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CONTENTS

Editors' note

As of May 1st 1988, the Institute of Phonetics ceased to exist as a separate, administratively autonomous unit in the Faculty of Arts. We are now part of the Institute of General and Applied Linguistics, together with the former Institute of Linguistics, Institute of Applied and Mathematical Linguistics, and the Centre for Audiologopedic Research. As a consequence, this is the last issue of the Annual Report of the Institute of Phonetics. We will of course continue to publish results of research in phonetics and phonology - in a new, joint publication, the first issue of which should appear in 1990.

ARIPUC 23, 1989, p. 1-85

STRESS GROUP PATTERNS, SENTENCE ACCENTS AND SENTENCE INTONATION IN SOUTHERN JUTLAND (SØNDERBORG AND TØNDER) - WITH A VIEW TO GERMAN

NINA GRØNNUM [THORSEN]

This paper investigates prosodic stress group patterns, the presence and manifestation of default and focal sentence accents and the nature of sentence intonation signalling in Standard Danish spoken on a substratum of South Jutland dialects, viz. Sønderborg and Tønder, and in two varieties of German, Standard North German and Flensburg. The following facts appear: sentence intonation (understood to encompass both utterance function and utterance juncture) is signalled globally in Tønder, locally in Sønderborg, and with a mixture of global and local signalling in German. Default accents are non-existent in the two Danish varieties, optional in German. Focus is signalled, optionally (and never in final position), by stress reduction of the surroundings in the Danish regions, but is compulsory and takes the shape of a proper sentence accent, though modest, in German. Sønderborg and German have unambiguous final lengthening, whereas both lengthening and shortening finally occurs in Tønder. Prosodic stress group patterns suffer a clean truncation when their duration is shortened in the Danish regions, but a mixture of compression and truncation in German. Finally, Tønder has stød, Sønderborg and (of course) German do not.

I. INTRODUCTION

This is the last paper in a series which deals with intonation in regional Danish. Similar investigations from Bornholm (and Swedish), Aalborg and Næstved were reported in ARIPUC 22

(p. 25-138 and 145-195, respectively). The original intention was to prick out on a map of Denmark some towns which - intonationwise - are clearly distinguished from Standard Copenhagen Danish, and easily identified. Among them, Bornholm was chosen for its affinity with Swedish, which proved to be very close indeed, and Sønderborg aroused my curiosity because it has a distinctly German ring to its prosody. Thus, the intention was to carry out a comparison between Sønderborg and German as spoken just south of the border (in Flensburg) as well as Standard North German, in the same manner that Bornholm was compared with Southern and Central Swedish. Sønderborg is situated on Als, an island north of Flensburg Fiord. Tønder is likewise situated close to the German border, but in the western part of South Jutland. It is my lack of familiarity with (and a lack of prosodic descriptions in the literature about) present-day regional southern Danish which led to Tønder's inclusion in the investigation. I did not at the outset have any precise idea of just how local any German influence might be, although I did expect Tønder speakers to have stød and Sønderborg speakers to lack it. (Readers not familiar with Danish should note that the five provinsial towns in my corpus do not exhaust the list of prosodically interesting and deviant varieties of Danish, far from it. Funish is one obvious omission.)

The results have become increasingly difficult to write up, and the descriptions correspondingly more messy to read, from my work with Copenhagen Danish through Bornholm, Aalborg and Næstved, to this last one. This is partly due to the fact that the prosodic systems differ greatly across regions, both with regard to the inventory of prosodic parameters, but also with regard to their manifestation. More particularly, not all systems are equally clear-cut, with equally explicit realization of the elements, nor with equal degrees of inter-speaker concordance. Partly, the description is complicated by the fact that there is so much more material now to compare it with. Further, the terminology has been changed and adapted, from paper to paper, to accommodate new facts; I have not been able to adhere to uniform graphical displays either (in terms of lines and annotations in figures), from one paper to the next.

terminologiforandringer

Apart from the complicating factors just mentioned, the present investigation turned out to be more difficult to handle than Bornholm, Skanian, Central Swedish, Næstved and Aalborg, for several reasons. I am less familiar with Southern Jutland Danish, for one thing. Secondly, there is a stronger distinction in this area, and a stronger sense among the speakers of the difference between the local language and (the approximation to) Standard Danish, to the point where one might actually talk about bilingualism. Speakers are generally very reluctant to use the vernacular in a conversation with a non-local person, and especially perhaps in reading aloud into a microphone. For this reason, a number of speakers had to be discarded who, in their dealings with me, were hardly distinguishable from Standard Copenhagen speakers. They were, perhaps not accident-

ally, also those with some form of higher education who had spent some time away from home during their studies. Of course, the type of material does not help here: highly monitored speech, presented in Standard Danish orthography, adhering to Standard Danish morphology and syntax, does not exactly further spontaneity and naturalness. But I do wish to point out that I did not encounter similar problems on, e.g., Bornholm, although the difference between Bornholm vernacular and Standard Danish as spoken in the capital is at least as great here, but Bornholm speakers seem much less inclined to shed their local phonological and prosodic habits. Surely, there are grounds here for interesting socio-linguistic observations, but this is far beyond the scope of this paper. As it turned out, three speakers from Tønder (out of four) and three speakers from Sønderborg (out of six) were subjected to further processing and compared with two Standard North German and one Flensburg speaker.

In the course of analysis of the material from Bornholm, Malmö, Stockholm, Næstved and Aalborg, I came to distinguish two types of sentence accent, which are different to their function as well as to their phonetic form: the prosodically or syntactically determined, final, DEFAULT accent (in isolated utterances) and the contextually or pragmatically determined FOCAL accent. This distinction is, accordingly, carried through from the outset here. It also became clear that focus signalling may take two different prosodic shapes (according to the language investigated): it may be a sentence accent in the traditional sense, i.e. the focussed item is boosted: it carries larger and quicker fundamental frequency (Fo) movements, and the surroundings are only moderately affected, or the focussed item itself is subject to no apparent change but a notable shrinking and reduction of surrounding stress group patterns is encountered, which is perceived as a stress reduction of the surrounding stressed syllables. Thus, in both cases we are dealing with a relatively more prominent focussed item, a prominence that is attained either by upgrading the focus or by downgrading its surroundings.

I made two further observations, in the summary on p. 134-135 (ARIPUC 22), which are quoted here, because the results below will have a bearing on both: Bornholm turned up with predominant final shortening, Stockholm Swedish with extensive final lengthenings, which is curious because otherwise they share most sentence prosodic features, i.e. they both signal sentence intonation locally, and both have focal as well as default sentence accents (although neither is compulsory in Bornholm). Thus, final lengthening is clearly a completely independent parameter and in no way principally linked to the occurrence of extensive tonal movements (in the shape of final default sentence accents and final terminal junctures), as also maintained by Bannert (1982), nor is it a "universal" feature.

The distribution of sentence accents across Copenhagen, Bornholm, Skanian and Stockholm Swedish (Copenhagen and Malmö do not have final default accents, they are optional in Bornholm and compulsory in Stockholm) might motivate a speculation that the manifestation of sentence intonation (which is globally signalled in Copenhagen and Malmö and local (final) in Bornholm and Stockholm) is linked to the presence (and manifestation) of final default sentence accents. Not in any insoluble, one-to-one relation, though, because local sentence intonation appears also in utterances produced without final default accents (in Bornholm). But it is not unlikely that globally distributed sentence intonation, i.e. a rather gentle overall slope, would be masked perceptually by the extensive final movements pertaining to the default accent, so, in the presence of default accents, sentence intonation signals need to be contained within or tagged on to the tonal movement of the accent. This strategy is generalized, it becomes the way to render sentence intonation, also in the occasional absence of a default accent. The hypothesis would state that global intonation precludes final default accents - which leaves the possibility of having local sentence intonation without default accents.

II. PROCEDURES

1. MATERIAL

a. The Danish recordings.

The material is exactly the same as previously recorded in other parts of the country, except that names of cities to be born in or travelled to have been substituted with places in Southern Jutland. The reader is referred to the corresponding sections in ARIPUC 22 (p. 27ff and 146ff, respectively) for a fuller account and motivation. I shall limit myself here to a mere listing of the utterances:

Kamma stammer fra Padborg.	(K. comes from P.)
Anders og Kamma skal til Ballum.	(A. and K. are going to B.)
Torbens søster hedder Kamma.	(T's sister is called K.)

These were presented in isolation and as answers to questions which invited focus either on Kamma, or elsewhere, i.e. on Padborg, Ballum, and Torbens.

I would like to make explicit here (which I omitted to do in ARIPUC 22) that my investigations were never conceived as a contribution in the more syntactically or semantically/pragmatically oriented debate about what determines focus placement; when and whether a focus is 'broad' or 'narrow'; what is focus and what is contrastive stress or emphasis; what determines the default location of sentence accents; etc. For an excellent treatment of these questions, see Ladd (1978) and the references therein, and for a more recent overview, see

Fretheim (1988). But I would like to note that the distinction between focal accents and emphasis for contrast may not always be clear-cut semantically or pragmatically in spontaneous speech. There will doubtless be many instances where a prominence is open to both interpretations. But in a read material of this kind it ought to be possible to elicit either one or the other (or both, naturally). Thus, the question 'Ved du hvor Kamma er født?' (Do you know where K. was born?) focalizes on K's birthplace, but does not contrast it with other possible places of birth as, e.g., the question 'Er Kamma født i Padborg eller i Ballum?' (Was K. born in P. or in B.?) would have done. Furthermore, focal accent and emphasis for contrast may have different phonetic manifestations, as is evident in German data published by Bannert (1985): A focal accent may be preceded by accented syllables (stressed syllables associated with an Fo excursion), but no such syllables may follow it, so stressed syllables after a sentence accent steer a smooth, undeflected course to the end of the utterance. Bannert (1985) notes that in his material, emphasis for contrast is associated with a larger Fo movement on the stressed syllable of the contrasted item, and it appears from his figures that there is a further difference between focal accent and contrast: the Fo movements preceding the contrasted syllable are also partially suppressed or completely deleted, so the only clear Fo excursion is the one associated with the contrast. This is also how emphasis for contrast is manifested in Standard Danish, cf. Thorsen (1980b). It would have been very interesting to compare focal accents and emphasis for contrast in this material, but I did not dare include the necessary dialogue material, for fear that speakers would - in the course of reading - get confused about the two types and mix them up.

The total of nine utterances above (one isolated and two from context) will allow me to look at default and focal accents, as well as at the realization of terminal declarative intonation and final lengthening.

A long declarative runs as follows:

Kofoed og Thorsen skal med rutebilen fra Tinglev til Tønder klokken fire på tirsdag.

(K. and T. are taking the bus from T. to T. at four o'clock on Tuesday.)

A question word question plus a one-stress echo-question:

Hvor langt er der fra Tønder til Padborg? - Til Padborg? Der er ca. 30 kilometer.

(How far is it from T. to P.? - To P.? It is about 30 km.)

Two utterances which have (a) one stress group (underlined) with a fairly large number of post-tonics, and (b) a polysyllabic word with stress on its last syllable (to certify that word boundaries per se leave no trace in Fo - as it generally does not in other varieties of Danish, or in Swedish, cf. Thorsen 1980a, 1982, 1984, Bruce 1977, Touati 1987):

De mange grænsehandelsbutikker vil snart blive nedlagt. (Sønderborg)

De sidste vadehavsfugle vil snart være forsvundet. (Tønder)

Fabrikken solgte elektronik for to millioner kroner.

(The numerous border trade shops will soon be closed down./ The last wading birds will soon have disappeared. / The factory sold electronics worth of two million crowns.)

Five utterances with a stress group, voiced throughout, which grows progressively shorter from top to bottom:

De fik kanerne frem til nytår. (They got out the sleighs for New Year's.)

Hun fik kanderne fyldt til kanten. (She had the jugs filled to the brim.)

Hun fik kanden fyldt med mælk. (She had the jug filled with milk.)

Koldt vand slukker tørsten. (Tønder) (Cold water quenches your thirst.)

Hun fik vand med på turen. (Sønderborg) (She brought cold water along on the trip.)

En grå kat kradser. (Tønder) (A grey cat scratches.)

Hendes kat lå på sofaen. (Sønderborg) (Her cat lay on the sofa.)

The last two utterances (as recorded by the Tønder speakers) were ill considered, because the stress group under scrutiny is not - as in the upper three cases - the first one in the utterance. They were changed prior to the Sønderborg recordings.

Two sentences to further pinpoint final lengthening:

Turisterne gør befolkningstallet større om sommeren.

Mange forretninger lever af turisterne.

(The tourists increase the population during the summer. Many shops live off the tourists.) The Kamma-utterances may of course also serve as data here, which will supply different sentence accentual conditions.

The total of twenty utterances were typed out on library index cards, in three different randomizations, twice, numbered consecutively from 1 to 120. Sentences in context were uttered in their context, i.e. the speaker took two roles here: asking the question and providing the answer.

b. The German recordings.

The sentences were translated into German, as close copy as possible:

(Wissen Sie wo Kamma geboren ist?)

(Wer von ihnen ist in Kappeln geboren?)

Kamma stammt aus Kappeln.

(Wo werden die jungen Leute den Urlaub verbringen?)

(Wer, ausser Anton, wird nach Kassel fahren?)

Anton und Kamma fahren nach Kassel. (Note that this utterance has four stressed syllables.)

(Wie heisst Bertha's Schwester?)

(Wer hat eine Schwester, die Kamma heisst?)

Bertha's Schwester heisst Kamma.

Wie weit ist es von Hamburg nach Kassel?

Nach Kassel? - Es sind ungefähr 200 Kilometer.

Die letzten Wattenmeervögel werden bald verschwunden sein.

Die Fabrik hat Elektronik für zwei Millionen Mark verkauft. (Note that the stressed syllable under investigation here has been shifted to 'Fabrik', since 'Elektronik' is stressed on the penultimate.)

Hannah und Markus werden am Donnerstag Nachmittag mit dem Autobus von Hamburg nach Kassel fahren.

(Note that the final stress group is longer than in the Danish recordings, because 'fahren' has reduced stress.)

Den Kähnen fehlten die Segel.

Die Kannen stürzten vom Tisch.

Die Kanne fiel auf den Boden.

Der Kamm fiel aus seiner Tasche.

Das Kap lag am Horizont.

Die Touristen verdoppeln die Bevölkerung im Sommer.

Im Sommer ist Glücksburg voll von Touristen.

(I presumed that if a sentence accent would be assigned to this utterance, it would hit 'voll' rather than 'Touristen', which turned out to be the case.)

2. SPEAKERS AND RECORDINGS

Three speakers from Tønder were selected, two males (AS and JC) and one female (KaP), all in their forties, and three speakers from Sønderborg, of approximately the same age (HS and PBP, males) and ES (female). HS and ES are married, and PBP is ES's brother. The Flensburg speaker (JB) is a male in his early thirties, and the two Standard North German speakers are MS (female, in her early thirties) and JoW (male, in his early forties). The Danes were all recorded in their homes with a portable Sony TC-D5M tape recorder, a Sennheiser clips back-elektrate MKE2-6 microphone on to BASF 90CR-MII tape. The Germans (who are all residents in or near Copenhagen) were recorded in our quasi-damped room, with a Sennheiser KD21 condensator microphone, Revox A700 tape recorder, Agfa PEM369 tape, at 7½ ips.

Actually, more speakers were recorded, as mentioned in the introduction, but a number of them had to be discarded for their lack of clear regional (phonological and prosodic) characteristics. Furthermore, KP and JC from Tønder were rather fanciful readers, i.e. they would subject some of the utterances (particularly, of course, the isolated Kamma-utterances, which stood out from other isolated utterances by the fact that they also occurred in various contexts) to a number of different "readings", so only part of the material by them is presented here. Another source of variety was introduced by the fact that some speakers consistently (KaP, JC, HS), another sporadically (ES) would adapt the utterances to the morphological demands of their regional language, i.e. they would preposition the definite articles, which has consequences for the last two sets of (5 and 2) utterances above.

The first twenty items of each of the German recordings were sent to Professor Klaus Kohler in Kiel for evaluation as to their authenticity. According to him, MS represents the North German Standard norm (as does JoW), whereas JB goes down as a Flensburg speaker. This is curious, since MS and JB are brother and sister, born and raised in Flensburg; both are bi-lingual (though with a clear German accent, stronger in JB's case, to their Danish) and have lived the greater part of their adult life in Copenhagen. MS, when confronted with Klaus Kohler's verdict, put the difference down to differences in social contacts during childhood and youth.

3. REGISTRATION AND MEASUREMENTS

For the account of the technical procedures, see ARIPUC 22, p. 30-31 (and note that pages 30 and 32 have been interchanged in the printing!).

III. RESULTS

A. SENTENCE ACCENTS

1. AUDITORY EVALUATION

The presence (or not) and location of any relatively more prominent stressed syllables in each utterance was ascertained while listening to the tapes and providing the mingograms with identification and proper text. Where the two sets of Danish recordings are concerned, the procedure was unproblematic: there were no specially prominent final stressed words in the isolated utterances (default accents), there was no focus indication in utterances where a final focus was invited by the preceding question, and non-final focus signalling always took the non-boosted form, i.e. the relative prominence was attained by a stress reduction of the succeeding stressed words.

The German recordings were less unambiguous to me, so I listened to the tapes about 6 months after the first processing, and again now - when another year has elapsed. The difficulty is

in ascertaining the presence or not of final (be they default or focal) sentence accents. (Non-final - focal - accents are clearly present when expected to be, and are of the Fo-boosting kind, i.e. the Fo movement during the accented stress group is audibly and visibly of greater extent than in non-accented cases.) There are, fortunately , a sufficiently large number of instances where I feel quite confident that a final accent is present and absent, respectively, and from those I can extract what seems to be the pertinent feature: the final stress group pattern is falling, which is a feature of sentence intonation and juncture, cf. below, but the onset of the fall is higher relative to the preceding stress group pattern under accent. The extent of the fall in itself is no stable cue. - This is a rather different situation from Stockholm Swedish,[1] where the sentence accent resides in a tonal movement (a rise) tagged on to the stressed syllable, a separate gesture (succeeded by yet another movement: the final terminal juncture Fo fall); and it is also different from Bornholm, where final sentence accents had both larger and more complex (bi-directional vs. unidirectional) movements than when no accent is present. The German final sentence accents are thus less explicitly and less generously signalled. Inspection of those, numerous, instances where I cannot make up my mind, where I react with a "yes, maybe" and a "no, I think not" on the next replaying of the tape, turn out in the Fo traces to be intermediate, as far as the relative location of the final stressed syllable is concerned, between the clear accented cases and the clear non-accented ones. Thus, the relative prominence of an utterance final element is not a binary feature with clearly non-overlapping manifestations, but a scalar feature. Add to this that there is a considerable difference between speakers in their inclination to supply default accents, it seems evident to me that this phenomenon has a different status in the German prosodic system than in, e.g., Stockholm.

Tables I through VII present the results of my auditory evaluation, which should be taken cum grano salis where the Germans are concerned, because I have given myself a forced choice, so shady cases, cf. above, have been assigned to definite categories. Due to inter-speaker differences, speakers are presented individually, except that HS and PBP are collapsed in one table. Note that the number of utterances counted in the tables will not always correspond to the number displayed in the tracings, where items may have been left out for independent reasons.

No final default accents occur with any of the Danish speakers. Besides, their focus assignments are always of the stress reduction type, and, apparently, only succeeding stresses suffer a reduction - but I have only one utterance to back up this statement (*'Anton og Kamma skal til Ballum'*). Furthermore, and maybe consequently, final focus does not get signalled at all. I.e. an utterance whose context invited a focus assignment finally (like *'Do you know where Kamma was born? - Kamma was born in Padborg.'*) is perceptually indistinguishable from the same utterance elicited in isolation. Initially invited

Tables I - VII

Number of focus assignments or sentence accents, in percentage of the possible maximum (given beneath the legend of each column), determined a priori by the context, i.e. columns should add up to one hundred.

Table I

Speakers HS and PBP, Sønderborg

	CONTEXTUALLY INVITED FOCAL ASSIGNMENTS			
	None (isolated utterances) (34)	Initially (23)	Medially (12)	Finally (35)
Utterances which received				
No accent	100%		16%	100%
Default accent				
Initial focus		100%		
Medial focus			84%	
Final focus				

Table II

Speaker ES, Sønderborg

	CONTEXTUALLY INVITED FOCAL ASSIGNMENTS			
	None (isolated utterances) (15)	Initially (12)	Medially (5)	Finally (17)
Utterances which received				
No accent	100%	50%	100%	100%
Default accent				
Initial focus		16%		
Medial focus				
Final focus				
Double focus		34%[1]		

1) on the initial and medial word.

Table III

Speaker AS, Tønder

	CONTEXTUALLY INVITED FOCAL ASSIGNMENTS			
	None (isolated utterances) (17)	Initially (12)	Medially (5)	Finally (18)
Utterances which received				
No accent	100%	16%	60%	100%
Default accent				
Initial focus		84%		
Medial focus			40%	
Final focus				

Table IV

Speaker JoW, German

	CONTEXTUALLY INVITED FOCAL ASSIGNMENTS			
	None (isolated utterances) (15)	Initially (12)	Medially (6)	Finally (18)
Utterances which received				
No accent				
Default accent	100%			
Initial focus		100%		
Medial focus			100%	
Final focus				100%

Table V

Speaker MS, German

	CONTEXTUALLY INVITED FOCAL ASSIGNMENTS			
	None (isolated utterances) (18)	Initially (12)	Medially (6)	Finally (18)
Utterances which received				
No accent	89%			44%
Default accent	11%			
Initial focus		100%		
Medial focus			100%	
Final focus				56%

Table VI

Speaker HH, German

	CONTEXTUALLY INVITED FOCAL ASSIGNMENTS			
	None (isolated utterances) (18)	Initially (11)	Medially (6)	Finally (17)
Utterances which received				
No accent	100%			
Default accent				
Initial focus		100%		
Medial focus			100%	
Final focus				94%
Double focus				6%[1]

1) on the initial and final word

Table VII

Speaker JB, Flensburg

	CONTEXTUALLY INVITED FOCAL ASSIGNMENTS			
	None (isolated utterances) (18)	Initially (12)	Medially (8)	Finally (20)
Utterances which received				
No accent	67%	8%	13%	30%
Default accent	33%			
Initial focus		50%		
Medial focus		42%	87%	
Final focus				70%

foci are more prone to be signalled than medial ones. This is very reminiscent of the results from Copenhagen, Næstved and Aalborg, cf. Thorsen (1988a, p. 193). We may conclude that default sentence accents are non-existent in these two Southern Danish regions, and that focus signalling by prosodic means (succeeding stress reduction) is optional, and seemingly excluded in final position.

The picture is more varied in the German variants. A Standard German speaker, HH, who is not otherwise employed in the analysis, due to his generally very high, but also erratically varying speech rate, is presented in Table VI. He is included here in order to alleviate any doubt that might be cast about the status of default accents in Standard German if MS's status is questioned (her being born and raised in Flensburg, in a family where the brother goes down as a typical Flensburg speaker). HH and JoW are both linguists, they know each other very well (and, of course, speak German among themselves), and they both agree that the other does indeed speak Standard German with no definable local traits. Thus, the inclusion of HH here allows me to state that default sentence accents exist in Standard German, but are apparently not compulsory: HH never produced one, MS rarely, JoW did so invariably. Otherwise, the Standard German speakers generally assign focal accents when and where the context invites them (but note MS's final focus omissions). The Flensburg speaker vacillates more and actually leaves out most default accents as well as a total of

9 (out of 40) focal accents, more often so in final position, which tallies with the Danish results, where final foci do not get signalled at all. I shall return to the deviant behaviour of final position below.

I should insert that listening to the Tønder and Sønderborg speakers, I would still maintain that Sønderborg speakers have elements in their prosody that are reminiscent of German, and Tønder speakers do not. This kinship cannot reside in sentence accent phenomena, however, since Sønderborg lacks default accents and the means to signal focus is different (downgrading of the surroundings versus upgrading of the focussed item).

