics* 3, p. 177-181
- Ringgaard, K. 1960c: "Den jyske dynamiske cirkumfleks på Samsø", *Sprog og Kultur* 22, p. 77
- Ringgaard, K. 1960d: "Kvantitet ved jysk stød", *Sprog og Kultur* 22, p. 112-113
- Ringgaard, K. 1963: "The apocope of disyllabics", *Phonetica* 10, p. 222-230
- Ringgaard, K. 1971: *Danske dialekter*, (Århus)
- Rischel, J. 1980: "Phrasenakzent als Signal des Objekts ohne 'determiner' im Dänischen", *Kopenhagener Beiträge zur germanistischen Linguistik, Sonderband 1*, p. 262-279
- Rischel, J. 1982: "On unit accentuation in Danish - and the distinction between deep and surface phonology", this volume, and to be published in *Folia Linguistica* 17
- Rossi, M. 1972: "Le seuil différentiel de durée", *Papers in Linguistics and Phonetics to the Memory of Pierre Delattre*, p. 435-450
- Sharf, D. 1962: "Duration of post-stressed intervocalic stops and preceding vowels", *Language and Speech* 5, p. 26-30
- Sievers, E. 1901: *Grundzüge der Phonetik. Bibliothek indogermanischer Grammatiken, Band I*, (Leipzig)
- Skautrup, P. 1944: *Det danske sprogs historie I*, (Copenhagen)
- Smith, S. 1944: *Stødet i dansk rigssprog*, (Copenhagen)
- Thorsen, N. 1980: "Neutral stress, emphatic stress, and sentence intonation in Advanced Standard Copenhagen Danish", *Ann. Rep. Inst. Phon. Univ. Copenhagen* 14, p. 121-205
- Thorsen, N. and Nielsen, B. Jul 1981: "Fundamental frequency patterning and sentence intonation in two Jutlandic dialects - A first approach", *Ann. Rep. Inst. Phon. Univ. Copenhagen* 15, p. 1-12
- Umeda, N. 1972: "Vowel duration in polysyllabic words in American English", *J. Acoust. Soc. Am.* 52, p. 133A

Zwirner, E. 1938: "L'opposition phonologique et la variation des phonèmes", *Archiv für vergleichende Phonetik II*, p. 135-144