2. FUNDAMENTAL FREQUENCY

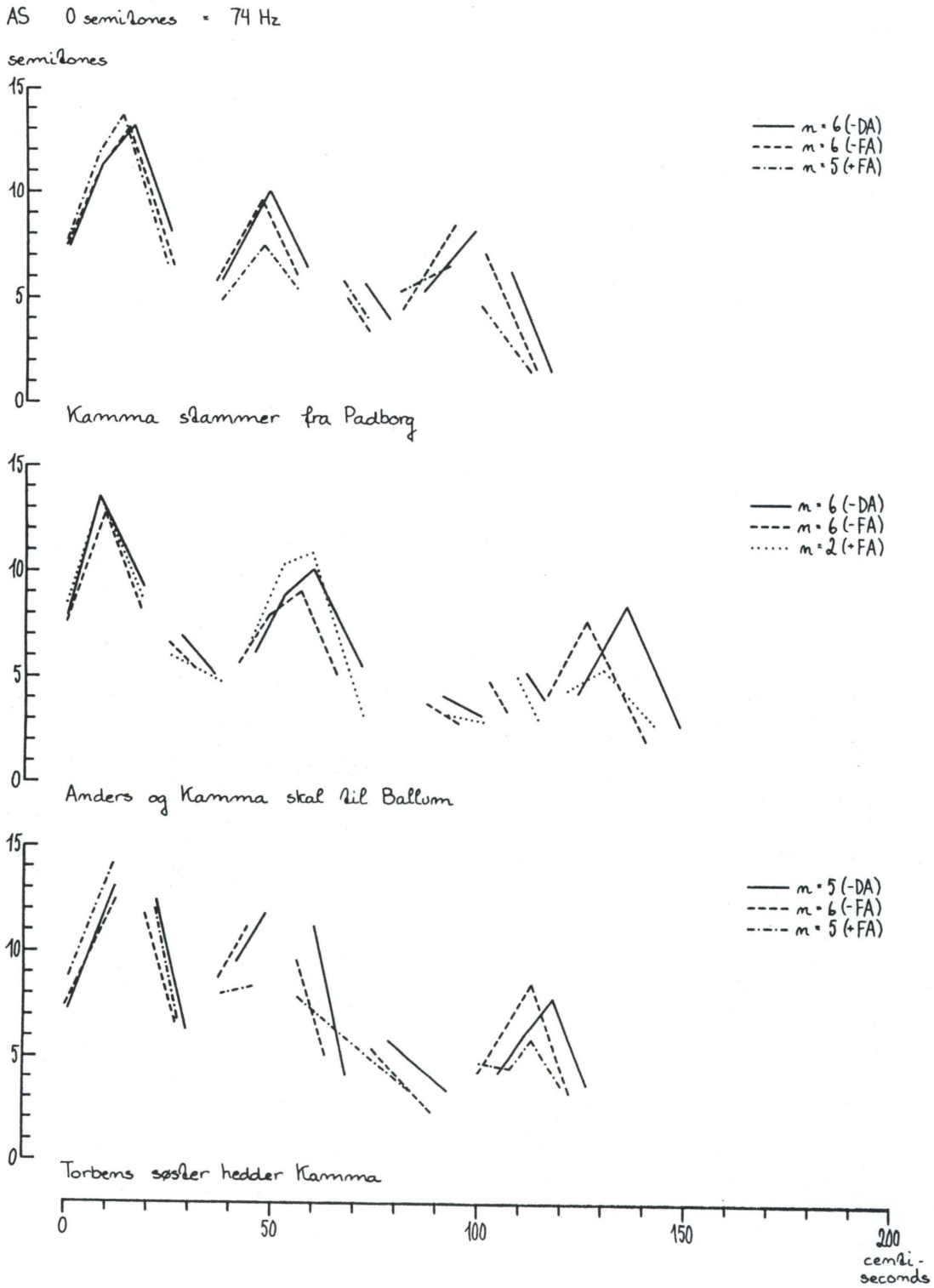
The Fo traces should establish the acoustic foundation for my auditory impressions.

a. The Danes

Looking at figures 1-4 (the Danes) it is apparent that full line tracings (isolated utterances) and broken line tracings (utterances from context which invited a final focus assignment) are very similar in shape, qualifying the auditory impression that they are indistinguishable. However, the utterance from context is generally somewhat shorter, see further below, section 3. Another trend appears (notably with HS and ES), namely for the isolated utterance as a whole to be situated slightly higher in the frequency range. This might be put down to a textual effect: All speakers actually took both roles, asking and answering, in the small dialogues, and thus the answers are all, in a way, text final, and - ceteris paribus - a text final utterance will onset and run lower than an isolated one, cf. Thorsen (1985 and 1986) and the references therein. It would be very interesting to see whether a similar effect exists across speakers, i.e. whether a speaker producing an answer to a question put to him will subordinate it to a textual contour enveloping the first speaker's question. (I note in passing that a cursory inspection of that part of the previously published material which fulfills a ceteris paribus condition confirms that this is a question worth pursuing, though it is beyond the scope of the present paper.)

Figures 1-7

Average fundamental frequency tracings (logarithmic display) by three Sønderborg, one Tønder, two Standard German and one Flensburg speaker, with different focus assignments (FA) and varying presence of final default accents (DA). Speakers are identified at the top left of each figure, as is the frequency value which is the basis for the conversion to semitones. The number of items behind each average is given at the top right of each subpart of the figures. Isolated utterances are traced in full lines, utterances from context which invited initial



foci are traced in broken-dotted lines, medial foci in dotted lines, and utterances where final focus was invited in broken lines. Occasionally (with MS and JB, figures 6 and 7) a thicker and thinner edition of the same line occurs, in utterances that were produced in two editions (without and with, respectively, a sentence accent). Note that 'Anton und Kamma fahren nach Kassel.' contains four stressed syllables, and that JoW (figure 5) produced 'Kamma stammt aus Kappeln.' with secondary stress on 'stammt'.

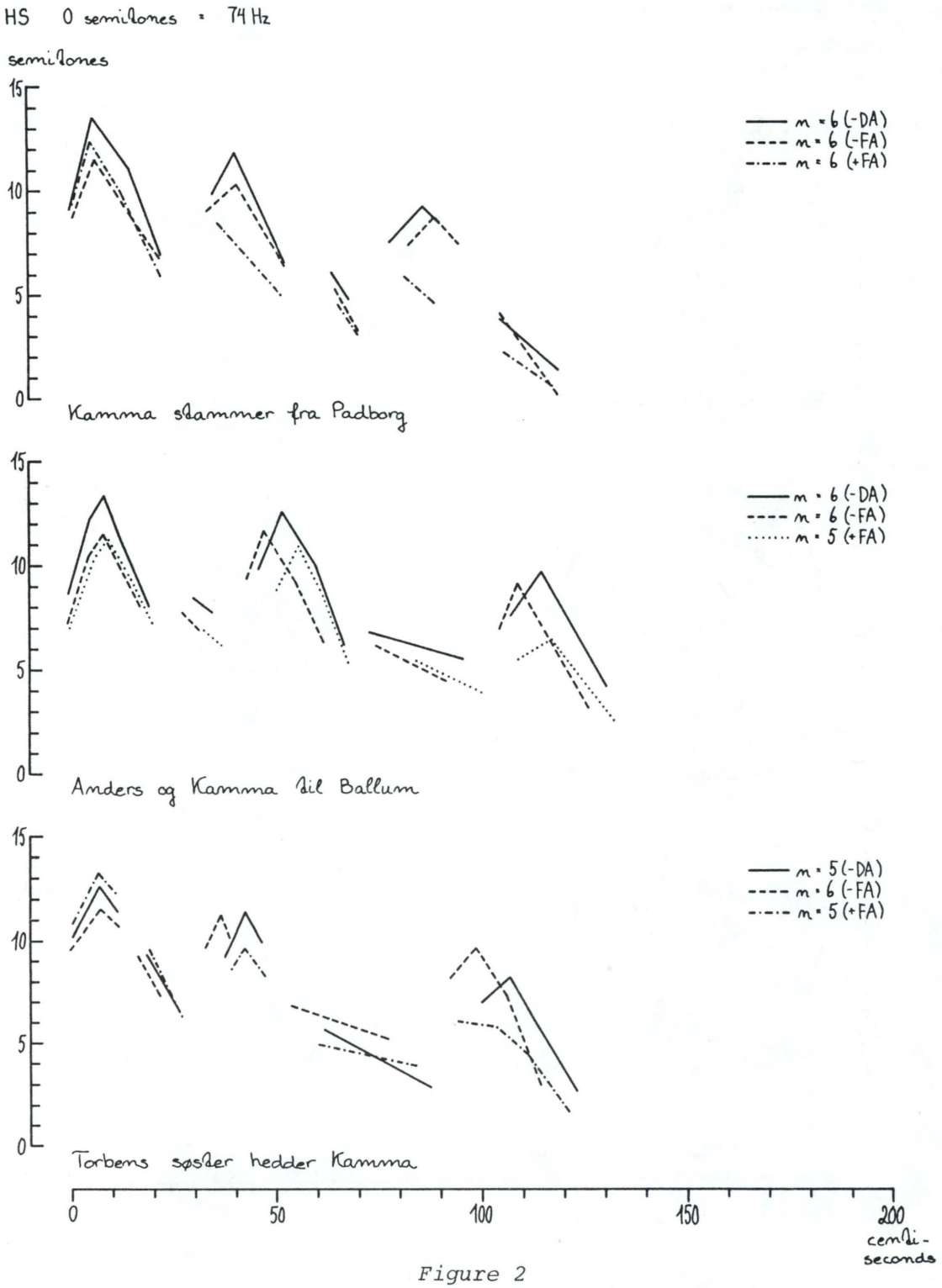


Figure 2

full line: isolated utterance
broken line: final focus invited
dotted line: medial focus invited
broken-dotted line: initial focus invited

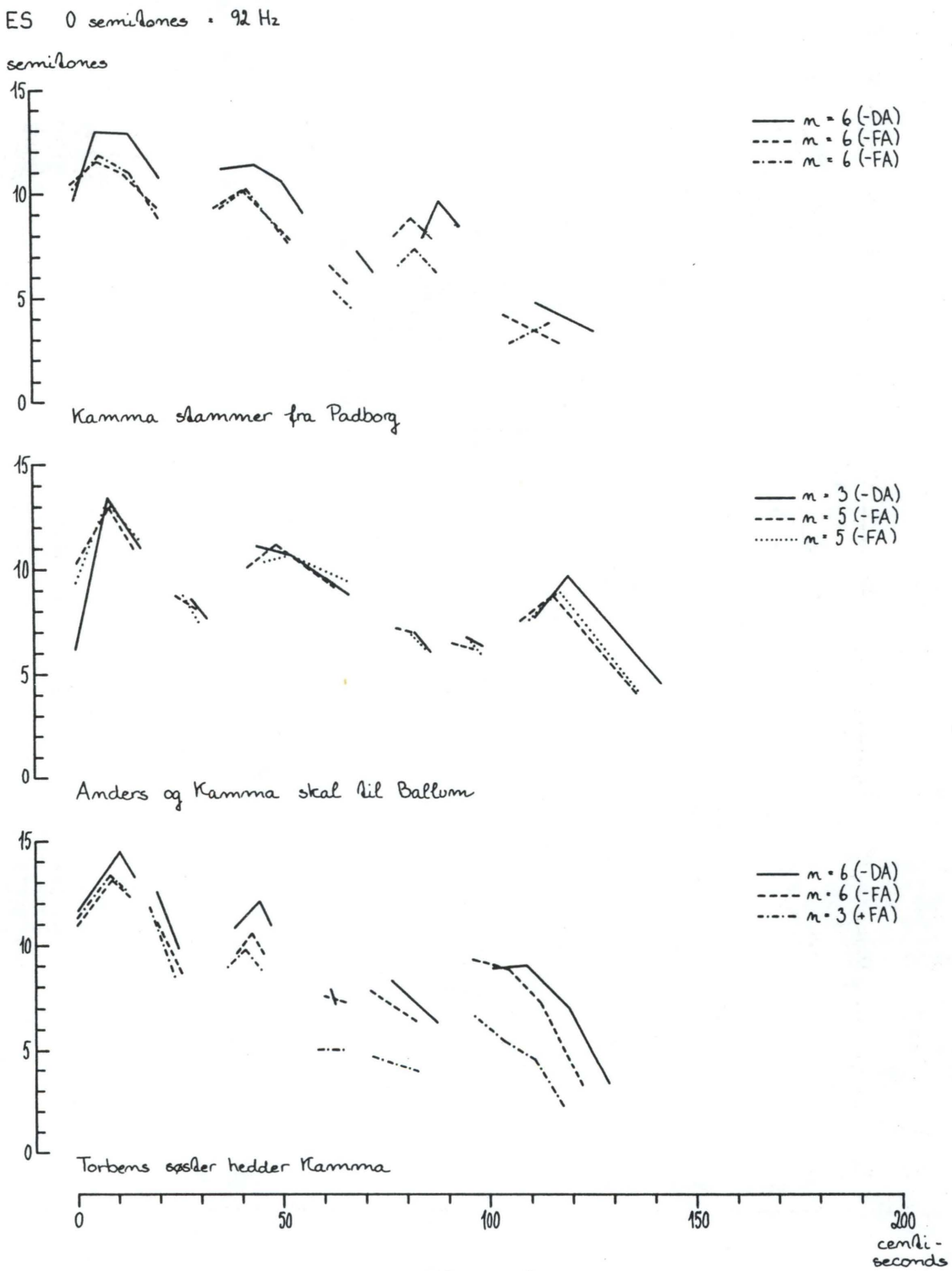

ES 0 semitones = 92 Hz
semitones
15
10
5
0
n = 6 (-DA)
n = 6 (-FA)
n = 6 (-FA)
Kamma skammer fra Padborg
n = 3 (-DA)
n = 5 (-FA)
n = 5 (-FA)
Anders og Kamma skal til Ballum
n = 6 (-DA)
n = 6 (-FA)
n = 3 (+FA)
Torbens søster hedder Kamma
0
50
100
150
200
centi-seconds

Figure 3

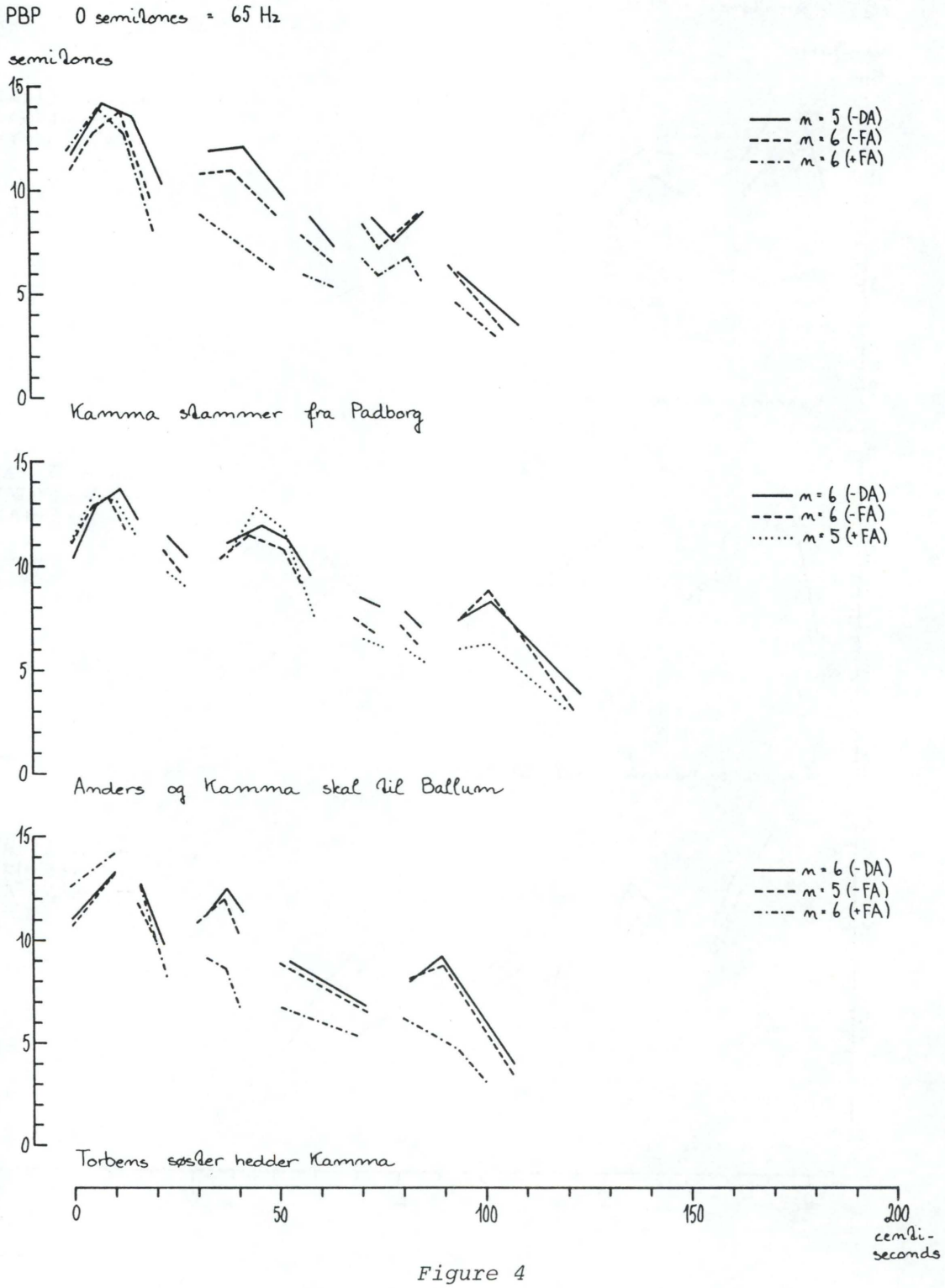


Figure 4

full line: isolated utterance
broken line: final focus invited
dotted line: medial focus invited
broken-dotted line: initial focus invited

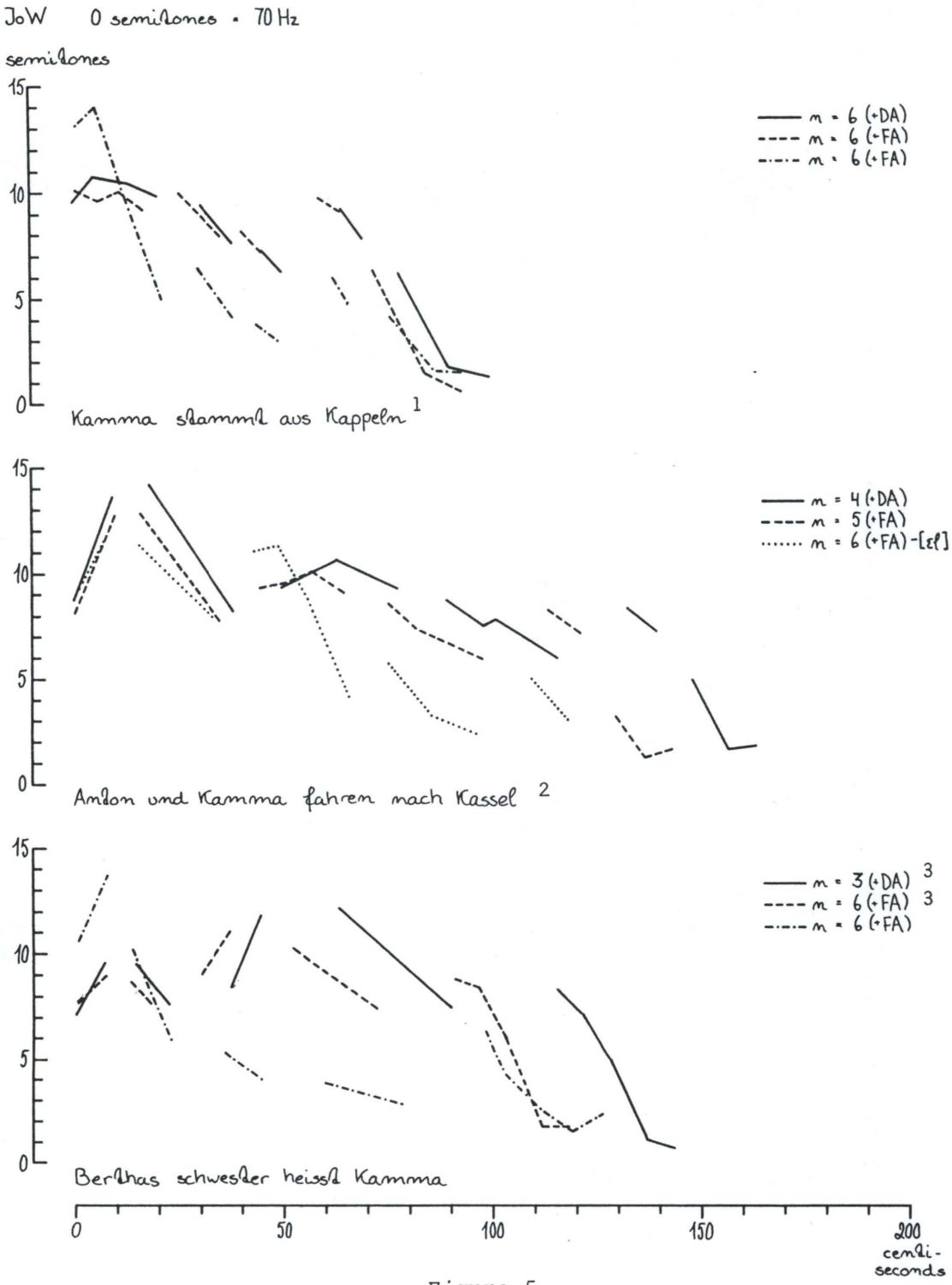


Figure 5

1) *two stresses only (secondary stress on 'stammt')*
2) *four stresses*
3) *'Bertha's Schwester' had a weak-strong prominence relation, i.e. only two full stresses in the utterance*

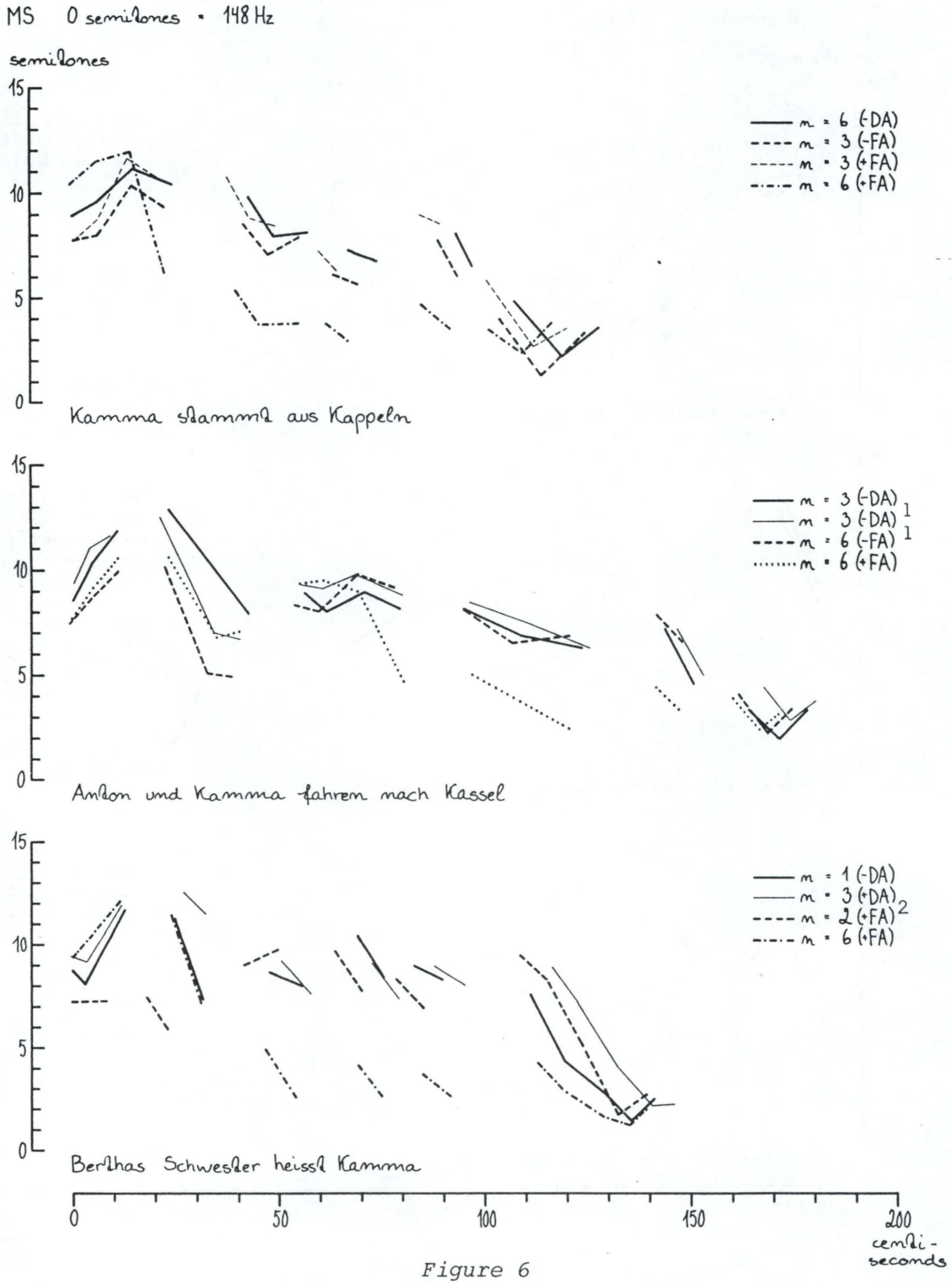


Figure 6

1) *'Anton und Kamma' had a weak-strong prominence relation, i.e. only three full stresses in the utterance*
2) *'Bertha's Schwester' likewise, i.e. only two full stresses.*

full line: isolated utterance, thin: with default accent, thick: without accent
broken line: final focus invited

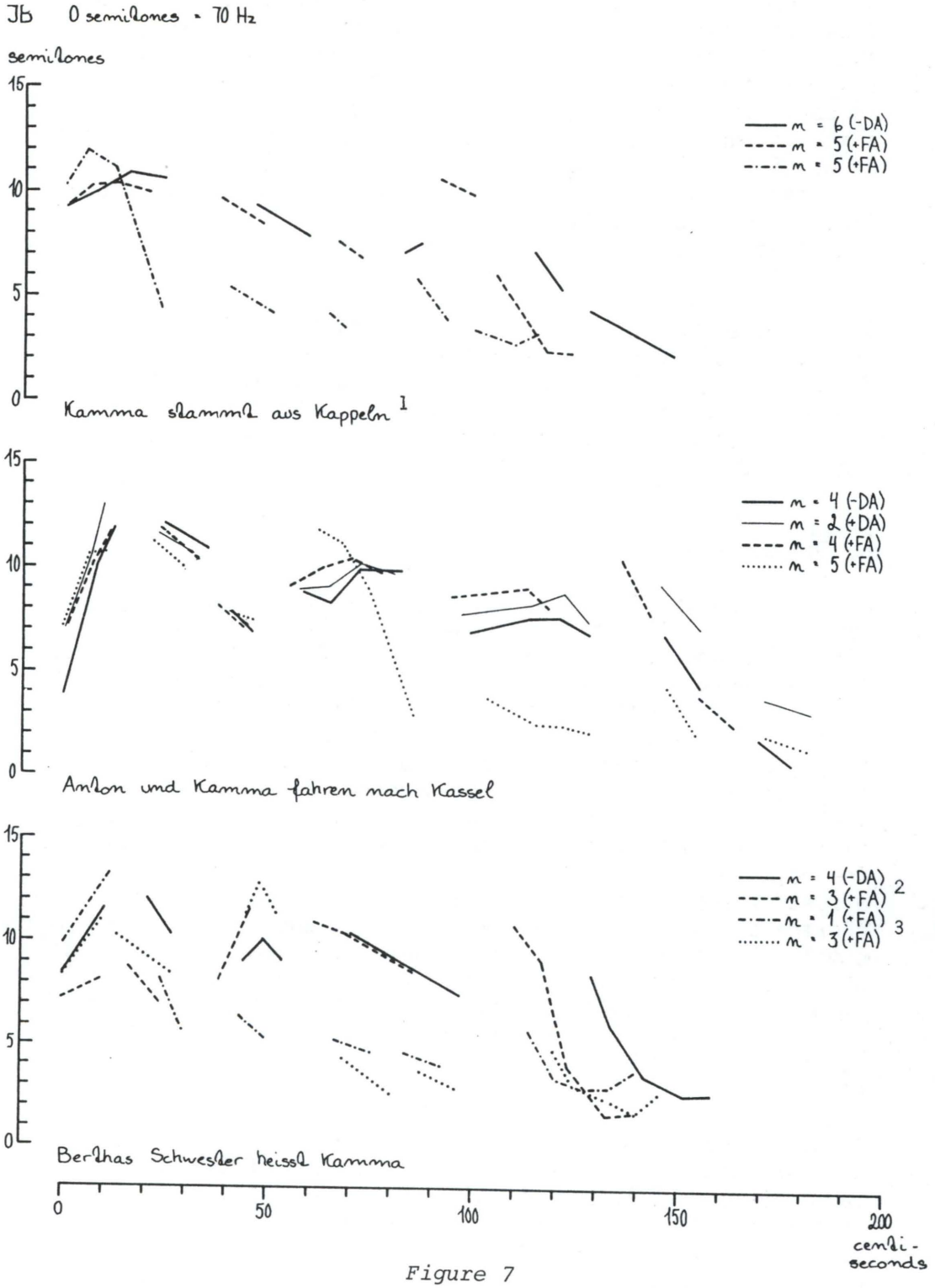


Figure 7

1) *I am uncertain whether 'stammt' has full or secondary stress*
2) *'Bertha's Schwester had a weak-strong prominence relation*
3) *The focal accent is misplaced to medial position*

dotted line: medial focus invited
broken-dotted line: initial focus invited

Utterances from context that invited initial focus and medial focus bear clear testimony to a downgrading of stress groups succeeding the focussed item in those instances where a focussing was perceived (denoted with a +FA in the figures). I.e. Fo deflections are smaller and situated lower in the range, although they cannot be said to be completely deleted. - Thus, if we distinguish two types of stressed syllables, those that are associated with an Fo movement, accented ones, and those that are not, unaccented ones, then we must state that the de-accentuation caused by a preceding focussed word is only partial. For a further discussion about the utility of a distinction between accented and unaccented stressed syllables in Danish, see Thorsen (1987a). This would leave a possibility for distinguishing between (non-contrastive) focus and emphasis for contrast, in line with the way emphasis gets signalled in Copenhagen: emphasis for contrast might entail a complete annihilation of succeeding (and preceding) stress groups, a complete de-accentuation, cf. Thorsen (1980b).

b. The Germans[2]

A note about the German speakers' production of 'Anton und Kamma ...' and 'Bertha's Schwester ...' is called for. JoW (fig. 5) produced the NP in 'A. und K. ...' with equal stress or prominence on the two proper names, whereas 'B.'s Schwester ...' got a distinct weaker-stronger relation, which comes out in the tracings as a relatively lower position of 'Bertha's'. MS (fig. 6) produced isolated 'A. und K. ...' in two different editions, with equal and weaker-stronger weighting, respectively, of the two proper names. 'A. und K. ...' from the final focus context got the same weaker-stronger distribution. The relatively weaker 'Anton' comes out primarily in a lower offset of the first stress group. The relatively weaker 'Bertha's' in the utterance with final focus accent has been completely stripped of any autonomous Fo movement. JB (fig. 7) had equal weighting of 'Anton' and 'Kamma' (except when 'Kamma' was in focus) and likewise in the isolated version of 'B.'s Schwester ...'. But in the final focus accent edition, 'Bertha's' was relatively weaker, and compares well with MS (fig. 6).

It is interesting that a weighting of the individual elements of noun phrases never seems to occur in any of the Danish varieties I have looked at (although I suppose that that is what a metrical phonological representation would prescribe), but it is equally interesting that though this is a distinct possibility in German, it is not a must. A further discussion is beyond the scope of this paper, however. These facts are mentioned here mainly so they will not obscure the issues in point in the tracings.

Before proceeding to a closer scrutiny of sentence accents, note that stress group patterns - when not under sentence accent, and in non-final position - have relatively smaller Fo deflections than with any of the Danish speakers, cf. the

the non-final parts of full line utterances. Initial 'Anton und' does, however, have a larger rise and fall than other non-final stress groups with JoW and JB's isolated utterance. A higher rise in 'An-' could be due to a glottal attack in JB's isolated utterance, and a larger fall through '-ton und' could be a cue to the boundary in the NP, cf. that JB actually produced a glottal stop between these two unstressed syllables.

It is reasonably evident in the tracings that those I have marked '+DA' do indeed have comparatively more prominent Fo movements. Compare the full line tracings (+DA) of JoW on the one hand and MS and JB (-DA, thicker lines) on the other and note that with JoW the onset of the final stress group is higher in relation to the preceding part of the utterance than is the case with MS and JB. The same relatively higher onset is observed in those instances where MS and JB produced the same utterance in two editions (thin and thick full line, fig. 6 bottom part, fig. 7 middle part). (See also Table IXa below.) Note that the fall is not greater under default accent, but it runs higher up in the range. As mentioned above, this is a rather miserly signalling of default accents, compared with Bornholm and Stockholm speakers, cf. Thorsen (1988a).

Final focal accents do not seem to be distinguished in any significant and consistent way, as far as Fo goes, from default accents, but they do abbreviate the whole utterance, cf. below, section 3. In Central Swedish and in Bornholm default and final focal accents differed somewhat: focal accents had slightly more comprehensive Fo movements and/or preceding tonal movements were somewhat lowered and diminished in amplitude. Thus, focal accents are - comparatively - even less generously signalled in North German.

Non-final focal accents have an unmistakable and nearly uniform manifestation: An extensively falling movement - accomplished within the stressed and first post-tonic syllable (or alternatively: within the focussed word - the issue cannot be decided, since the focussed words are all di-syllabic here. But from JB's misplaced medial focal accent in 'Bertha's Schwester heisst Kamma', where 'heisst' is unstressed and thus forms the tail end of the prosodic stress group beginning with 'Schwester', it appears that the slope is not expanded to cover the whole stress group). The fall is nearly to the floor of the speaker's range, after which Fo runs low and nearly level. The last stressed syllable performs a slight step up from the floor, succeeded by a slight fall to the post-tonic, see further section C.2.b. Pre-accentual items seem unaffected. - With JoW, the onset of the fall in initial position is considerably higher than in non-accented items, in initial position, but otherwise the "boosting", i.e. the expansion of movement in accented vs. non-accented position, is downwards.

At this point an ambiguity stands out with regard to the parameters involved. The line of argument runs as follows: Final sentence accents, whether default or focal, were never very prominent perceptually or acoustically, and quite a few cases

remain perceptually ambiguous to me (accented or non-accented?). Medial and initial focal accents stick out a mile perceptually, although, as can be seen in the traces, their associated Fo pattern (the fall) is neither qualitatively nor quantitatively different from final sentence accents. This would suggest that the perceptually salient feature of a non-final sentence accent is the downgrading of succeeding stressed elements. And that would explain the relatively weak perceptual status of final accents. But it simultaneously raises the question of the "phonological" status of the Fo fall. Is it anything to do with the sentence accent per se? Or is it a juncture and sentence intonation function signal (terminal, declarative)? Let me recapitulate: (a) the "same" utterance in this German material appears in three different variants: (1) without any extra prominence on the last lexically heavy item (when isolated), i.e. the last stressed word does not sound any more prominent than other stressed words in the utterance; (2) with an extra perceived prominence on the last lexically heavy item (when isolated); (3) with an extra perceived prominence on the last lexically heavy item (when in answer to a question which focalizes that word). (2) and (3) are not distinguishable in their Fo course, but they are both different from (1) in a relatively higher onset of the Fo fall. (b) The common denominator to these three variants (and to utterances which are prosodically marked at the end as non-terminals (questions)) is that the final stress group changes its stressed vowel movement from rising to falling (rising stressed vowels being characteristic of stress groups in non-final position), and the final post-tonic fall is larger and/or steeper than in non-final stress groups. This would deprive the fall as such (but not its relative onset) of any sentence accent status, and assign it rather to juncture and sentence intonation, see further sections B.1., B.5., and C.2.b below. Under this analysis, the manifestation of final sentence accents consists in a (modest) boosting of the given stressed syllable, i.e. a raising of the onset of the final fall. Non-final (focal) sentence accents tend to preserve their rising stressed vowel movements (most pronouncedly so in initial position). They need not be boosted, as they are not with MS and JB (figs. 26, 27). Both facts can probably be ascribed to the earlier location on contours which are globally declining, cf. section B.3., which leaves plenty of space for a significant fall to be performed, without straining the speaker's lower Fo limit.

Although the purpose here is not to shed light on such theoretical issues as focus scope, theme/rheme distribution, reference, default location of sentence accents, etc., I do feel tempted to ask why a contextually coaxed final focal accent, in the German prosodic system, is permitted to be so much weaker acoustically and perceptually than non-final ones (and weaker, too, than in Stockholm and Bornholm, cf. Thorsen 1988a) - and why do final foci go prosodically unsignalled in the Danish variants? If final position per se is rhematic or highlighting, which is a common enough assumption, then why do German speakers not uniformly omit any prosodic, focal

singling out of final elements? And is German syntax so significantly different from Swedish and Danish, respectively? That is not a reasonable assumption, and I think that linguists and phoneticians will probably have to end up accepting that some languages are simply more prosodically expressive than others.

The data presented here are not entirely in accordance with Bannert (1985) (or with Bannert and Thorsen 1988). Firstly, default and focal accents are not distinguished in his (our) nomenclature. Both are subsumed unter the heading 'nucleus, main accent, Satzakzent'. Be that as it may, but Satzakzent is said to be compulsory, which is contradicted by the present data. JoW is the only one to invariably produce final default accents; and even contextually invited final focal accents may occasionally be missing. One might argue that in monitored speech like this, speakers will not always behave according to their normal habits - and undoubtedly this is a valid objection. For instance, the normal answer to most of the probing questions here would not be in terms of a complete sentence, but rather more elliptical, like 'Who has a sister called Kamma? - Torben does'; or 'Do you know where Kamma was born? - She's from Padborg', etc., etc. However, to this objection I will counter that all the speakers, from all the towns I have worked with have been subjected to the same conditions, and they did react differently between groups and in most respects consistently within groups. Surely, this must have some bearing on their different prosodic systems. Also, Bannert's (1985) material was, in this sense, just as 'unnatural' as the present one. And yet results differ.

3. DURATION

It is apparent from the previous figures, that utterances with a final focal accent are generally shorter than isolated utterances (whether these latter ones are produced with or without a default accent). Of course, this difference might be due exclusively to the difference in condition: final focal accents occur in utterances which are final in a larger textual context, which in itself might induce a difference in utterance duration (abbreviation of non-isolated utterances).

The durational data presented here does not lend itself to any statistical treatment, because of its disparity and scarcity, but a trend can at least be observed. The speakers fall into three groups: I: MS and JB who produced all four possible variants (isolated utterances (a few) with and without DA, utterances from context with and (a few) without final FA; II: JoW (who only produced utterances with DA and FA); III: HS, ES, PBP, AS (who only produced utterances without DA and without final FA). To make the durational data comparable across speakers, a normalization is required. The average total duration of the isolated, -DA edition of each utterance is set at 100, and other sentences adjusted proportionately. JoW ("II") had no isolated utterances without DA, so when the

average normalized total duration of isolated utterances with DA by group I had been found (101.4), that was the value assigned to the same utterances by JoW, and his utterances from context were calculated to this proportion.

Figure 8 presents the results. The number of sentences behind each average is given in raised numerals. For groups II and III there are generally 6 items behind the average of each of those sentences that constitute the basis for the conversion, but that cannot be so for group I, where the sum of items behind the same utterance with and without DA, and with and without FA, respectively, does not exceed 6. Granted the reservations which are due to the relative scarcity of +DA and -FA data in group I, the following statements can be made. Putting an utterance into context (in text final position) will abbreviate it by about 4%, compare full and broken line in groups I and III. Give an isolated utterance a default accent, and it is very slightly lengthened (though I doubt whether the difference of 1.4%, group I, would prove to be statistically significant - it seems just as likely that the default accent has no consistent consequences for the duration of an utterance). Utterances with a final focal accent come down to about 90% of the duration of isolated utterances (dotted lines, groups I and II). The context is responsible for about 4% of the abbreviation, the remaining 6% must be due to the focal accent. This figure tallies with what I found with Bornholm and Stockholm speakers. Note, however, that (the more explicit) default accents would also shorten the utterance in those regions, but only about 3.5%. The abbreviation due to a final focal accent is mainly due to an accelerated prelude, cf. figure 9. I measured the duration of the prelude (more accurately: I took down the time coordinate of the last Fo measuring point in the prelude, which actually excludes its final consonant), and held that up against total duration, after a normalization procedure as described above had been performed. Only data from JoW, MS and JB are relevant here. It appears that the duration of the final word itself, as expressed in the durational units which result from the normalization procedure, varies very little across conditions (between 35.6 (+FA) and 36.8 (+DA)). Accordingly, it is the prelude which is shortened under final focal accent, and - consequently - the final, accented word takes up a larger proportion of the utterance, cf. the percentages in figure 9. This tallies well with the results from Bornholm and Stockholm.

4. CONCLUSION

The two southern Danish regions do not have default accents at all, whereas in German (Standard as well as Flensburg) they are optional, i.e. one speaker will apply it invariably, another will just as invariably leave it out, and others produce occasional default accents. The one Flensburg speaker, who produced rather few default accents, cannot of course justify generalizations about Flensburg speech, except to say that

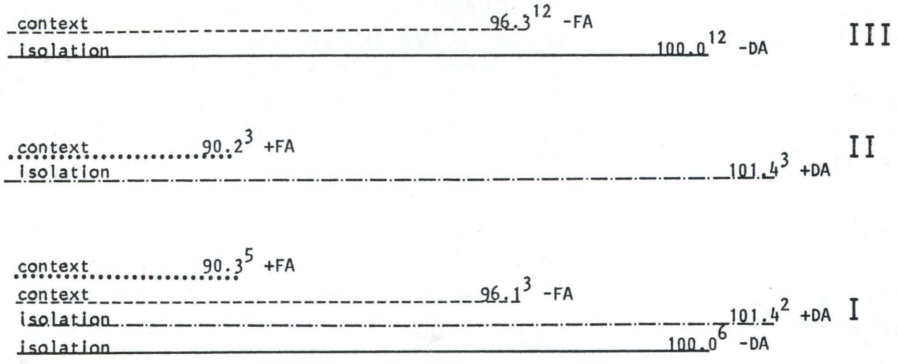


Figure 8

Normalized duration of utterances produced in isolation and in context with and without default and focal sentence accents, respectively, as indicated. Three groups of speakers: I comprises MS and JB, II consists only of JoW, and III contains AS, HS, ES, and PBP. See further the text.

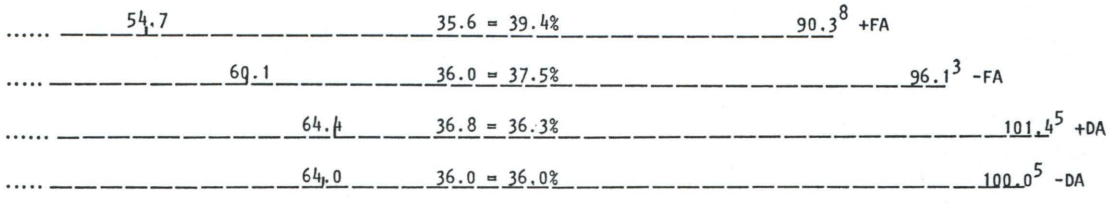


Figure 9

Normalized average durations of utterances by JoW, MS, and JB, with and without final default and focal sentence accents, as indicated. See further the text.

default accents there are not compulsory. - Focus is signalled - in the Danish regions - exclusively by stress reduction of the succeeding passage, i.e. the focussed item carries neither different nor larger Fo movements than when un-focussed. This stress reduction (consequently) never applies when the rhematized item is final, and it is optional in non-final positions, with a preference for initial focus signalling. In the two German varieties, focus signalling is a sentence accent proper (but see above about the relative perceptual weight in non-final and final positions), and it is - roughly speaking - compulsory, though final focal accents are occasionally omitted, by those same speakers who did not invariably produce final default accents.

Default and final focal accents have different consequences for the durational relations within an utterance, a focal accent will accelerate its prelude and thus take up a proportionately larger part of the utterance, but as far as the Fo course is concerned, no consistent differences between focal and default accents were observed. This last aspect differs from results from Bornholm and Stockholm, where focal and default accents were found to be somewhat different both with regard to durational relations and with regard to Fo.

B. SENTENCE INTONATION

The central issue here is how phenomena associated with utterance function, in casu declarative and interrogative, are signalled prosodically, but juncture, resetting of the intonation contour, and speaker pre-planning will also be treated. It is a trivial observation that utterances which syntactically are questions may not function so pragmatically, and even if their function is interrogative, they may not, in the presence of syntactic cues, have any prosodic question markers. Likewise, utterances which syntactically are declaratives may not function as such, and the pragmatic function may (or may not) be accompanied by prosodic signals. To simplify matters, when I do not need to be more specific, I shall talk about (syntactic) declaratives and questions or interrogatives and about (prosodic) terminals and non-terminals. The declaratives in this material actually functioned as such, and were all produced as terminals (excepting a few deviant renderings, due to "list-reading" effects). The questions (including all those which probed the 'Kamma'-utterances) likewise functioned as such (at least within the pseudo-communicative framework in the experiment), but were not necessarily, by all speakers, produced as non-terminals. However, sufficient non-terminals exist to make a comparison with terminals meaningful.

The criteria for categorizing signals to terminal and non-terminal intonation, respectively, as local versus global, are as follows: (1) is the last stress group qualitatively or quantitatively different from preceding ones, ceteris paribus (i.e. final and non-final stress groups should be compared under identical accentual conditions and in prosodically similar utterance types)? A "yes" implies local signalling.

If "yes", does the difference reside (a) within the stressed syllable (a change in the magnitude of its movement and/or in the direction of movement) and/or (b) in the course of the post-tonic syllables? (2) Is the last stress group discontinuous with the course described by the prelude? I.e., will it be positioned outside (whether below or above) the grid which envelops the preceding part of the utterance? A "yes" implies local signalling. Of course, (1) and (2) are not mutually exclusive. Conversely, if the final stress group does not deviate in any principled way from preceding ones, and if it forms the termination of one smooth overall course (which varies in terminals versus non-terminals), intonation signalling will go down as global. Local and global signals may co-exist, if final cues are preceded by global ones.

In the long declarative, intonational phrasing is expected to occur, which may be accompanied by resettings of the contour (cf. Thorsen 1983, 1988a, 1988b). This will disrupt the smooth course of top- and/or baselines (the connection of Fo maxima and minima, respectively).

The data to be dealt with here are figures 1-7 (the isolated utterances), figures 10-18 (the long declarative), and figures 19-27 (wh- questions).

1. LOCAL VERSUS GLOBAL

Figures 10-18 display the long declarative utterance. Cursory inspection of figs. 1-7 and 10-18 would put down Tønder subjects (1, 10-12) as global speakers: there is nothing to distinguish the last stress group from preceding ones (except, of course, when an initial or medial focus indication downgrades its Fo pattern). If anything, its movement is less extensive. (One exception is AS's long utterance, fig. 10, where the last stressed vowel movement is falling.) The utterance as a whole describes a smooth fall, made only slightly bumpy by the resetting at the arrows, with AS and KaP. This fall is carried primarily by the Fo maxima, i.e. by the stressed syllables. That is most apparent in figs. 10-12: the fall through the post-tonics is so steep that when the stress group contains two or more post-tonics, its offset will almost hit the bottom of the speaker's range, irrespective of position in the utterance, which makes the baseline, the connection of Fo minima, only very weakly declining.

Contrarily, the three German subjects (5-7, 16-18) - with no apparent distinction between JoW and MS versus JB in this respect - have clear local traits: the prelude floats well above the floor, though with a clear downwards trend, while the last stress group twists its stressed vowel movement downwards and performs a steep fall (i.e. steeper than in preceding stress groups) to the bottom of the range. With MS and JB I am certain that the last stressed word in the long declarative, 'Kassel', was neither more nor less prominent than preceding words (whereas it carries a default accent with JoW). So again,

the fall per se cannot be a manifestation of sentence accent, cf. section A.2.b above and see below.

The Sønderborg subjects (2-4, 13-15) appear intermediate between Tønder and German.

Among the questions (figs. 19-27), only JoW (25) is conspicuous by his falling-rising final post-tonic. - Note that resetting of the contour occurred before the first PP with AS (19), JC (20) and ES (23), and possibly also with HS (22), although it is impossible to distinguish between resetting and a non-declining intonation contour here, when only one prosodic stress group precedes. Furthermore, higher intrinsic Fo in 'Tøn-' than in the surrounding low stressed vowels may account for part of the apparent upstep. Note also that 'fra' which syntactically belongs with 'Tønder' teams up prosodically with the preceding stress group, i.e. the syntactic and prosodic boundaries do not exactly coincide: the prosodic boundary is located immediately before the stressed vowel, after the syntactic boundary, or - in other words - the stress group patterns cut across the syntactic boundary. This pattern is repeated with the Danes in the long utterances, with a few possible exceptions, see 2. below. This is entirely in line with previous results, cf. Thorsen (1983).

Figures 10-18

Average fundamental frequency tracings (logarithmic display) of a long terminal declarative utterance by three Tønder speakers (AS, JC, KaP), three Sønderborg speakers (HS, ES, PBP), two Standard German speakers (JoW, MS) and one Flensburg speaker (JB). The stressed vowels are drawn in thicker lines. The number of items behind each average is given in the upper right of each figure. Zero on the frequency scale corresponds to the same values as indicated in figures 1-7, and 20-21, respectively. Note that the time scale is compressed compared with previous figures. Arrows indicate places where I have perceived prosodic boundaries.

Figures 19-27

Average fundamental frequency tracings (logarithmic display) of a question with question word, succeeded by an echo-question. Three Tønder-speakers (AS, JC, KaP), three Sønderborg-speakers (HS, ES, PBP), two Standard German speakers (JoW, MS), and one Flensburg speaker (JB). The stressed vowels are drawn in thicker lines. The number of items behind each average is given in the upper right of each figure. Zero on the frequency scale in figures 19 and 22-27 corresponds to the same values as in figs. 1-7, respectively. Arrows indicate places where I have perceived prosodic boundaries.

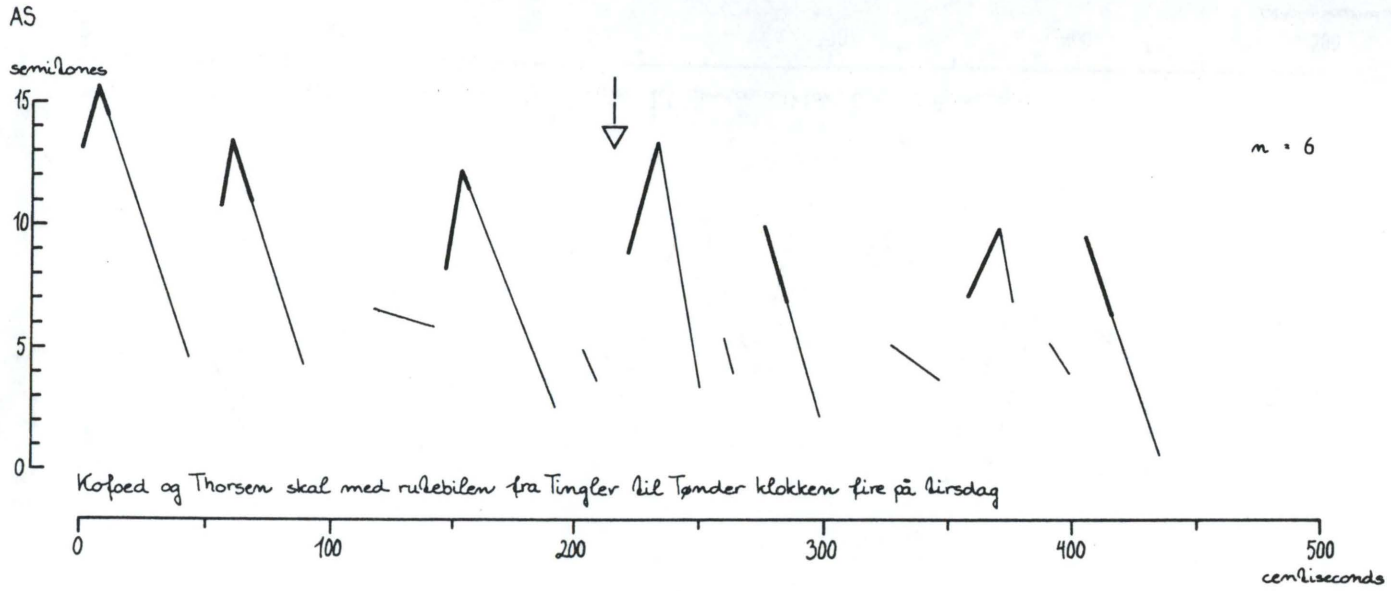


Figure 10

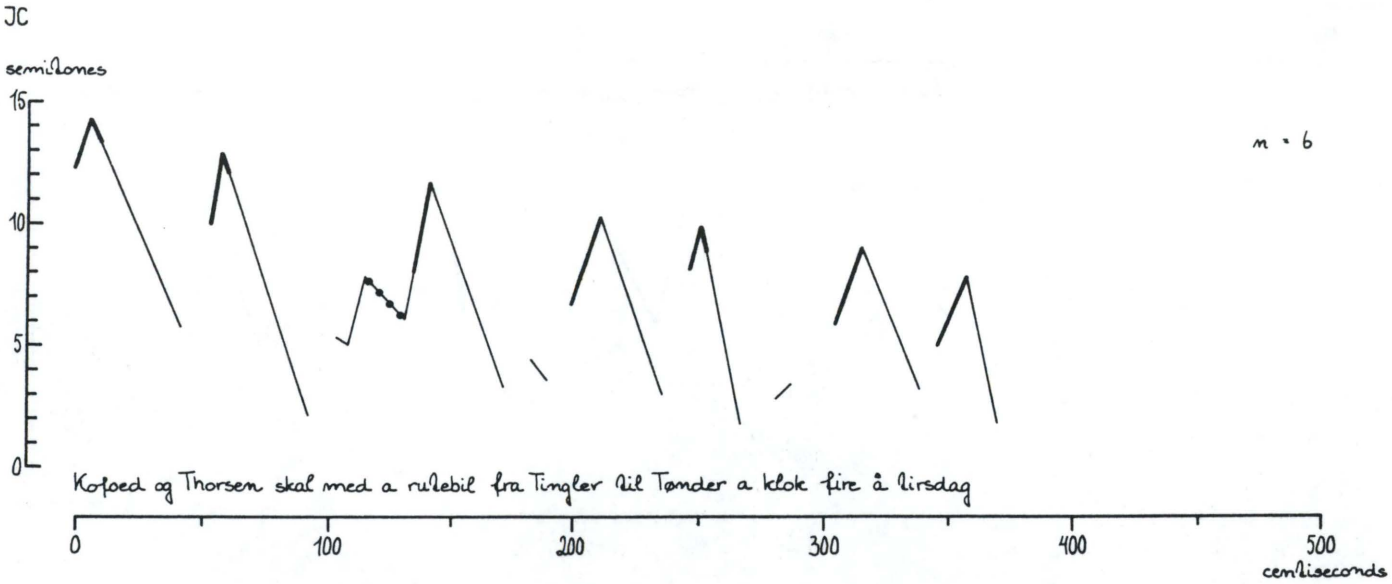


Figure 11

Note that 'med' has secondary stress (dotted here)

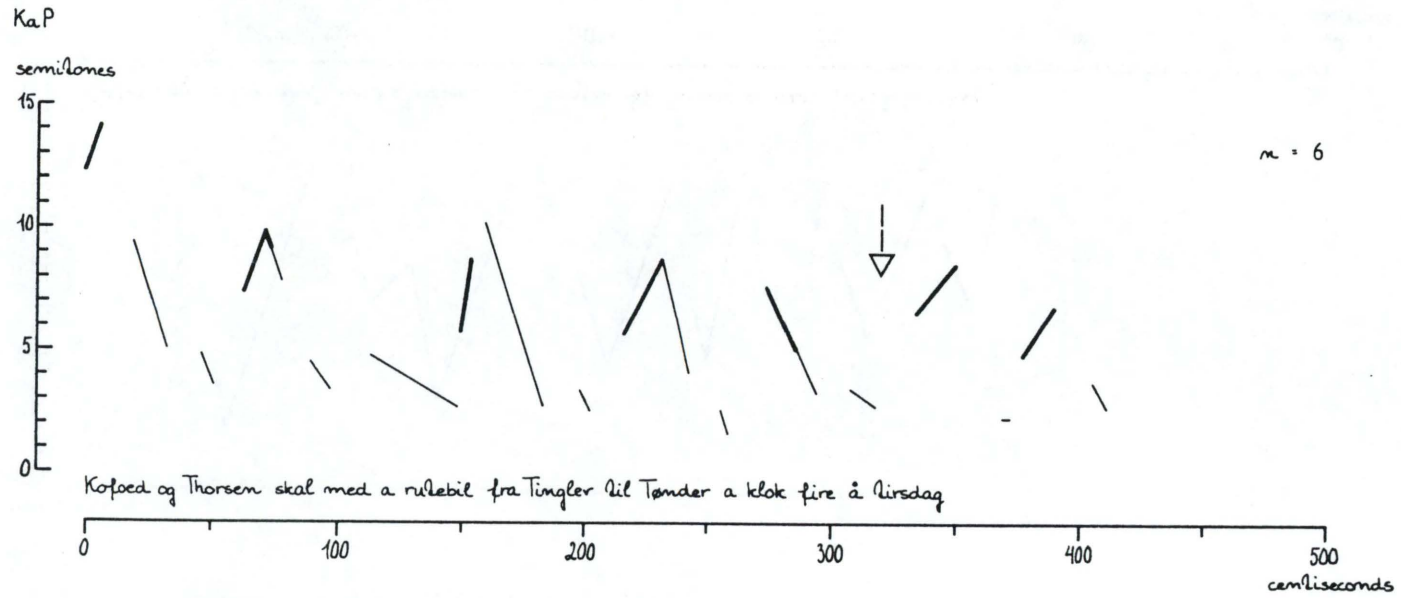


Figure 12

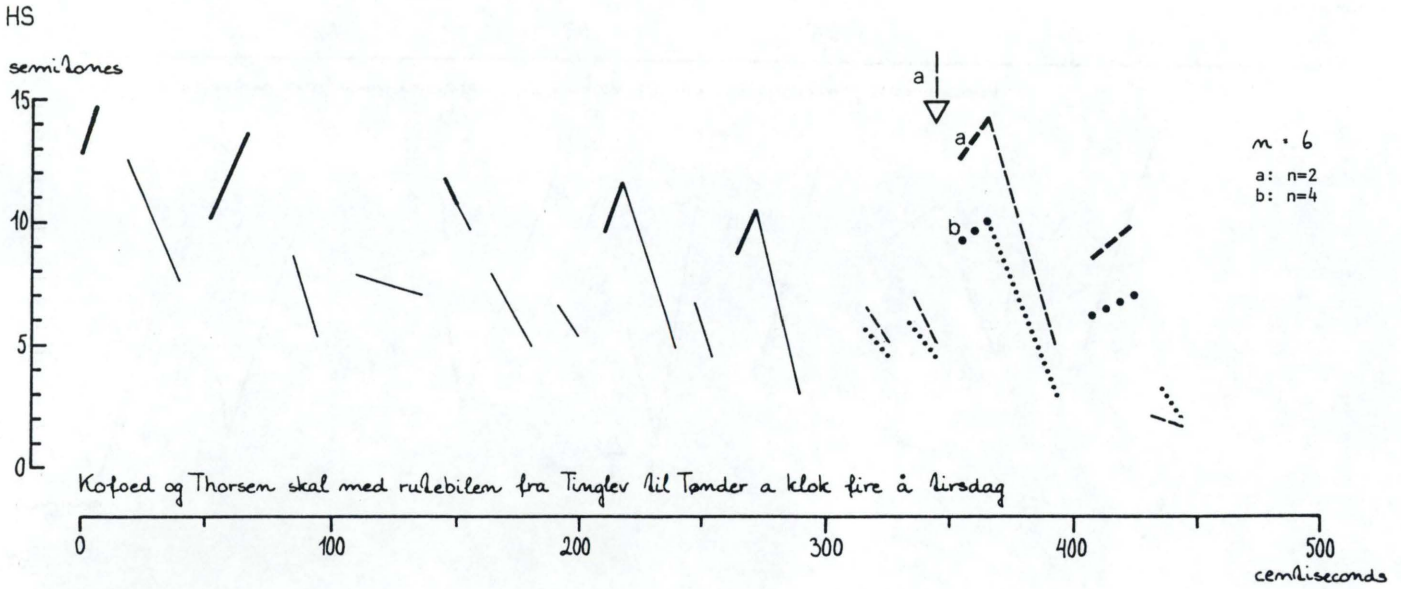


Figure 13

ES

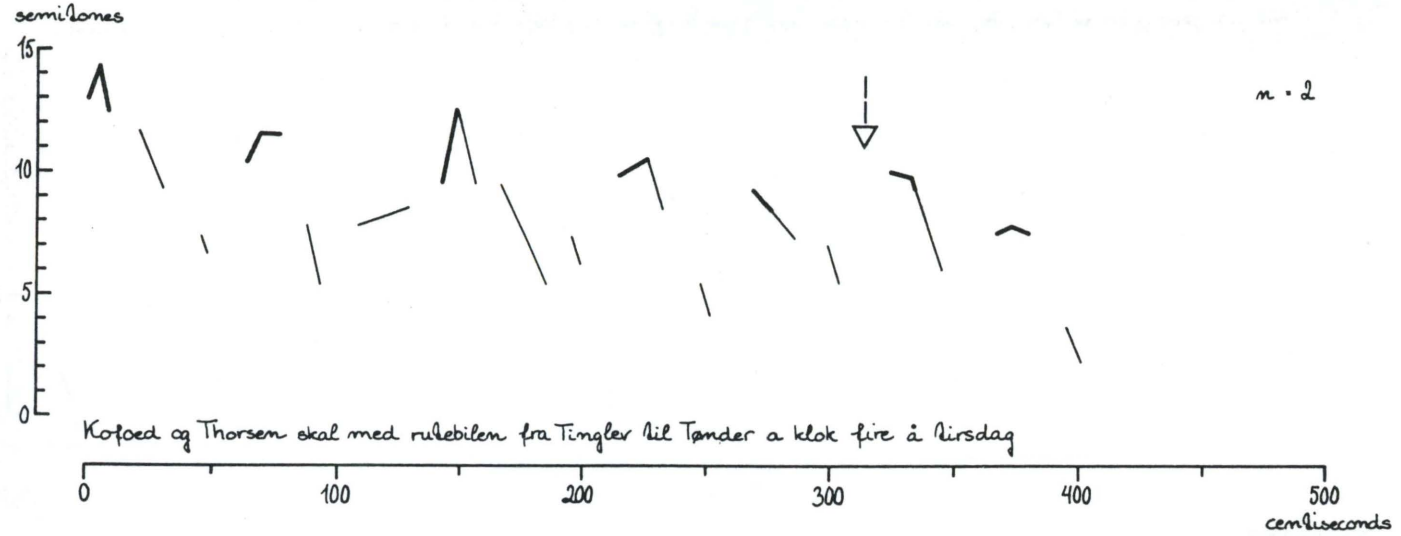


Figure 14

PBP

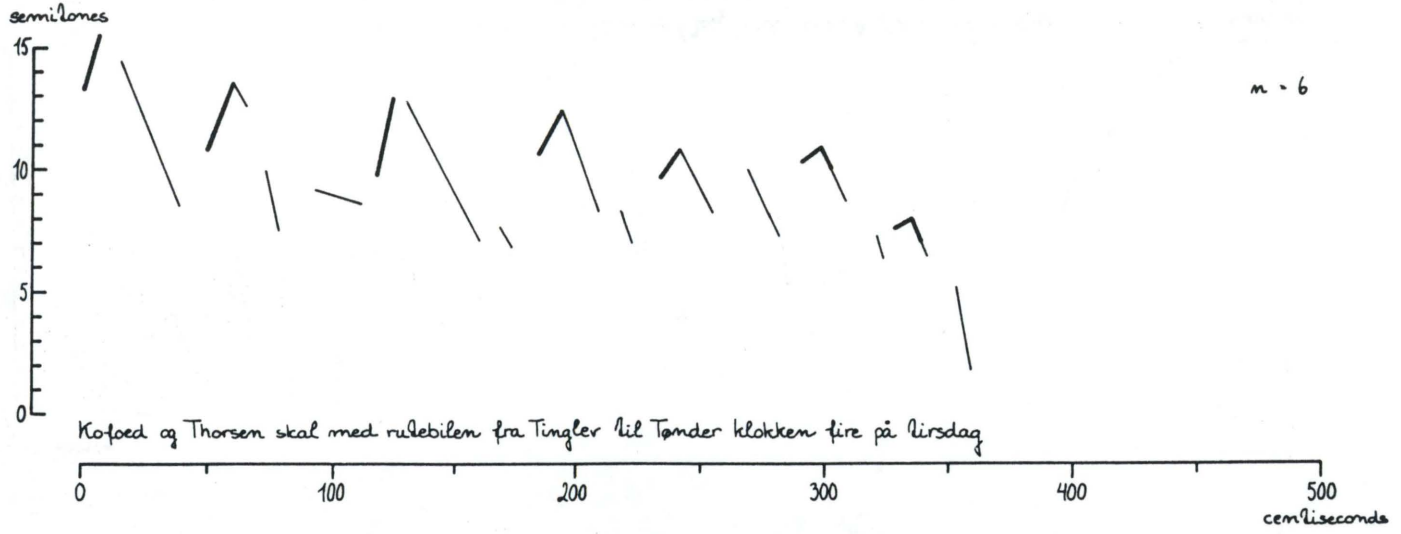


Figure 15

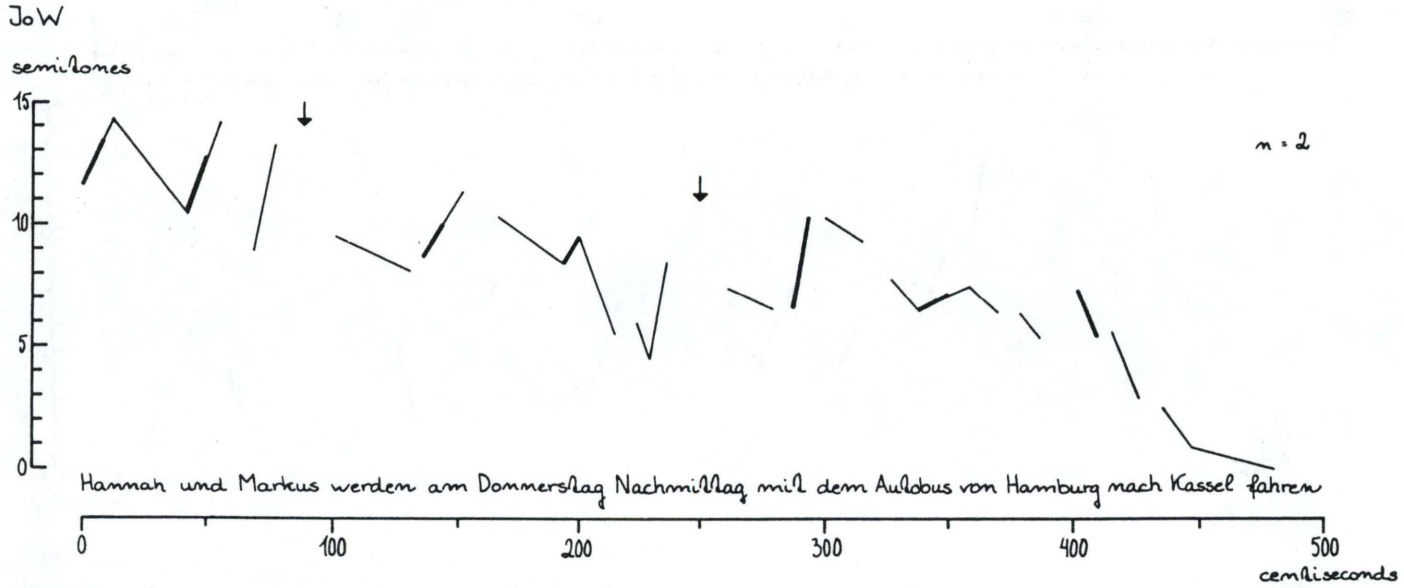


Figure 16a

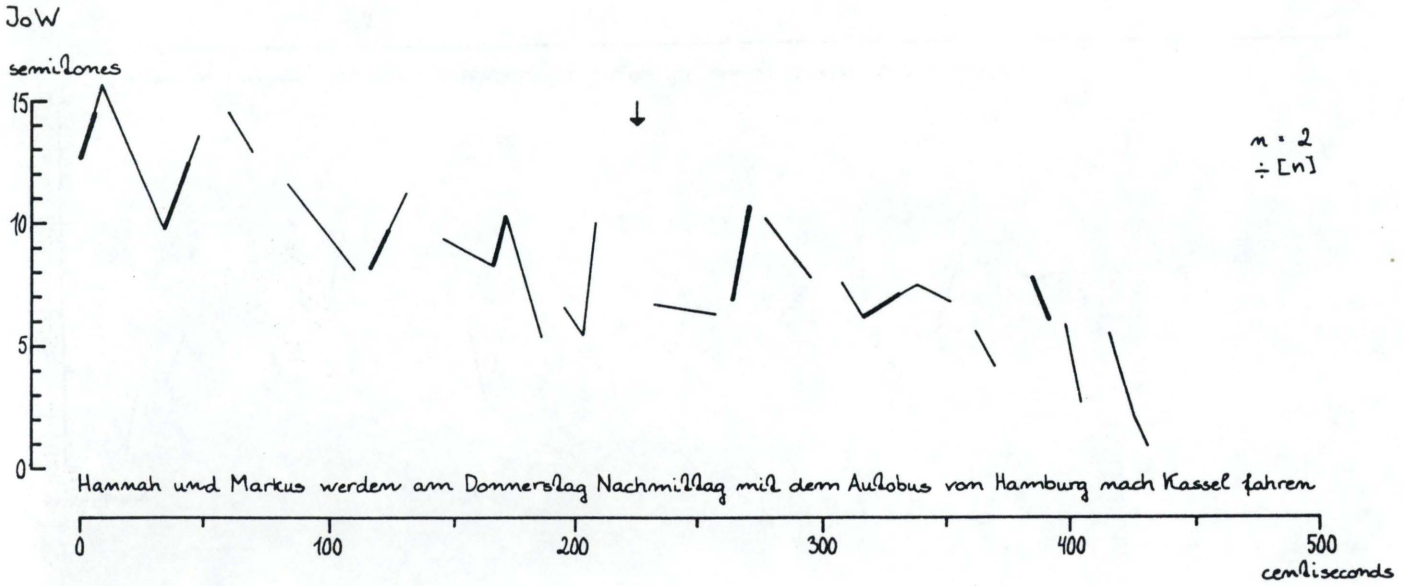


Figure 16b

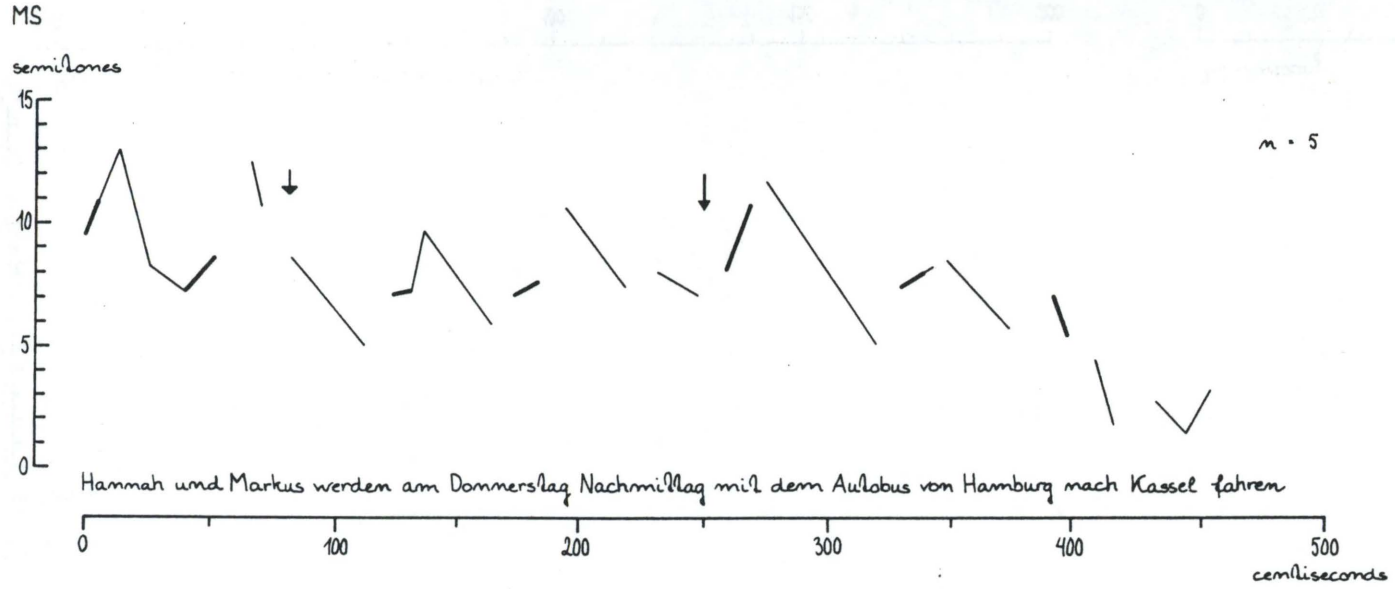


Figure 17

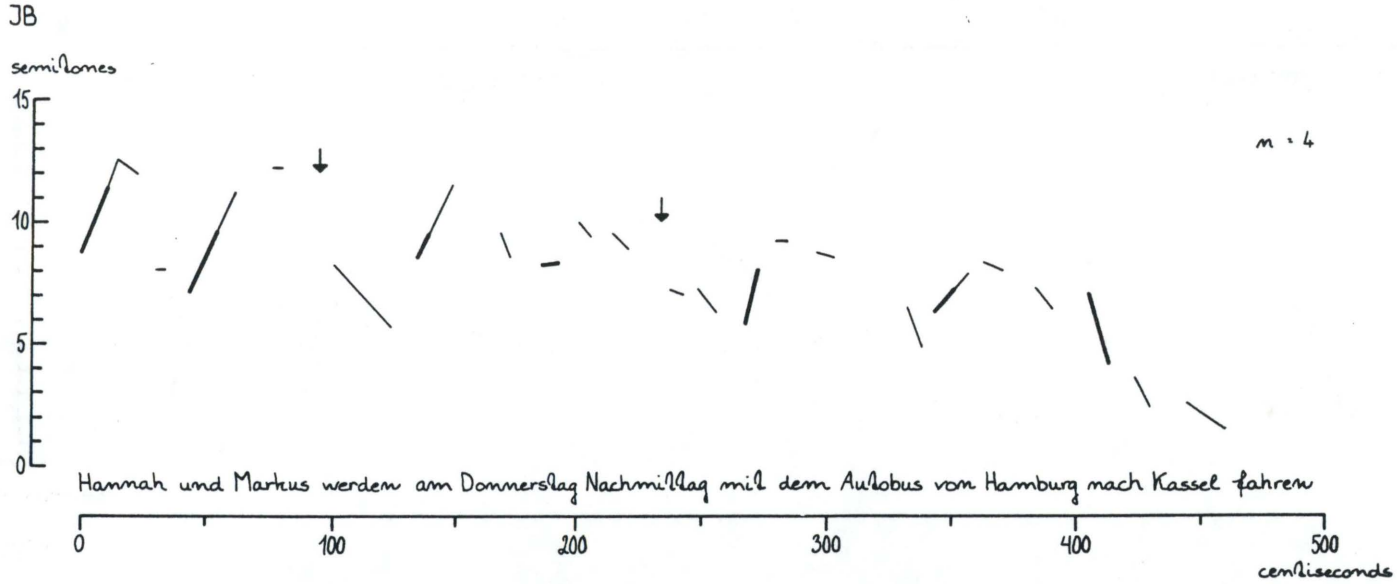


Figure 18

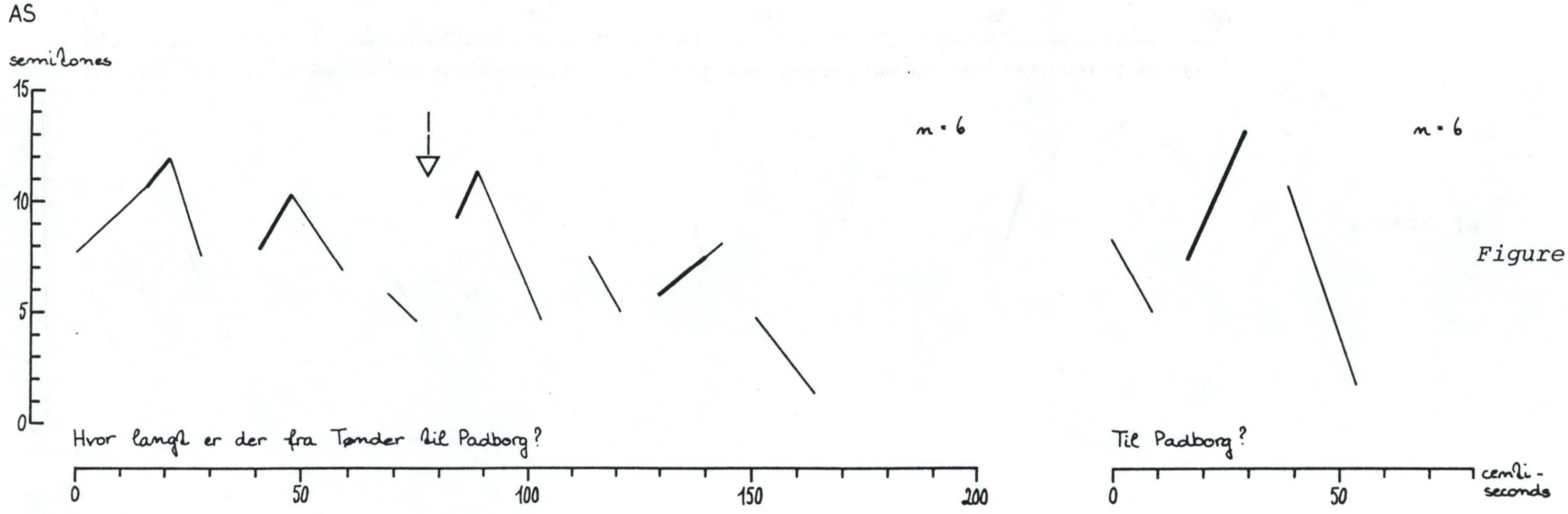


Figure 19

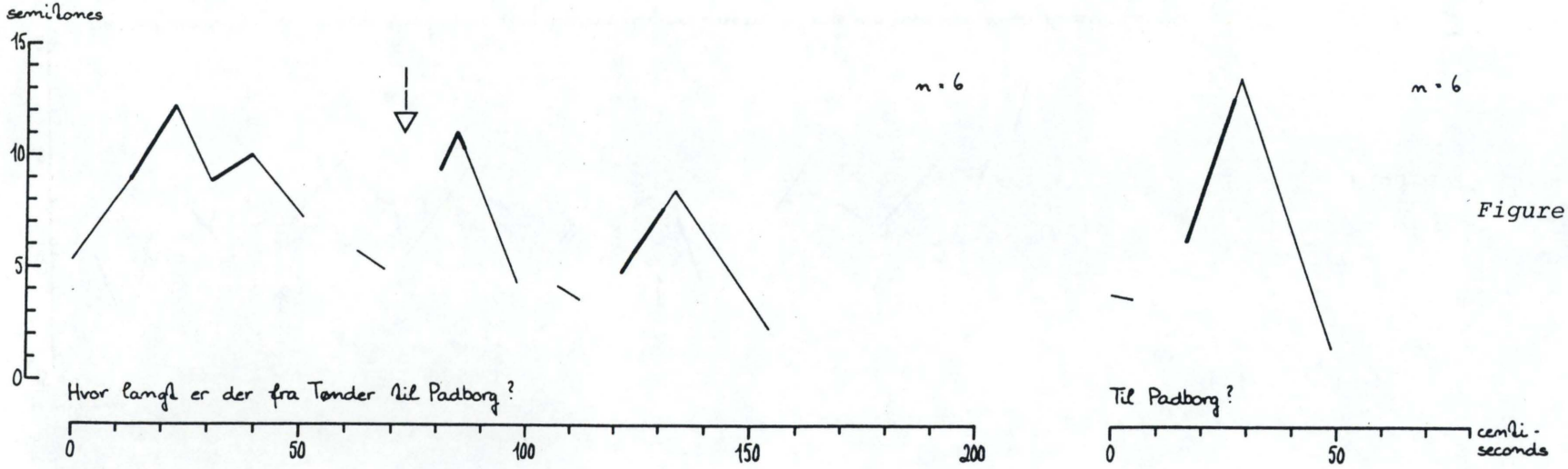
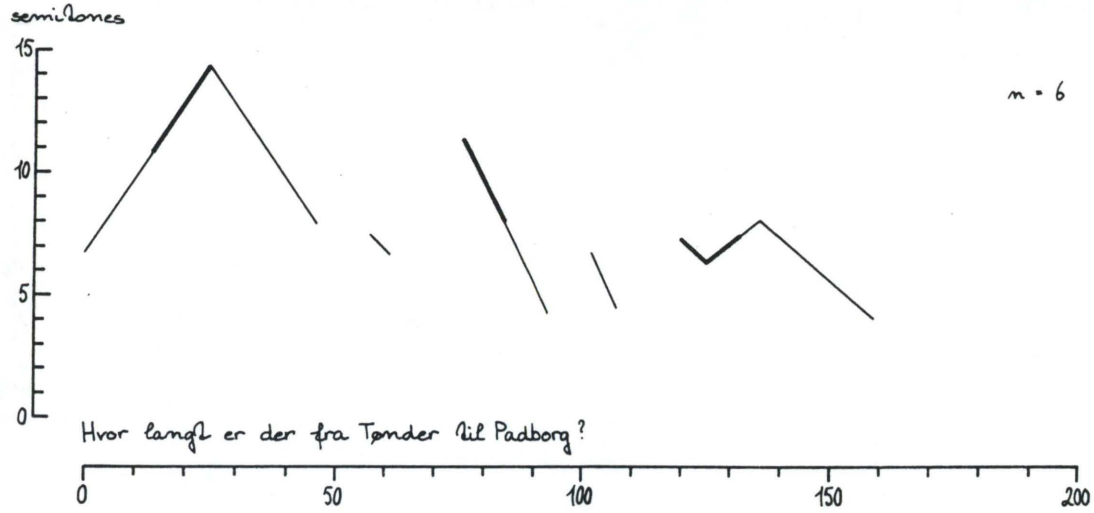


Figure 20

KaP 0 semitones = 132 Hz



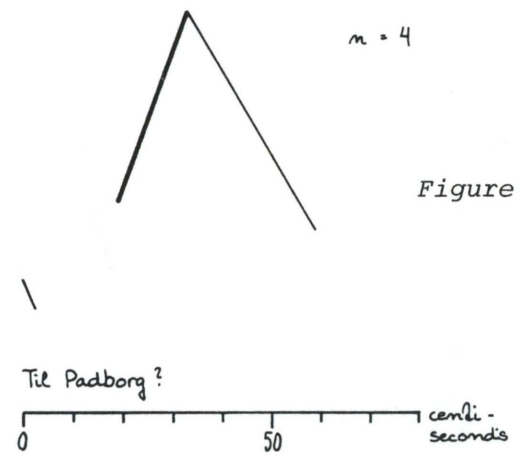
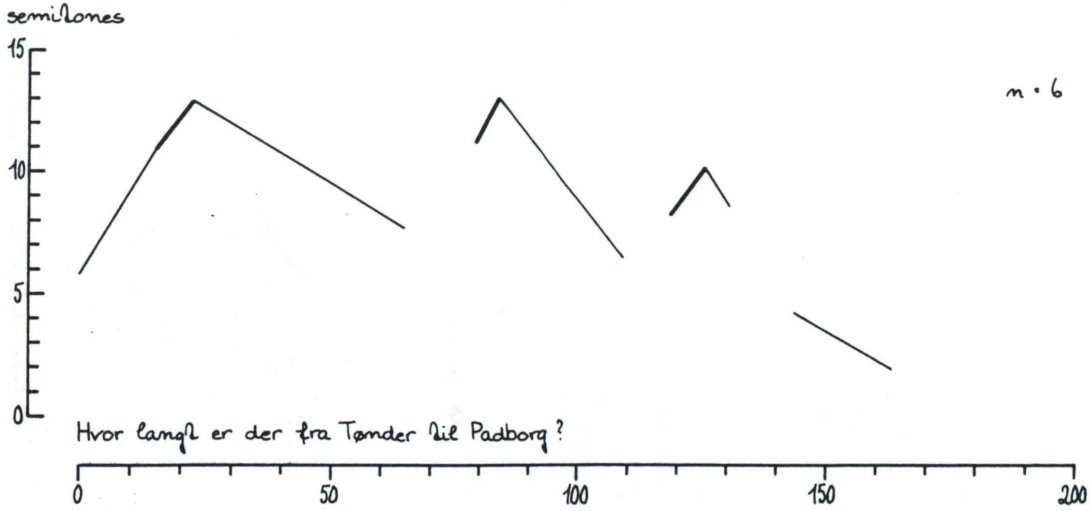


Figure 21

HS



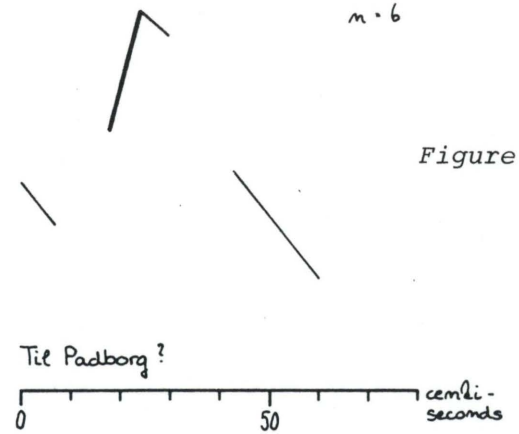


Figure 22

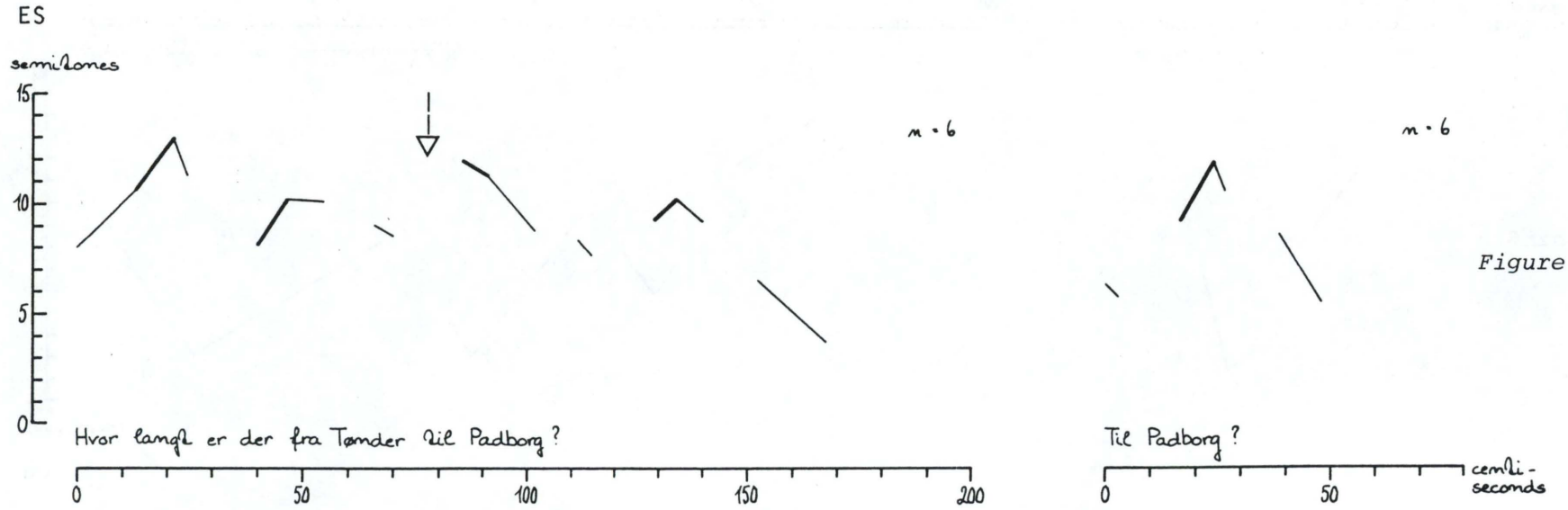


Figure 23

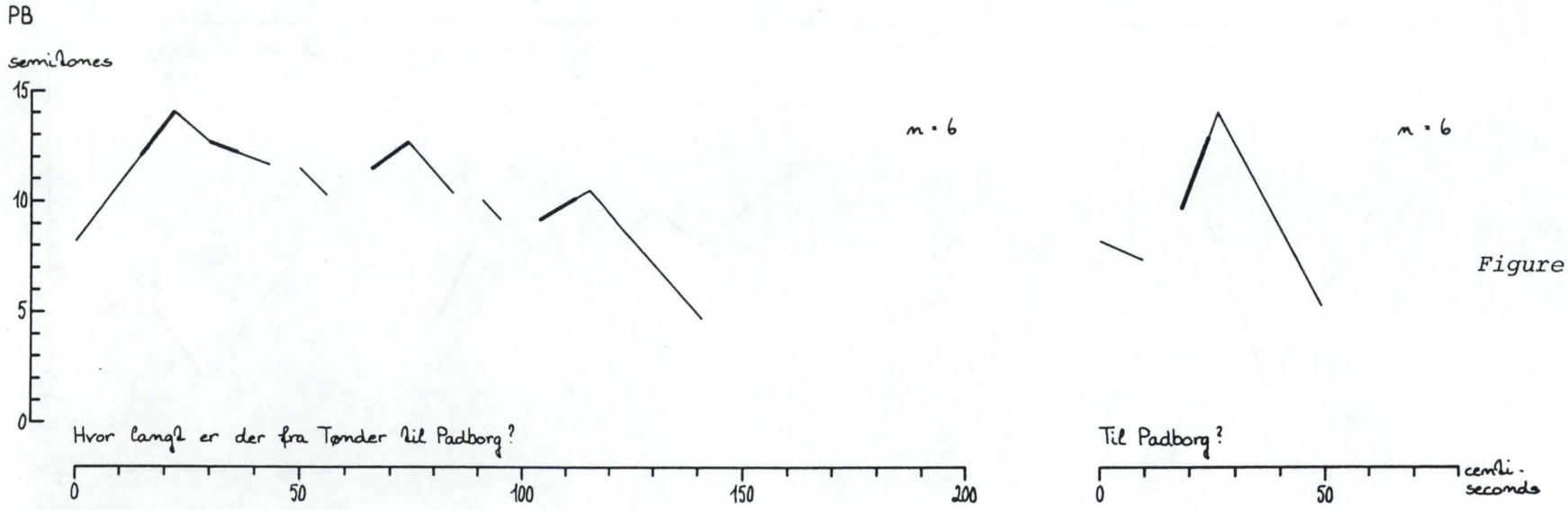
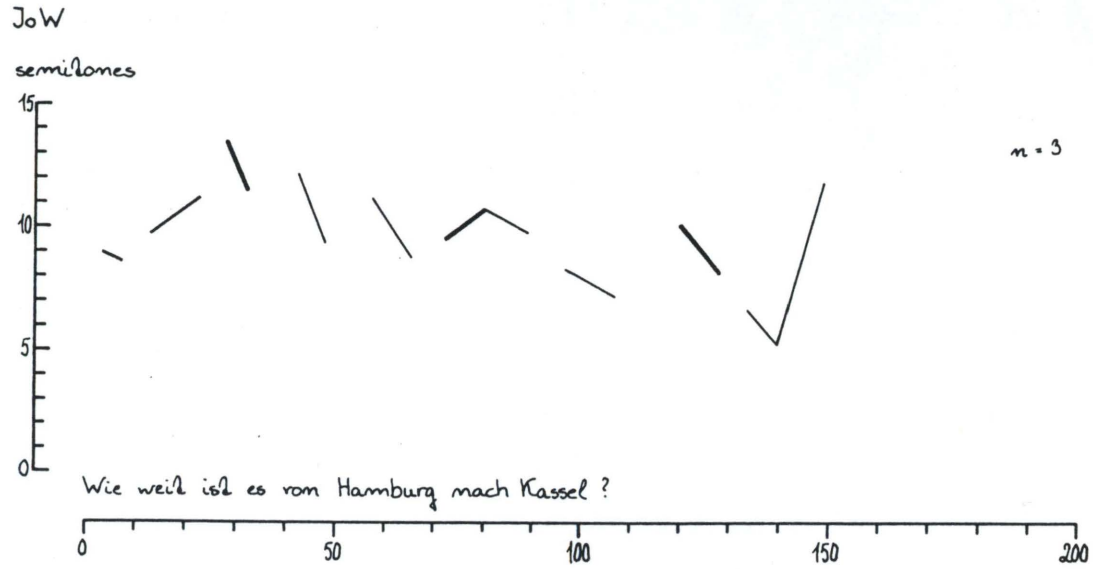


Figure 24



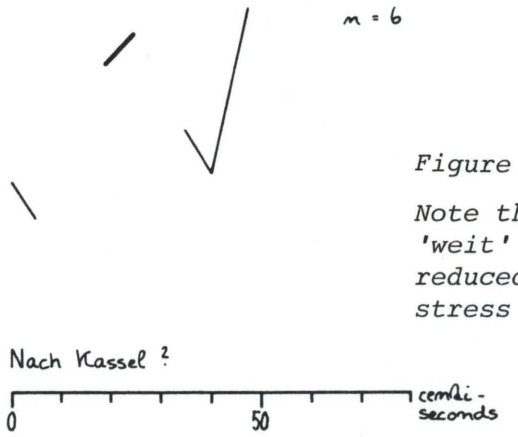
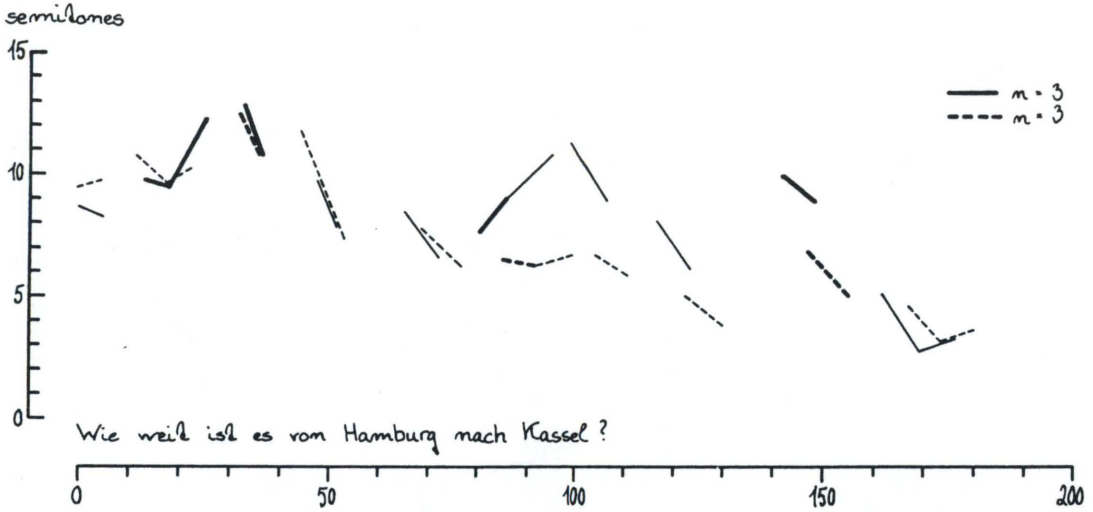


Figure 25

Note that 'weit' has reduced stress



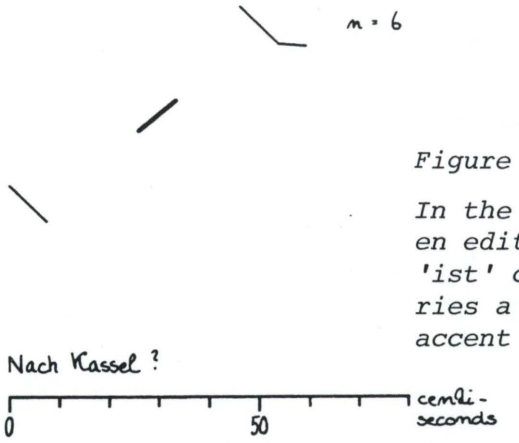


Figure 26

In the broken edition, 'ist' carries a focal accent

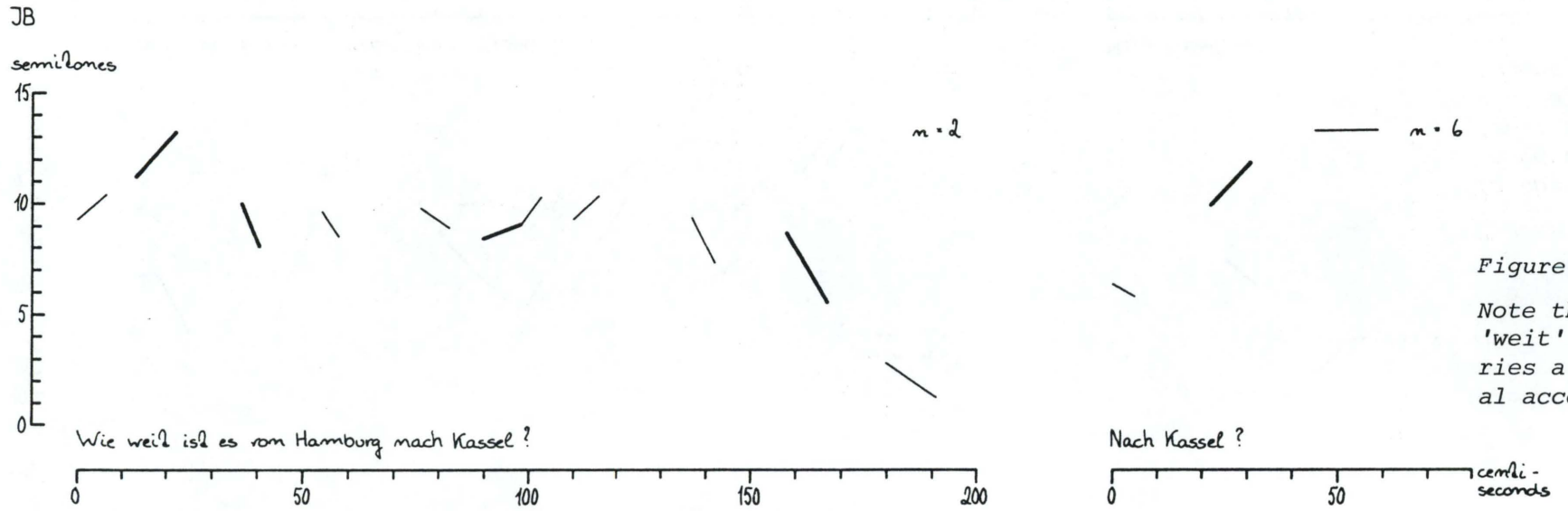


Figure 27

Note that 'weit' carries a focal accent

A closer scrutiny of figs. 1-7, 10-18 and 19-27 and the various locality markers resulted in Table VIII, with the following notes:

(1) This factor is connected with the relation between the last stressed and post-tonic vowels, of course.

(2) Comparing this with the other Kamma-utterances, it is obvious that it is not the last stressed vowel which is (deviantly) lower, but the middle 'søs-' which onsets higher, maybe due to an intrinsic effect from the preceding /s/.

(3) At least not if we take the resetting into, or rather out of, account.

(4) Note that the fifth stressed vowel, before the resetting, is falling.

(5) The final downstep in these utterances is admittedly not large, but if you compare with AS, it is clear that the trend is different here: two nearly level stressed vowels and one which is lower than both by 2-3 semitones, cf. also Table IXa below.

(6) In the same way, the interval between the first and second Fo minimum is smaller than between the second and third.

(7) The extremely low onset of 'An-' disturbs the picture, but if you look at the same utterance from the context which invited final focus it is apparent that the same tendency prevails as with HS's and ES's "K_i"-utterance.

(8) The last Fo minimum may not be discontinuously lower than preceding ones but nevertheless, the single final post-tonic performs more of a fall than does the post-tonic in the initial stress group.

(9) If you consider only the nearest preceding Fo minima, then the last one is unambiguously discontinuously lower, less unambiguously so, if all of the preceding baseline is included.

(10) On the contrary, it is rising.

(11) 'ton und' is exceptionally extensive, but compared with the second and third stress groups, the final fall is larger. Maybe the more extensive fall could be a signal for the syntactic boundary, i.e. for a dissociation between '-ton' and 'und'.

(12) Its movement is bi-directional: falling-rising.

(13) Only the full-line edition is considered.

(14) If it is not larger, the last movement is steeper.

(15) JB had a sentence accent on 'weit', cf. the suppressed patterns on the second and third stress groups.

(16) JoW had a sentence accent on 'ist'.

Table VIII

Presence (+) or absence (-) of four features of local sentence intonation signalling in (the average of) four declarative and one interrogative utterance by nine speakers. "Ki, Km, Kf" designate the isolated utterances with 'Kamma' in initial, medial, and final position, respectively, "L" designates the long declarative, "Q" the question. The information is read off from figures 1-7, 10-18 and 19-27.

		AS	JC	KaP	HS	ES	PBP	JoW	MS	JB
The final stressed vowel changes direction:	Ki	-			-	-	-	+	+	+
	Km	-			-	-	-	+	+	+
	Kf	-			-	-	-	+	+	+
	L	+	-	-[4]	-	-	-	+	+	+
	Q	-	-	-	-	-	-	+[16]	+[13]	+[15]
The final stressed vowel is discontinuously lower than preceding stressed vowels:	Ki	-			+[5]	+[5]	+	-	-	-
	Km	-			+[5]	+[7]	+	-	-	-
	Kf	-[2]			+[5]	+[5]	+	-	-	-
	L	-	-	-	+(b)	-	+	-	-	-
	Q	-[3]	-[3]	-	-	-	-	-	-	-
The final post-tonic Fo minimum is discontinuously lower than preceding Fo minima:	Ki	-			+[6]	?+[8]	?+[8]	+	+	+
	Km	-			-	-	-	+	+	+
	Kf	-			-	?+[8]	?+[8]	+	+	+
	L	-	-	-	-	+[9]	+	+	+	+
	Q	-	-	-	+	+	+	*[10]	+	+
The final stress group performs a larger and/or steeper Fo movement:[1]	Ki	-			-	-	-	+	+	+
	Km	-			-	-	-	+[11]	+[11]	+[11]
	Kf	-			-	-	-	+	+	+
	L	-	-	-	-	-	-	+	+[14]	+
	Q	-	-	-	+	+	+	*[12]	+	+

Table VIII establishes Tønder speakers as having no local prosodic cues to sentence intonation, whereas Sønderborg and German speakers do, and - glossing over minor variations - Table VIII could be summarized thus:

	Tønder decl./interrog.	Sønderborg decl./interrog.	German decl./interrog.
The final stressed vowel changes direction	no/no	no/no	yes/yes
The final stressed vowel is discontinuously lower than preceding ones	no/no	yes/no[1]	no/no
The final post-tonic Fo minimum is discontinuously lower than preceding ones	no/no	yes?/yes	yes/yes[2]
The final stress group performs a larger and/or steeper Fo movement	no/no	no/yes[1]	yes/yes[2]

(1) This is to do with the way Sønderborg speakers control the difference between terminals and non-terminals, by the level of the last stressed vowel - see further section 2. below.

(2) unless it is rising, as with JoW.

Sønderborg and German differ in the nature of the final cue: with the Germans, the final stressed vowel is still acoustically within the range established by preceding ones, though it is falling, and the very final "low" is considerably lower than any preceding ones. With Sønderborg, the last stress group as a whole, without any further qualitative or quantitative change, is positioned somewhat below the range established by the prelude, in the terminals. This lowering is - if not suspended - at least diminished in the non-terminal. I would say that, on the whole, the final cues are weaker, both perceptually and acoustically, in Sønderborg than in German. This fact does not, of course, make a terminal perceptually ambiguous: if we consider terminal intonation the unmarked case (whether generally or when accompanying certain syntactic sentence types) and non-terminal intonation the marked one, then the absence of specific

non-terminal cues is naturally sufficient to secure identification.

A comment about rising versus falling stressed vowel movements: it is entirely possible that these movements are too brief (both in time and in frequency span) to be perceived as movements, cf. Rossi (1971, 1978) and Thorsen (1979), but it would take separate perceptual experiments to find out. Assuming that the stressed vowels, presented to listeners in isolation, would be perceived as levels or points, rather than movements, there are still two possibilities for their production: (1) there IS a separate voluntary gesture involved, though its acoustic result is not perceived accordingly (as a movement), or (2) stressed vowel rises and falls are the by-products of the planning and production of a larger scheme, i.e. the stress group pattern. I have taken the latter view in analyses of Standard Copenhagen Danish, cf. Thorsen (1980a, 1980b, 1982, 1984a). Under this assumption, the German stressed vowel falls in final position can be conceived of as an anticipation of, or shortcut to, the final "low", which would be consistent with the fact that stress groups before a non-terminal juncture have rising stressed vowels: they do not face a final low (cf. the next section). On the other hand: (a) stressed final falling vowels also characterize questions which are marked as such with a final fall-rise, or "high-low-high" if you like, where the lowness of the "low" is debatable, and (b) when the final fall, the low, is transposed to the left, as with medial and initial focal accents, rising (initially) and at least non-falling (medial) stressed vowels are encountered. I shall leave the issue at that, for the moment.

2. PHRASING/JUNCTURES AND RESETTING IN THE LONG DECLARATIVE

No speaker produced six repetitions of the long declarative without some form of perceptible phrasing at/near one or more of the major syntactic boundaries. This phrasing takes different forms and has different consequences for the Fo course.

AS (fig. 10) might pause after 'rutebilen' and 'Tønder', but comparing items with and without such pauses, I could establish that a pause as such has no consequence for Fo (and pauses are suppressed in this and all other figures). There is a clear resetting before 'Tinglev' and it is debatable whether there is not also one before 'fire'. With the stressed vowel representation I have chosen for the calculations in Table IXa (mid point, or maximum in bi-directional movements), 'fi-' is rather level with 'Tøn-', and I have considered the last four stresses to compose one intonational phrase. Thus, AS's long utterance consists of two prosodic phrases, each with its own declination, though subordinate to a grosser overall fall: the second phrase onsets and offsets at lower values than the first phrase (insofar as the phrasal contours are determined by the stressed vowels alone, i.e. the post-tonics carry no independent information about phrase and sentence intonation, they are predictable from the stressed syllables - see further

below about stress group patterns in section C.). This is in line with previous results about Copenhagen Danish and Næstved and Aalborg (Thorsen 1980c, 1987b, 1988a). Falling stressed vowels, though the exception rather than the rule before prosodic phrase and utterance boundaries - if AS, JC, and KaP are representative - is then one of the means at Tønder speakers' disposal to regulate the perceived relation between the stressed vowels and thus the perceived slopes within prosodic phrases, and their subordination to the overall contour. This would mean that it is not the falling movement as such which is planned and controlled but a lower (perceived) level of the stressed vowel. Of course, a lower perceived level - which according to Rossi (1971, 1978) would correspond to the frequency value at 2/3 of the distance from vowel onset - could also be attained from a physically rising stressed vowel, but its onset would have to be rather considerably lower in the three particular instances which are my concern here (two with AS, one with KaP). - JC (fig. 11) would most often pause after 'Thorsen' and again either before the time complement or in the middle of it, i.e. before the very last PP, 'på tirsdag'. Again, pauses as such have no consequence for Fo, and JC's sentence intonation is perfectly smoothly falling, with no distinguishable resettings of the contour. The sequence 'skal med' which seems to step up, sounds like 'med' has secondary stress. This perception of secondary stress could, however, also be due to segmental factors (a rather long vowel), and the disruption between 'Thorsen' and 'skal med', i.e. between NP and VP, may be a separate (optional) boundary cue: 'skal med' is reset to utterance or phrase initial unstressed syllable value, rather than being tagged on to the tail of the preceding stress group. - KaP (fig. 12) would generally pause before the time complement, but irrespective of pausing, she would slightly reset her contour at this point and precede the step-up with a falling stressed vowel as well. KaP is otherwise only remarkable for the very high onset of the contour, succeeded by an immediate 4-5 semitone drop to the second stressed vowel. I think this feature reflects an attempt to add some (clearly audible) liveliness to the rendering of otherwise dead-dull utterances, i.e. it should be put down as a stylistic variable. - Tønder speakers' behaviour is reminiscent of Aalborg (Thorsen 1988b), where in final position in the long declarative, the three speakers had pre-dominantly falling stressed vowels, as opposed to rising-falling ones in other positions and utterances. That apart, Tønder, Aalborg, Næstved and Copenhagen speakers' long declarative utterances can be described along the same lines, as having a globally distributed falling contour, which can be decomposed into a succession of individually slanting phrase contours, whose boundaries are marked solely by resetting, with no special pre-boundary cues (though with the possibility for Tønder and Aalborg speakers to produce the required perceptual lowering, in relation to preceding and/or succeeding stresses, by changing the direction of the stressed vowel movement). More particularly, unstressed syllables which are pre-tonic in the syntactic constituent whose first stressed syllable is being up-stepped or reset, will - more often than not - behave prosodically as post-tonic

to the stressed syllable preceding the syntactic boundary (see, e.g., AS: 'rutebilen fra Tinglev', KaP: 'Tønder a klok fire'), i.e. they will be continuous with the preceding rather than the succeeding stressed syllable.

HS's (fig. 13) two items with a very sharp resetting co-occurred with fairly long pauses, whereas the continuous contours were produced fluently, but note that this has very little consequence for the two syntactically pre-tonic syllables ('a klok'). ES (fig. 14) did not pause in the two otherwise acceptable items, and produced a slight resetting before the time complement. PBP (fig. 15) paused slightly before the time complement in every rendering, but is otherwise a perfect example of a long continuous, slightly declining prelude before the final fall. Downdrift/declination and resetting in contours which end with specific prosodic cues to terminality and juncture will be treated in section 3. below.

JoW (fig. 16a+b) paused once, MS (fig. 17) occasionally, after the time complement (and JB - fig. 18 - never paused), but the pauses as such have no consequences for Fo. Prosodic boundaries were perceived after the NP and the time complement with all speakers, although JoW omitted the NP/VP boundary in two cases (16b). There are different ways to signal the prosodic boundary: (a) JoW does so with a particular phrase-final Fo gesture, a rise-fall-rise, as opposed to the rise-falls of non-phrase-final stress groups, in the same way that he signals prosodically marked questions finally; but no resettings occur, i.e. the stressed syllables perform one long slow declination. Note that here the syntactic and prosodic boundaries coincide exactly, and the syntactically pre-tonic syllables ('werden am', 'mit dem') team up with the succeeding stressed syllable. The same can be said for MS and JB about syntactic and prosodic boundaries, but the boundary signal is different: (b) it consists in higher rises from the stressed to first post-tonic, and a resetting at the second boundary with MS. JB also does a higher rise in 'Markus' and a resetting, but only a discontinuity between the unstressed syllables ('-mittag / mit dem') at the second boundary. - The difference between JoW versus MS and JB (post-tonic rise-fall-rise versus no phrase-final rise) is reflected in their one word echo question, cf. below. Again, one might speculate that this difference in phrase boundary signalling reflects a difference between Standard German and Flensburg, and that MS after all does have Flensburg traits in her prosody. But inspection of the fourth, and unambiguously Standard speaker, HH's data reveals that he, like MS and JB, performs higher rises to the post-tonic, not rise-fall-rises, before a perceived prosodic boundary. Whether this difference is a truly individual one or whether it is a stylistic variable, open for every North German to bring into play, I cannot say. JoW did not to me sound neither more distinct nor more formal than, e.g., MS. - The most interesting fact here is that there seems to be a more distinct tendency in German versus Sønderborg Danish (and Danish in general) to mark syntactic boundaries in longer utterances explicitly.

3. PLANNING AND EXECUTION STRATEGIES

Thorsen (1983) contains data and documentation from declarative utterances of systematically varying length (Standard Copenhagen Danish) which led me to conclude that Standard Danish sentence intonation is handled more easily and adequately within a descriptional framework where the various components are a hierarchically structured set of parametric, simultaneous and interacting categories (sentence contours, superposed by phrase contours, superposed by stress group patterns), the actual production of which demands a certain amount of look-ahead and pre-planning. This view is in opposition to a theory where intonational events occur in linear sequence and where grosser trends in the Fo course is accounted for as the result of iterative application of locally applying rules which can only look back, and where - specifically - look-ahead and pre-planning is uncalled for, except that utterance onset may vary with length, cf. Pierrehumbert (1980), Liberman and Pierrehumbert (1984). For a modified version of the linear sequence approach, see Ladd (1983). - I shall not repeat the argumentation here, but merely note that the Tønder-speakers would be very well accommodated under the same description as Standard Danish (and Aalborg and Næstved). But how do the data from Sønderborg and German fare? It is the description of the prelude, i.e. what leads up to the final lowering, that is our concern, since it is beyond any doubt that there is a separate, special final command involved in the production of the final stress group (Sønderborg) and the final post-tonic (German), respectively.

The material cannot possibly resolve the issues here, because utterance length has not been systematically varied, but the relevant questions can be raised and tentative answers outlined. Firstly, downdrift/declination in the prelude is unmistakable with all Sønderborg and German speakers. With the German speakers, it is nearly as steep as with Tønder speakers, whereas Sønderborg speakers are less slanting, cf. Table IXa. Why this downdrift - what is its function and how is it regulated? There are two possibilities: (1) it is a voluntary, controlled part of the cue to the (unmarked) terminal intonation, in which case I would have to modify the statement, derived from Table VIII, that intonation cues are local in Sønderborg and German, to say that intonation signalling is a mixture of global and local cues, or (2) it is involuntary, automatic in a sense, and a gesture that should be ascribed to a relaxation of those muscles that control Fo height (which is not paramount to saying that this relaxation could not be checked or counter-acted for the production of less slanting contours). Under assumption (1) we would expect the prelude to differ in utterances which are prosodically marked as non-terminal versus terminal: prelude slopes should be steeper in terminals and their offsets lower, ceteris paribus. Furthermore, for a given utterance type, the prelude would show systematic variation with length, either (a) through higher onsets with longer preludes, and/or (b) through lesser slopes with longer preludes. Under assumption (2), preludes would show no systematic difference in onset and slope in long and short terminals, or in terminals vs. non-terminals, ceteris paribus.

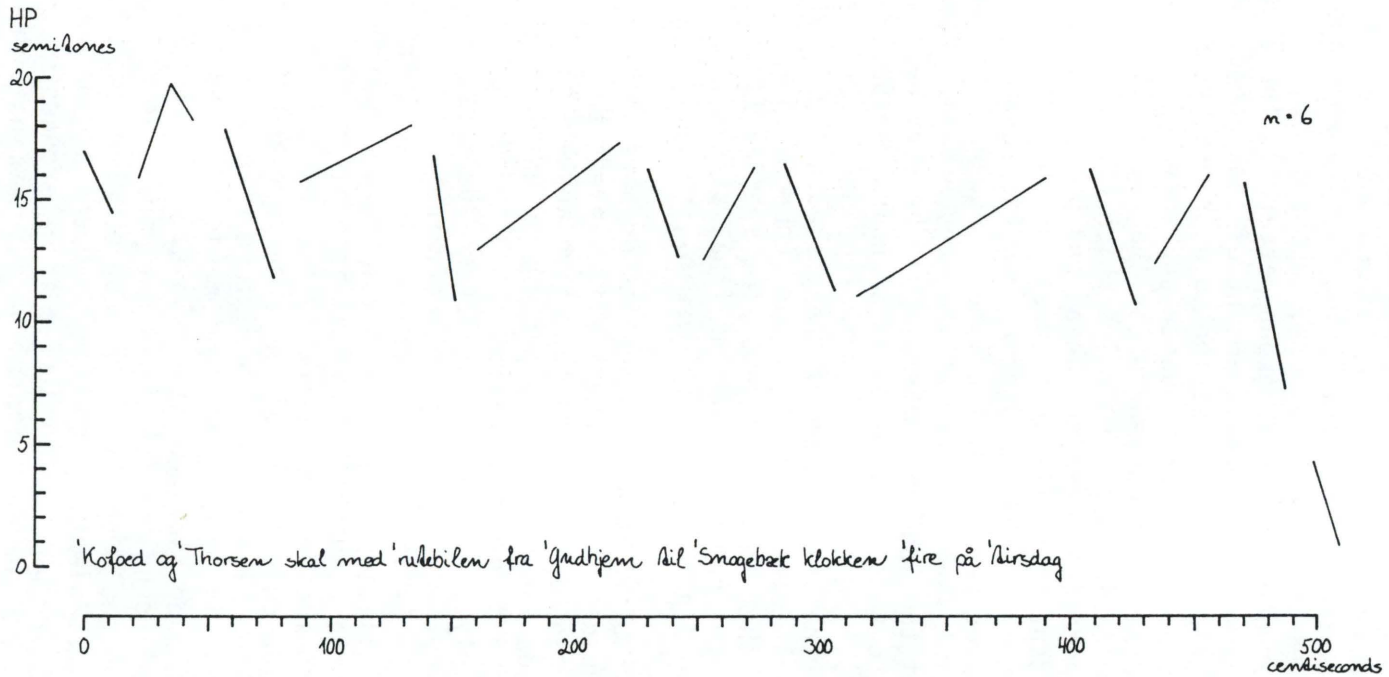


Figure 28

A long declarative utterance by a Bornholm speaker. See the legend to figs. 10-18. - Reproduced from Thorsen (1988a).

Support for assumption (1) - functional, voluntary, controlled prelude declination (at least with the Germans) - comes from two sources: from a comparison with the Bornholm data and from the data itself. In figures 19-24 in Thorsen (1988a), it is evident that prelude declination in long declaratives with six Bornholm speakers is decidedly less steep than in German. Fig. 19 is reproduced here as fig. 28. Simultaneously, the local final fall is more extensive. Thus, with Bornholm speakers it is reasonable to assume that prelude slope has no role in the identification of utterances as terminal vs. non-terminal, which is backed up by the fact that the only difference between a question that is prosodically marked as such and one that is not, lies in the final stress group pattern, preludes are indistinguishable (cf. figs. 33 and 34, Thorsen 1988a). The steeper preludes and relatively weaker final signal in German could therefore both be integral parts of terminal intonation.

Table IXa and IXb present quantitative and qualitative observations relevant to the issue: variation in isolated utterance onset with utterance length, variation in prelude offset with utterance length and type, variation in final low post-tonic values, prelude slopes, and the interval between penultimate and last stressed vowels. Stressed vowels have been measured at their midpoints, because onset, offset, maximum or minimum values would either obscure or exaggerate the variation which is introduced by the fact that not all stressed vowel movements are in the same direction. Note also that the slopes given are not calculated from the time coordinates of the Fo measuring points, but from serial, i.e. left-to-right number. What they really indicate, then, is an average (though not the arithmetic mean) downstep magnitude. This is founded on the assumption that that is how a speaker calculates and produces his stressed vowel intervals; that what is relevant is how many stressed vowels are contained within the phrase, not where, exactly, they occur in time. An assumption to the contrary (that downstep magnitude is a function also of time) would put rather strong demands on the speakers' look-ahead and pre-planning of the execution, having to take into account also how many unstressed syllables intervene between each pair of stressed ones, since the stressed syllables are not isochronous. Thorsen (1984a) contains documentation for this non-isochrony, and you have only to look at the figures here to appreciate how much stressed vowel time intervals can vary. This is entirely uncontroversial and it has long been recognized that so-called stress-timed languages are not characterized by perfect isochrony. See, e.g., Strangert (1985). Values have been left out where they are jeopardized by the presence of sentence accents or resettings (step-ups). Table IXb summarizes IXa, and should be self-explanatory.

Table IX is, of course, a rationalization after the facts which shaped it. (1) It is evident that Sønderborg speakers DO have a discontinuity before the last stressed vowel, compare "last step" with them versus German and Tønder speakers, and note that the difference between overall slope, i.e. "average" step-size, and last step is considerably greater with Sønderborg

Table IXa

Values in semitones of the first and last stressed vowel in intonation contour preludes, as well as the last post-tonic. Preludes include the last stressed vowel with German and Tønder speakers, but terminate with the penultimate with Sønderborg speakers. The interval between penultimate and last stressed vowel ("last step") is given, too. Overall prelude slopes and individual phrase slopes, calculated as the least squares regressions on stressed vowel Fo midpoints or maxima (in rising-falling movements) against their serial left-to-right number are given with their italicized correlation coefficients. Individual phrase offsets and onsets are given in parentheses after "first 'V" and before "last 'V", respectively. Starred values pertain to stressed vowels affected by sentence accent; exclamatory values derive from reset stressed vowels. See further the text and the legend to Table VIII. Km with sentence accent on 'Kamma' is included for comparison with the questions by JoW and JB.

	number of 'Vs	first 'V	last 'V	last post-tonic	last step	overall slope	phrase slopes	correlation between last 'V and last post-tonic
JoW (German)								
La +DA	7	13.8	6.8*	0.9	+0.1*	-1.2/*-0.95*		
Lb +DA	7	12.6	6.3*	0.0	-0.5*	-1.1/*-0.98*		
Ki +DA	2	10.2	8.4*	1.2		-1.8		
Km +DA	4	10.8	7.7*	1.8	-0.3*	-1.1/*-0.97*		0.69
Kf +DA	2	10.4	7.8*	0.8		-2.6		
Q +SA on 'ist'	3	12.8*	(9.5)	11.9				
Km +SA	3	11.3*	(4.9)					
MS (German)								
L -DA	4+3	10.3(→7.4)	(!9.3→)6.3	1.3	-1.5	-0.4/*-0.59*	-1.0/*-0.86*;-1.5/*-1.0*	
Ki -DA	3	9.3	7.1	2.1	-1.6	-1.1/*-0.95*		
Km -DA	4	9.5	5.6	1.8	-1.9	-1.3/*-0.99*		
Kf -DA	3	9.0	6.0	1.5	-2.3	-1.5/*-0.96*		0.88
Kf +DA	3	10.0	8.2*	2.2	-0.2*	-0.9/*-0.91*		
Q -DA	4	10.2	9.4	2.7	+1.0	-0.6/*-0.52*		
JB (German)								
L -DA	2+5	10.0(→8.4)	(!9.0→)5.6	1.5	-1.2	-0.7/*-0.96*	-1.6 ;-0.8/*-0.99*	
Ki -DA	3	9.7	6.2	2.1	-1.4	-1.8/*-0.96*		
Km -DA	4	8.2	5.4	0.6	-1.8	-1.0/*-0.90*		
Km +DA	4	9.6	8.2*	3.0	+0.2*	-0.5/*-0.91*		0.63
Kf -DA	3	10.0	7.0	2.6	-3.0	-1.5/*-0.87*		
Q +SA on 'weit'	4	12.3*	(7.0)	1.2				
Km +SA	3	11.4*	(3.1)	1.3				

Table IXa (continued)

	number of 'Vs	first 'V		last 'V	last post-tonic	last step	overall slope		phrase slopes		correlation between last 'V and last post-tonic
HS (Sønderborg)											
Lb	7	13.8		6.6	2.0	-3.0	-0.8/*-0.95*				
Ki	3	11.8		8.5	1.3	-3.5	-0.8				
Km	3	11.6		8.7	4.1	-3.5	-0.4				0.13
Kf	3	11.4		7.6	2.6	-2.9	-0.9				
Q	1+2	12.0	(12.2→)	9.3	2.0	-2.9!			;-2.9		
ES (Sønderborg)											
L	5+2	13.7(→8.6)	(9.9→)	7.8	2.2	-2.1!	-0.8/*-0.85*	-1.1/*-0.94*	;-2.1!		
Ki	3	11.6		9.0	3.4	-2.4	-0.2				
Km	3	11.6		8.8	4.5	-2.1	-0.7				0.57
Kf	3	13.3		9.0	3.3	-2.6	-1.7				
Q	2+2	11.8(→9.1)	(11.6→)	10.1	3.7	-1.5!		-2.7	;-1.5!		
PBP (Sønderborg)											
L	7	14.5		8.0	1.8	-2.9	-0.7/*-0.84*				
Ki	3	13.0		7.5	3.4	-4.4	-1.1				
Km	3	11.8		7.8	3.8	-3.8	-0.2				0.63
Kf	3	12.2		8.7	3.9	-3.5	0				
Q	4	13.1		9.8	4.8	-2.4	-0.5/*-0.95*				

Table IXa (continued)

	number of 'Vs	first 'V		last 'V	last post-tonic	last step	overall slope	phrase slope		correlation between last 'V and last post-tonic
AS (Tønder)										
L	3+4	14.4(→10.2)	(!11.2→)	7.8	1.7	-0.8	-1.1/*-0.94*	-2.1/*-0.95*;	-1.0/*-0.86*	
Ki	3	9.6		6.2	1.5	-1.3	-1.7/*-0.99*			
Km	3	10.8		5.8	2.7	-1.8	-2.5/*-0.99*			0.71
Kf	3	10.2		5.4	3.6	-0.8	-2.4/*-0.81*			
Q	2+2	11.4(→9.2)	(!10.5→)	6.7	1.4	-3.8!	-1.3/*-0.81*	-2.1	;-3.8!	
JC (Tønder)										
L	7	13.3		6.4	1.8	-1.0	-1.1/*-0.97*			
Q	2+2	10.6(→9.7)	(!10.2→)	6.2	2.3	-4.0!	-1.3/*-0.81*	-0.9	;-4.0!	
KaP (Tønder)										
L	5+2	13.2 (→6.4)	(!7.6→)	5.8	2.7	-1.8!	-0.9/*-0.80*	-1.5/*-0.87*;	-1.8!	
Q	3	12.8		6.4	4.0	-3.2	-3.2/*-1.0*			

speakers. This is why the last vowel with Sønderborg speakers has been excluded from the calculation of overall slope. (2) It is perhaps not justified to give overall slope values at all for utterances with resettings, and some have actually been left out, but anyway the correlation coefficient will attest to the validity or not of this measure, compare, e.g., the long utterance by MS and JB. (3) The questions by JoW and JB do not really compare with anything else, because of the early sentence accent - they will be commented separately below.

We are looking for evidence of controlled differences in the course of the prelude in longer versus shorter terminals, and in terminals versus non-terminals, respectively. German and Sønderborg speakers are in focus here. Even though (i) resettings in the long declarative and in some of the questions, (ii) some early sentence accents, and (iii) uneven number of stressed syllables in utterances to be compared conspire against a simple exposition, such evidence exists, but it is scant and should be backed up by an experiment especially designed to confront the issue.

Long versus short prelude. JoW: the 7- and 4-stress utterances differ mainly in higher onset and lower offset, with a step size of about 1 semitone. But 4- and 2-stress utterances differ mainly in step size, which is twice as large in the shorter utterance. (This is not due to a special final lowering of the last 'V, cf. above.) The resetting in MS's long utterance makes the overall slope invalid for comparison (the correlation coefficient is only -0.59), but note that phrase slopes are inversely proportional to their length. JB's resetting is slight enough that the correlation on the overall slope is high (-0.96) and the smaller average step size is evident at least when we compare with the 3-stress utterances. Neither MS nor JB use onset or offset differences to accommodate differences in length. - The adjustment of step size to the number of steps to be performed, in prosodically terminal intonation contours, cannot come about if the speaker is not supposed to look ahead and preplan the execution of the utterance.

Sønderborg speakers appear not to employ the same strategy: like JoW they will onset higher (and offset lower) in the long utterance. Higher onset, of course, is proof of look-ahead, it is something you do to be able to accommodate more stressed syllables within the same utterance contour, but average step size is unaffected and need not be pre-planned. Compared with the Germans, Sønderborg speakers' downstep through the prelude is smaller, the gross average of their "overall slope" is -0.7 semitones per step, with the Germans it is -1.2 (and -1.7 with Tønder speakers). This leaves room for a much more considerable "last step", averaging 3.2 semitones versus 1.0 semitones with the Germans (and 1.5 with Tønder). ("Last steps" affected by resettings are excluded from these averages.) This last step in Sønderborg is approximately constant over utterances of different length, which means that the last vowel is lower in longer than in shorter utterances. PBP is an exception in that his last vowel in terminals is approximately constant

Table IXb

Qualitative summary of the data in Table IXa. Empty slots occur where comparisons cannot meaningfully be made because values derive either from reset or accented stressed vowels (or where data is missing). Comparisons are made only to identical accentual conditions. Differences in onset, offset and last step are considered to be present if they exceed one semitone, differences in last post-tonic are reckoned if they exceed two semitones. Slopes are different, if the difference exceeds 0.5 semitones per step. Values approaching different status are rendered as (+). JC's and KaP's question is treated as a terminal here, apparently lacking any intonational signalling of the interrogative function.

Long versus shorter terminals

	onset higher	offset lower	lower last 'V	slope smaller	final low lower	final step smaller
JoW	+	+		+[1]	-	(+)
MS resets long	-	-		+[2]	-	-
JB resets long slightly	-	-		(+)	-	-
HS	+	+	+	-	-	-
ES resets long	+[3]	+[4]	+	-	-	-
PBP	+	(+)	-	-	(+)	+
AS resets long slightly	+	--[5]		+	-	-
JC resets question	+	-		-	-	+[6]
KaP resets long	-	-		+[2]	-	+[7]

1) 2 stresses versus more have steeper slopes but no difference between 4 and 7 stresses
2) about overall slopes in utterances with resetting, see the text
3) but note Kf
4) even though it is an upstepped 'V
5) it is higher, actually
6) probably due to the upstep in Q
7) even though the penultimate is upstepped

Table IXb (continued)

Shorter terminals versus non-terminal

	onset higher	offset higher	higher last 'V	slope smaller	final low higher	final step smaller
JoW	-[1]	++		?	+++	
MS	-	++		+	(+)	+
JB	-	++		?	-	
HS resets question	-		(+)		-	
ES resets question	-		+		-	
PBP	-	-	+	-	-	+

1) the difference is small enough to be attributable to a difference in instrinsic vowel Fo

over different lengths, which makes the final step from the lower prelude offset in the long utterance decidedly smaller.

The Tønder data is rather incomplete, but if "overall slope" is considered a valid measure (with a correlation coefficient of -0.95) with AS, and if we consider the first of KaP's phrases in the long utterance, then it seems safe to conclude that step size is regulated according to the number of steps to be performed, in conjunction with an optional higher utterance onset. And, again, this is inconceivable under a model where - once you have chosen onset value - succeeding values are (at least for a given utterance type) unaffected by upcoming events, being controlled only by what immediately precedes.

Terminal versus non-terminal. The German data is inconclusive. Taken at face value, the comparison of JoW's and JB's question and Km-utterances, with their early sentence accents, would imply that in the question, the whole contour runs higher in the range and ends higher than in the corresponding declarative, that declination is less in the question. But I am not sure that it is legitimate to compare these utterances, after all. Whether what normally characterizes a prelude without sentence accent can be meaningfully applied to the unaccented tail to an early accent. Whether the speaker still uses the lexically stressed syllables as anchorpoints for the post-accentual Fo course, or whether post-accentual degree of downdrift is performed as a direct control of each (stressed and unstressed) syllable, since the stressed syllables appear to be stripped of their autonomous rise-falls. With JB (fig. 27) this control seems to be rather straightforward: after the step down from the accent, the course runs high and rather exactly level until the final fall to the last post-tonic, but with JoW (fig. 25) a gradual downdrift is observed, until it is checked by the upstepped fall-rise in final 'Kassel'. MS's accented items (fig. 26) follow the pattern of JoW, but the downdrift is somewhat steeper. If we compare MS's unaccented question with the corresponding Kamma-utterances, the pertinent difference is in the level of the last stressed vowel, which is about 3 semitones higher in the question (which accounts for the smaller overall slope), but the penultimate (inferred from "last 'V" and "last step" in Table IXa) is not significantly higher, so it seems that preludes do not differ with MS, but the level of the last vowel does (which is exactly the situation in Sønderborg, cf. below).

What is interesting in JB's and MS's questions/non-terminals, though, is the fact that a considerable final fall to the last post-tonic is maintained; that regardless of what precedes it, the final low can be considered constant and is not confined to terminal intonations. (You will note that some variation in the final post-tonic is present, and is roughly correlated with stressed vowel level, though the correlation is tight only with MS, but the range of variation in the final post-tonic is less than in the preceding stressed vowel, and the extent of the final fall is, accordingly, not constant. Thus,

we have a - somewhat counterintuitive - situation where non-terminals have larger final falls than terminals). What status does this assign to the final low? If it is not a feature only of terminal intonations as such, it should perhaps be regarded as a boundary, a juncture signal in the true sense, not a "terminal juncture" as it is most often understood, i.e. as "the juncture signal which accompanies terminal intonations", but an "end-of-utterance" signal, irrespective of other utterance prosodic characteristics. But where does that leave those utterances which end in a high rise, like JoW's question, and all the Germans' one-word echo-question? Possibly, final utterance boundaries can be signalled either by an extreme high or an extreme low, i.e. by a movement to either end of the speaker's range, where final highs are confined to non-terminal utterance contours, but final lows are not similarly restrained, and could be considered the unmarked utterance final boundary.

Unfortunately, those other questions which have been recorded, the probes to the focal Kamma-utterances, will not serve to back up the data in Table IX. Most of them received non-final sentence accents, and not necessarily in the same place in each rendering. But their termination can be unambiguously ascertained. It turned out that in all six of these questions, JoW performs a high utterance final rise, and so does HH. MS and JB do so invariably in "Wissen Sie who Kamma geboren ist?", MS once in "Wer, ausser Anton, wird nach Kassel fahren?", and JB twice in "Wie heisst Bertha's Schwester?".

A cautious and preliminary conclusion about preludes in long and short terminals and in terminals versus non-terminals in German would state that preludes do show systematic variation with length, either through increased range supplemented with smaller average step size, or through resetting which - when slight - still necessitates adjustment of step size. Non-terminal prelude contours end higher in the range than terminal ones. With MS this appears to be achieved by a simple step up of the last stressed vowel, with JoW and JB it is possible that preceding slopes are also less slanted, if utterances with early sentence accents are indicative. Thus Germans mix global and local prosodic signals to utterance function, and the global part is most likely to be produced under conditions of both look-ahead and pre-planning, not only for adjustment of utterance onset (which is also incorporated in the linear sequence theory mentioned above) but also for the execution of stressed vowel to stressed vowel interval and phrasal resetting.

Sønderborg speakers' non-terminal contours are non-terminal by virtue of a higher position of the last stressed vowel, to judge from PBP, which makes the step down from penultimate to last stress smaller. It would seem, then, that Sønderborg speakers are true local ones, insofar as the only difference between terminal and non-terminal utterances reside in the relative level of the last stressed vowel. Step size - which is fairly small and which could possibly be ascribed to relaxation effects - is no indication to what final cue may follow.

Prelude length is accommodated through increased range or resetting, but no further adjustment of neighbouring stressed vowel interval takes place. Though final lows are not quite constant, they correlate poorly with last 'V, and they are not higher in the questions except maybe with PBP, so again the final fall may have to be considered an utterance juncture cue.

Tønder speakers did not produce the question with an unambiguous perceptible non-terminal Fo marking, and the last stressed vowel is no higher in the question than in the declaratives.

4. THE ONE-STRESS ECHO-QUESTIONS

These are, of course, heavily prosodically marked with all speakers, but in different manners, according to their different prosodic systems.

Tønder speakers reproduce the archetypical, rising-falling stress group patterns, but in expanded form: the rise is higher, to the top of the speaker's range, and the fall deeper, to the level of other utterance final post-tonics. The same can be said for the Sønderborg speakers, although here the higher rise is not as conspicuous, compared with 'Padborg' in final position in the wh-question, because of the relatively higher level which marks the wh-question prosodically as non-terminal.

JoW repeats in 'Kassel' his fall-rise from final position in the wh-question, but the stressed vowel is rising, rather than falling, and as a whole the pattern is situated higher in the range. With MS and JB the stress group pattern changes compared with other final ones, to a clean rise, reminiscent of the pattern of phrase final stress groups in the long declarative.

Common to all speakers, then, is a high stressed vowel, succeeded by a movement either to the lower or the higher end of the speaker's range.

5. CONCLUSION

Tønder speakers' sentence intonation does not differ in any significant way from sentence intonation in Standard Copenhagen or Næstved and Aalborg. There are no specific final cues to either sentence function or utterance juncture. Both are mediated by the way the stressed syllables proceed through the whole utterance. Differences in utterance length affect utterance onset optionally, and the amount of step down between stressed syllables.

Cues to utterance function in Sønderborg are contained solely in the last stress group which is positioned below the grid established by the prelude, a lowering which is more pronounced in terminals than in non-terminals. Prelude onsets may vary with utterance length but slope (step size) is constant, both

over length and utterance function. Sønderborg shares with Tønder the lack of any particular phrasal boundary cue, apart from the optional resetting of the intonation contour, and the apparent lack of any obvious prosodic correlate to the syntactic boundaries, at least in this material. The final, steep fall to the last quasi-constant post-tonic is presumably not indicative of terminal 'mood', because it is present also in non-terminals, but may be purely an end-of-utterance signal.

The German speakers, with no apparent distinction between the one Flensburg and the two Standard German speakers, mix global and local cues to utterance function: downdrift in the preludes is steeper than with Sønderborg speakers, and varies with utterance length both in regard to utterance onset (optionally) and in the amount of step down between stressed syllables. It is debatable whether prelude slopes differ in terminals versus non-terminals or whether it is only the last stressed syllable which is higher in non-terminals, i.e. a local cue, cf. above. But Germans have another option for non-terminals, added to the higher stressed syllable, i.e. the last post-tonic may perform a fall plus a rise, to the upper end of the speaker's range. This is the rule with JoW (and HH), but the exception with MS and JB. And it is this option which is decisive for the classification of German as having definitely also local cues: the presence of the final rise is such a cue to non-terminal intonation. Absence of a final rise is not confined to terminals, however, but the extent of the fall from the higher final stressed vowel to the (constantly) low post-tonic increases (and this is true also of the questions with early sentence accent by JoW and JB). It is curious, and somehow counter-intuitive, that non-terminals thus may be accompanied by more extensive final falls than terminals. This contradiction is dissolved, however, if we regard the final low as an end-of-utterance cue, as with the Sønderborg speakers. Final lows, then, are utterance juncture cues, final highs are specific non-terminal utterance juncture cues. - Prosodic utterance internal boundaries get signalled more explicitly with the Germans and are mapped directly onto the syntactic structure, in contradistinction to the Danes, whose stress group patterns cut across the various syntactic boundaries.

Please note that some of the issues raised here call for a more thorough investigation, and the matter of especially non-terminal intonations cannot be considered anywhere near closed.

On page (4) I quoted one concluding hypothesis from Thorsen (1988a, 1988b) that global intonation precludes final default accents, on the grounds that a globally distributed sentence intonation might be masked perceptually by the extensive final movements pertaining to the default accent. The present data from Flensburg and Standard German blur the neat picture of sentence intonation and default accent occurrence established by the two 1988 investigations: German has both globally distributed and final local cues to sentence intonation function and optional default accents, and it is my own distinct impression that the preludes to the final fall do sound declining,

in accordance with what has been observed in the acoustic registrations. I think the hypothesis will have to be abandoned, which is no great loss, and the difference across languages/varieties in the occurrence of default accent be ascribed to language and regional differences in prosodic expressivity, which is a feature which raises a number of provoking questions and calls for an intimate cooperation between phonetics, linguistics, psycho- and sociolinguistics and pragmatics.

C. ALIGNMENT OF SEGMENTS AND FO

It has been shown previously for Standard Danish (Thorsen 1980a, 1982, 1984a) for Bornholm, Aalborg and Næstved (Thorsen 1988a, 1988b), and for German (Bannert and Thorsen 1988) that the relevant unit for the patterning of Fo is the prosodic stress group, that is: a succession of a stressed plus all following unstressed syllables (if any), irrespective of intervening word or syntactic boundaries, within the same phrase or sentence intonation contour. That is not to say that a speaker has no means at his disposal to signal word boundaries, if he so desires, and one speaker in the 1980a investigation actually did so. I suggested then, that this may be an optional characteristic of rather distinct, though not necessarily slow, speech. - Among the Danish varieties investigated so far, Bornholm stands out by the great variability and flexibility of stress group patterns. For the particulars, see Thorsen 1988a, p. 103 ff, but roughly: the Fo pattern is falling-rising. Both movements are rather extensive and of approximately equal magnitude. The duration and thus the slope of the rise, however, is adjusted to the total duration of the post-tonic syllables, i.e. the rise is expanded and compressed in accordance with the temporal structure of the post-tonics, see fig. 28. In contrast, Copenhagen, Aalborg and Næstved stress group patterns need not involve any particular on-line look-ahead which will scan the segmental composition of the stress group in order to align Fo with the segments: once the pattern is initiated, its course is simply interrupted when no more segments are present to carry it. On this background we shall look at stress group patterns in Tønder, Sønderborg and German.

1. COMPRESSION OR TRUNCATION

a. Systematically shortened stress groups

Figures 29-37 display the five words where the voiced stretch is shortened progressively from frame to frame. I should point out again that I made a mistake in the Tønder-material: 'vand, kat' were the intended comparisons with the three words at the top of the figures, but I disregarded the fact that those three longer words constitute the first stress group in the utterance (preceded only by unstressed words), whereas the shorter words are preceded by another stressed monosyllable. That first stressed word ('koldt, grå') is therefore included in figs. 29-31.

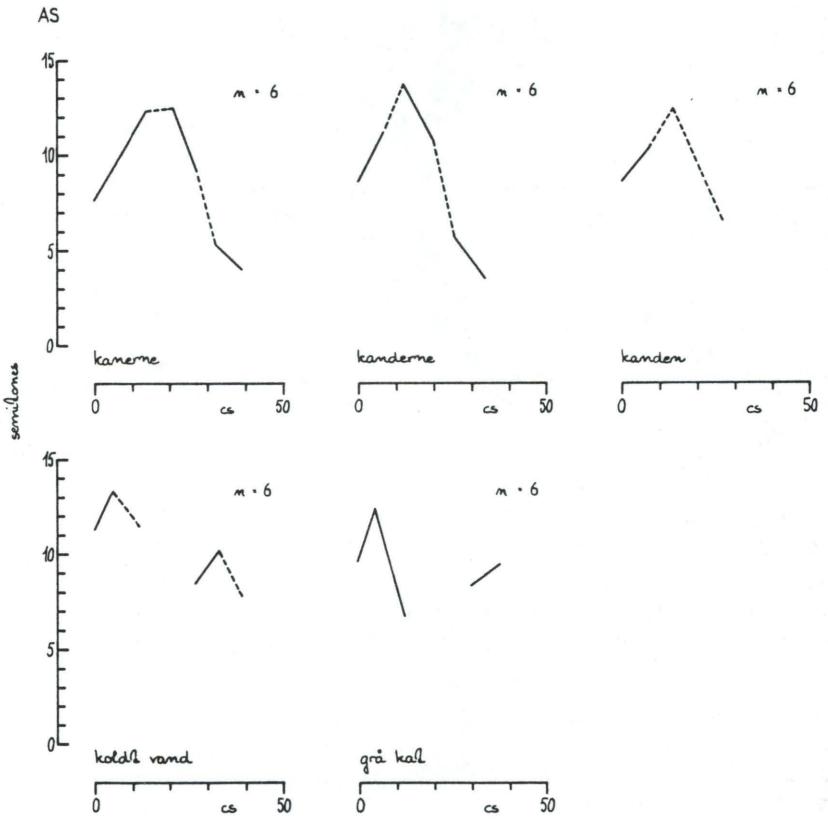


Figure 29

Figures 29-37

Average fundamental frequency tracings (logarithmic display) of five words (three words and two pairs of words in figs. 29-31) where the voiced stretch becomes progressively shorter through the frames. Three Tønder, three Sønderborg, two German and one Flensburg speaker. Where the sonorant consonants could be delimited, they are drawn in broken lines. See further the legend to figures 1-7.

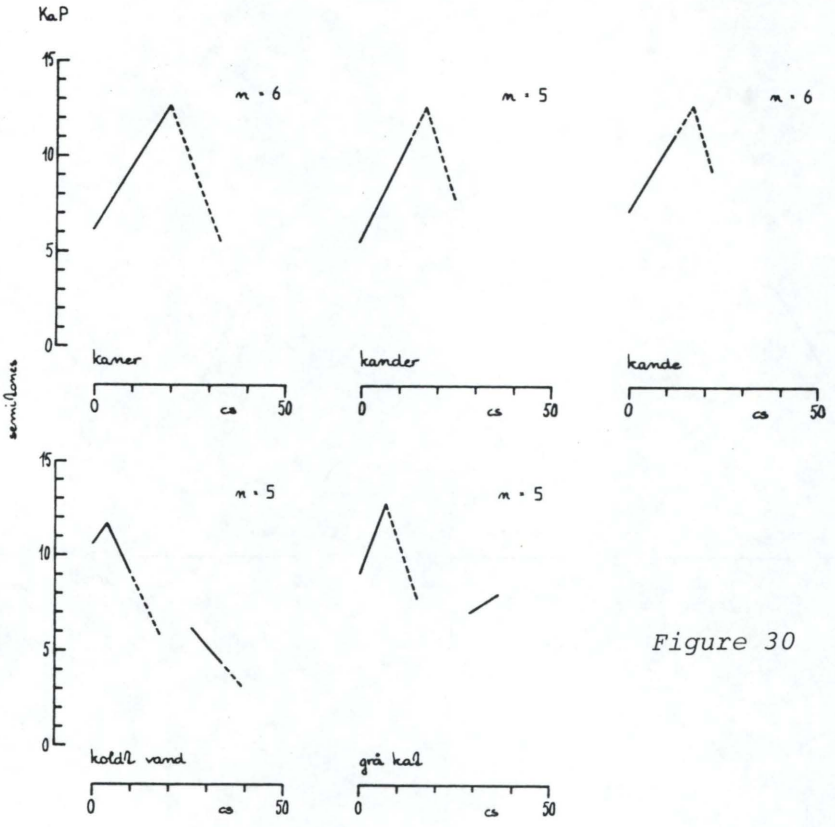


Figure 30

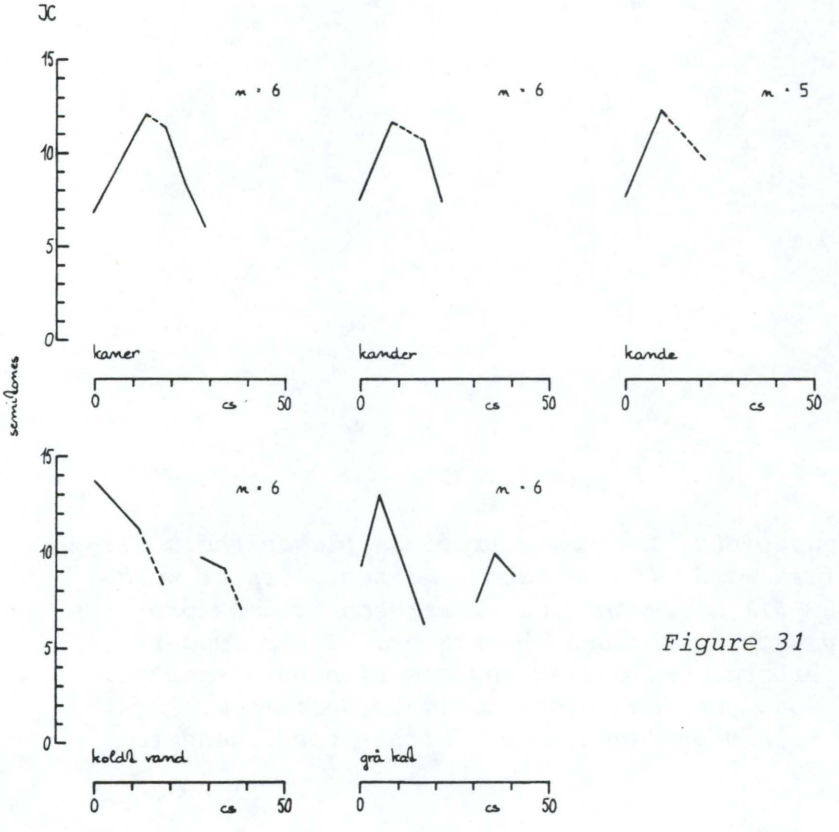


Figure 31

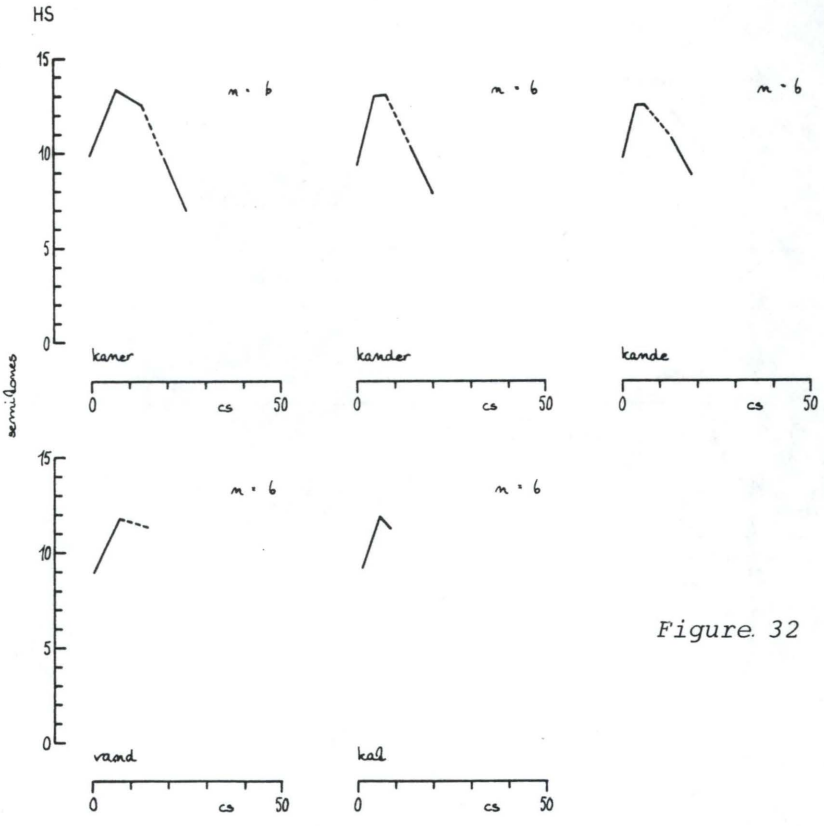


Figure 32

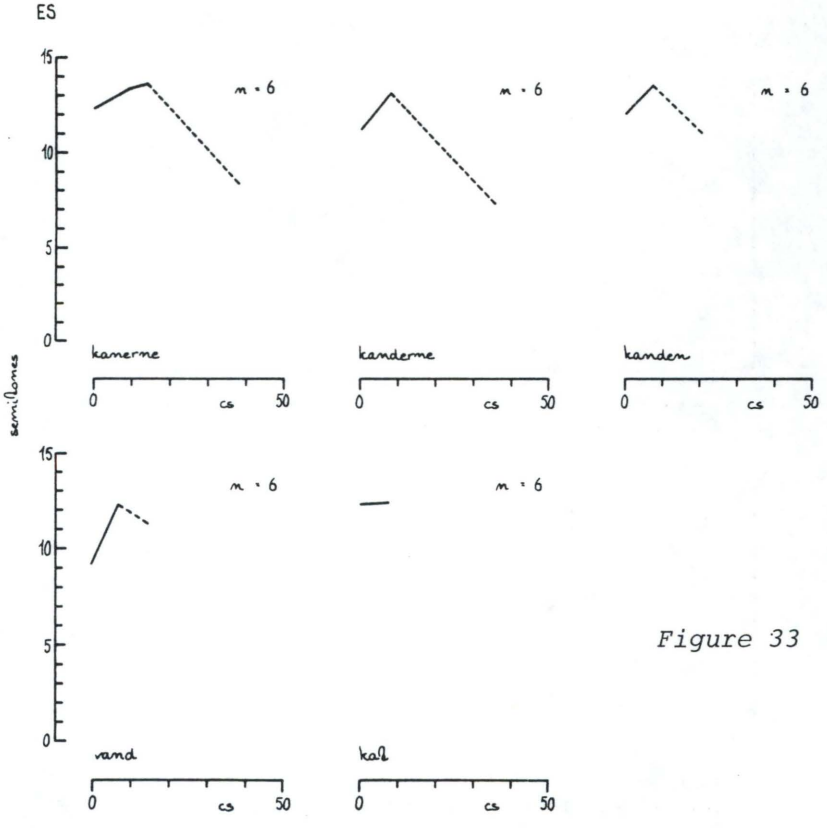


Figure 33

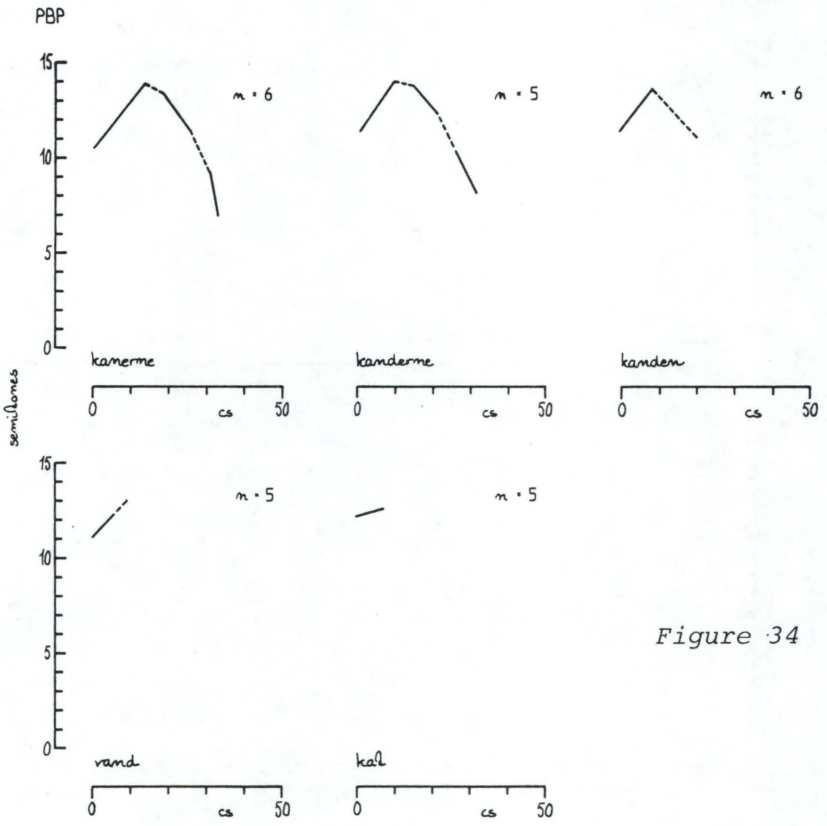


Figure 34

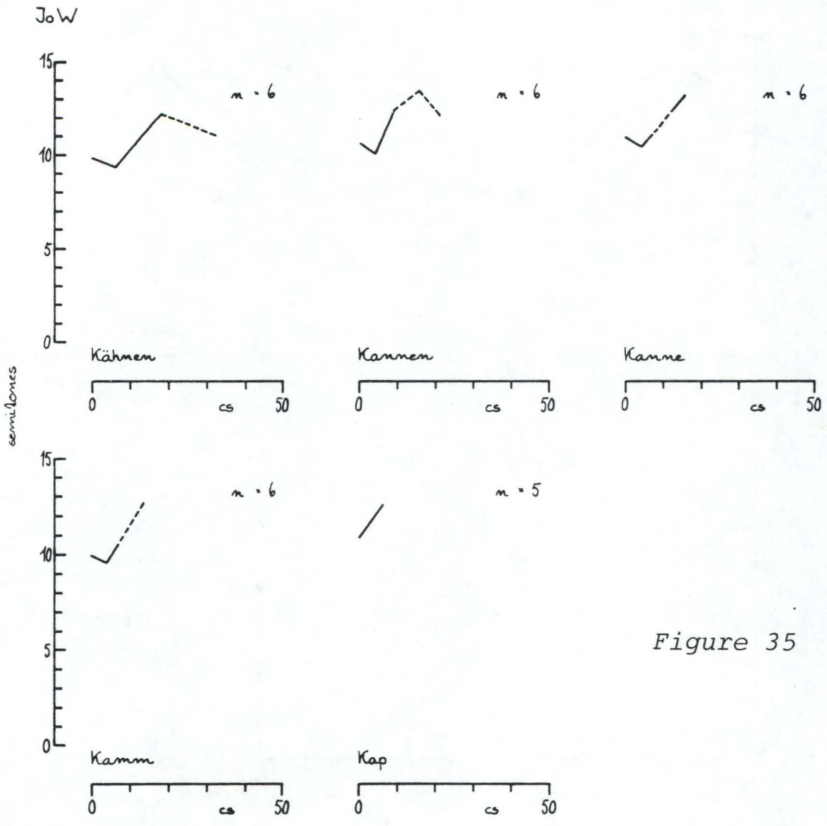


Figure 35

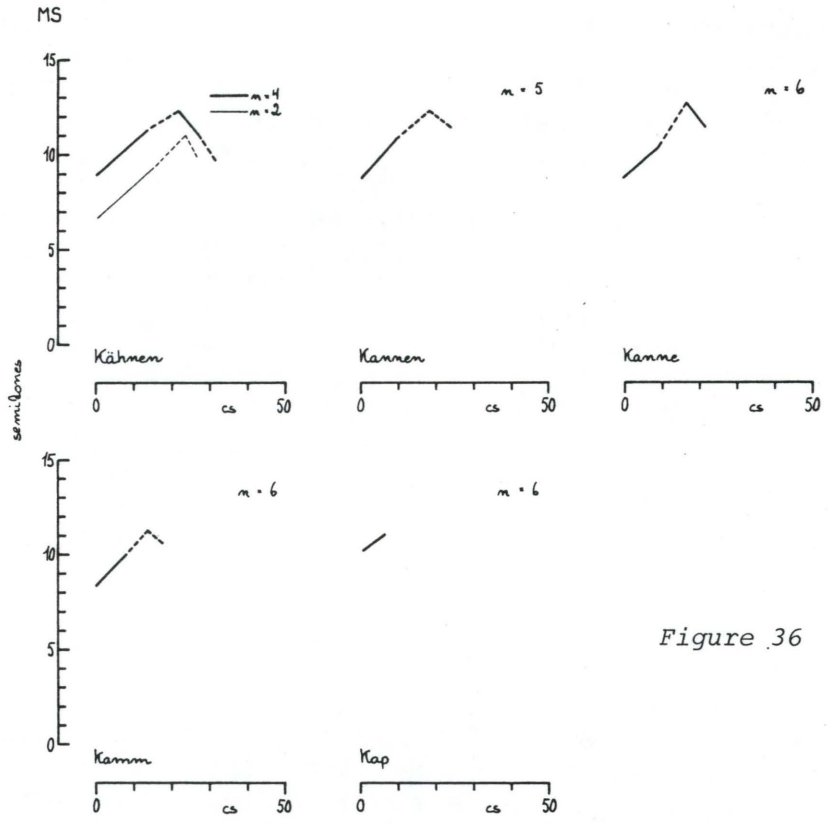


Figure 36

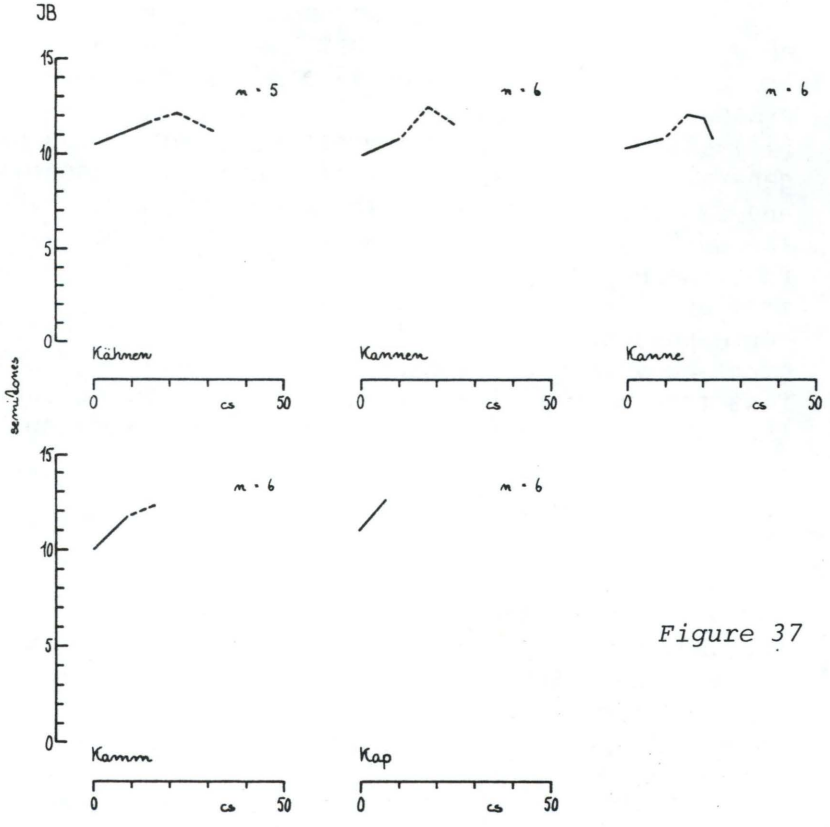


Figure 37

JC, KaP, and HS produced the upper three words with a pre-positioned definite article, which somewhat shortens these words, compared with Tønder, but it is nevertheless abundantly clear, and with all nine speakers, that the shorter stress groups are truncated editions of the longer ones; nowhere does a pattern maintain its range of movement, compressed in time, i.e. steeper and quicker in the shorter editions. - What looks like compressed Fo movements in 'grå' with the three Tønder speakers is probably the effect of the presence of a stød, and likewise in 'koldt' and 'vand': they may not appear time compressed but the fall begins earlier than you would expect from the apparition of the three upper (stød-less) words.

Rises and falls, both, are more extensive, ceteris paribus, with Tønder speakers, and least so with German speakers (and least of all with JB, cf. below). Rises are also slower with the Germans, to the effect that the peak of the pattern occurs later relative to stressed syllable onset with them.

b. Stress groups in the long utterances

(i) As mentioned previously, the fall from the maximum is so deep and steep with Tønder speakers that the bottom of the speaker's range is reached within the first or second post-tonic, most expressively so with KaP. Post-tonics after that continue low and level. The falls are less extensive with Sønderborg speakers, but completed, also with them, within the first or second post-tonic, and succeeding post-tonics continue at the level where the fall lands them, only that level is relatively higher than with Tønder speakers. It is evident from figs. 16-19 that the maximum with the Germans is generally only reached in the first post-tonic. The picture of stress group pattern falls is complicated by the presence of specific prosodic boundary cues:
(ii) As noted above, the prosodic stress group patterns seem generally to be insensitive to syntactic boundaries with Tønder and Sønderborg, but not with German speakers. Their control of the unstressed syllables is less automatized, and it is evident that the higher rises and fall-rises encountered at the arrows in figs. 16-18 are time-compressed, i.e. they are steeper than corresponding movements in other positions. Falling final stressed vowels and steeper falls altogether finally also attest to a more active control of stress group patterns than that exercised by the Danes, see further section 2. below.

Figures 38-45

Average fundamental frequency tracings (logarithmic display) of two sequences with different word boundary locations, by three Tønder, three Sønderborg, and two German speakers. The composite words were pronounced with two main stresses by the two groups of Danish speakers. See further the legend to figures 1-7 and see the text.

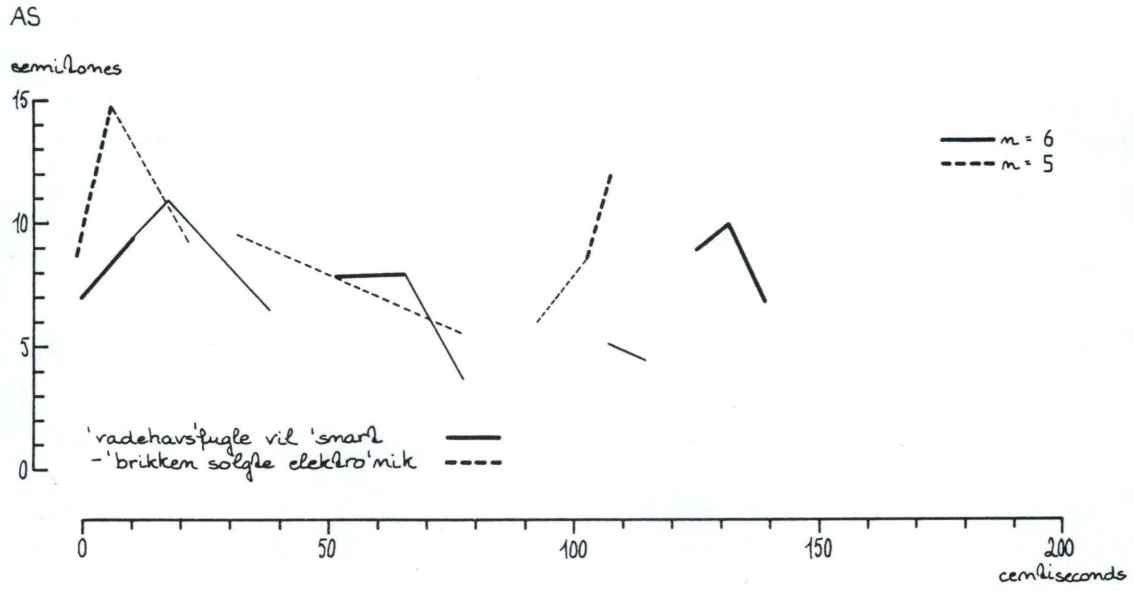


Figure 38

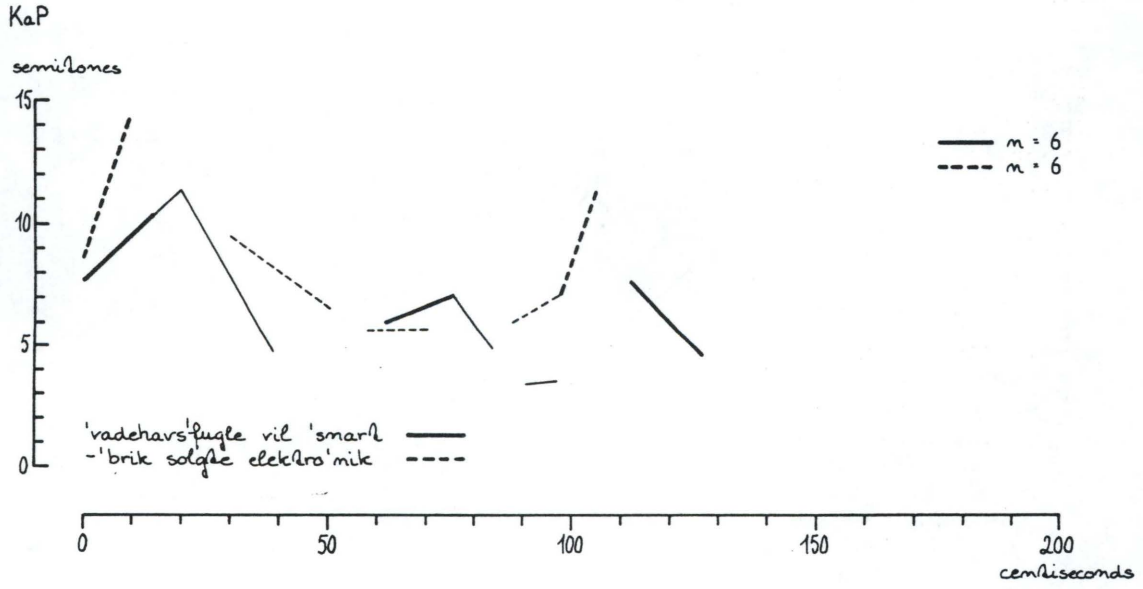


Figure 39

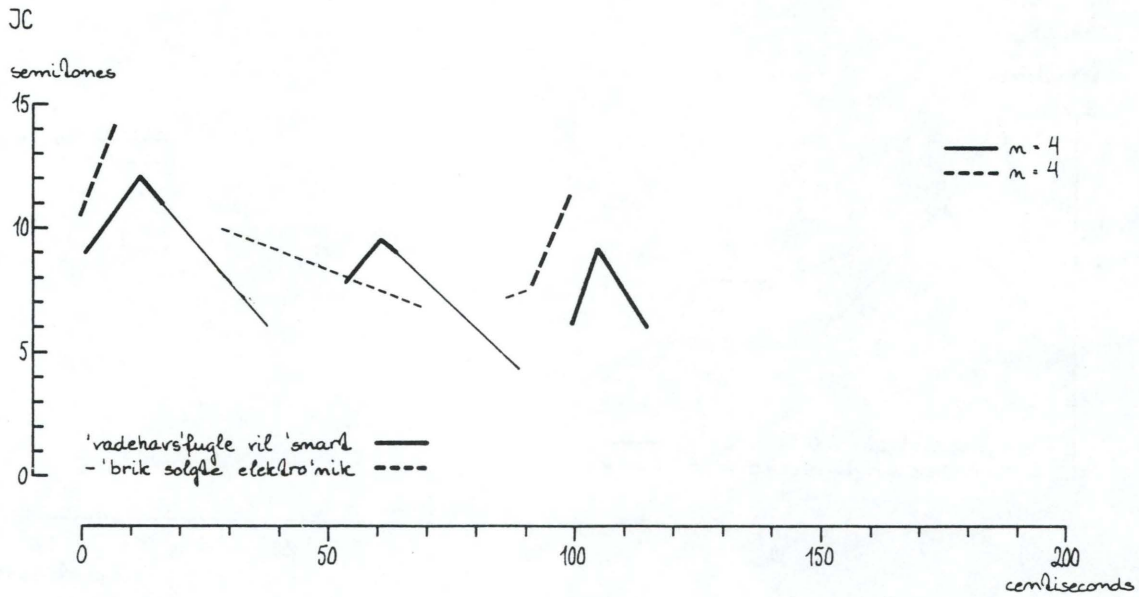


Figure 40

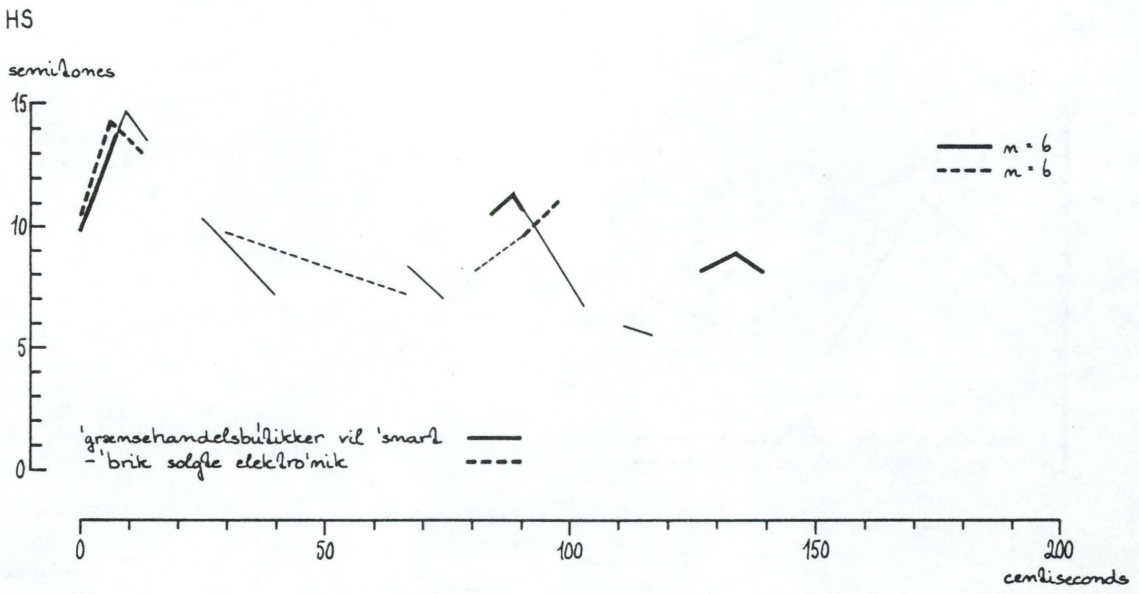


Figure 41

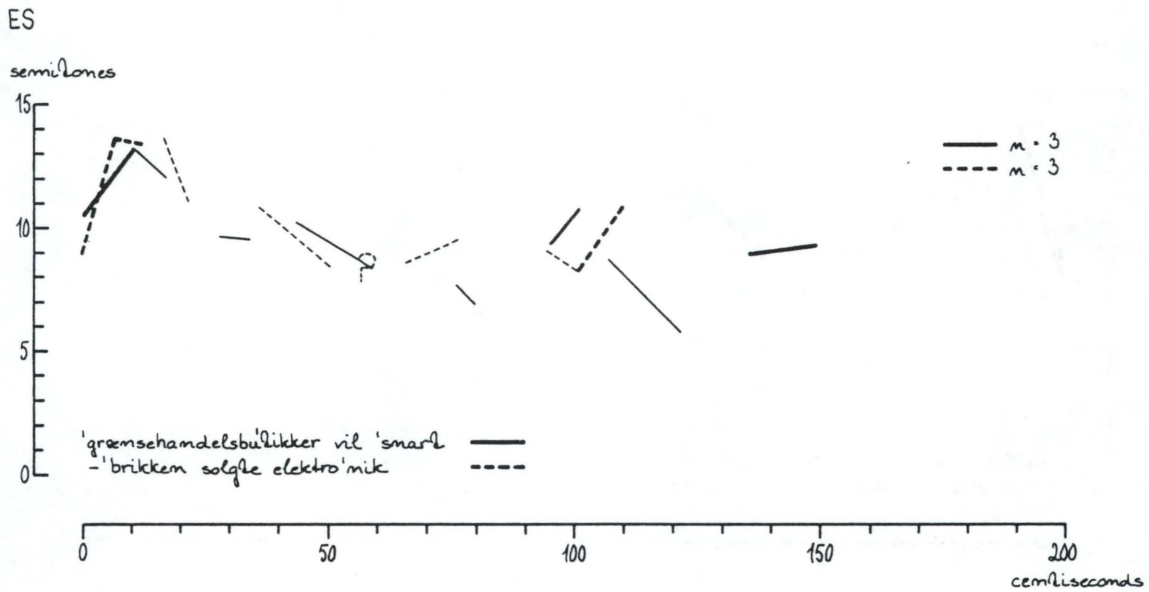


Figure 42

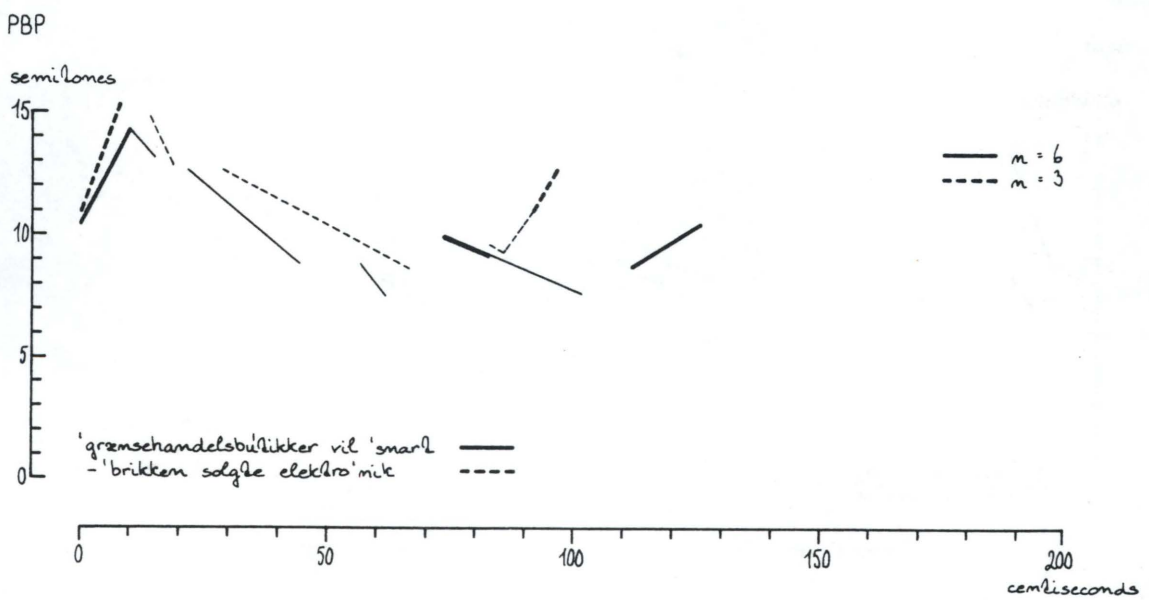


Figure 43

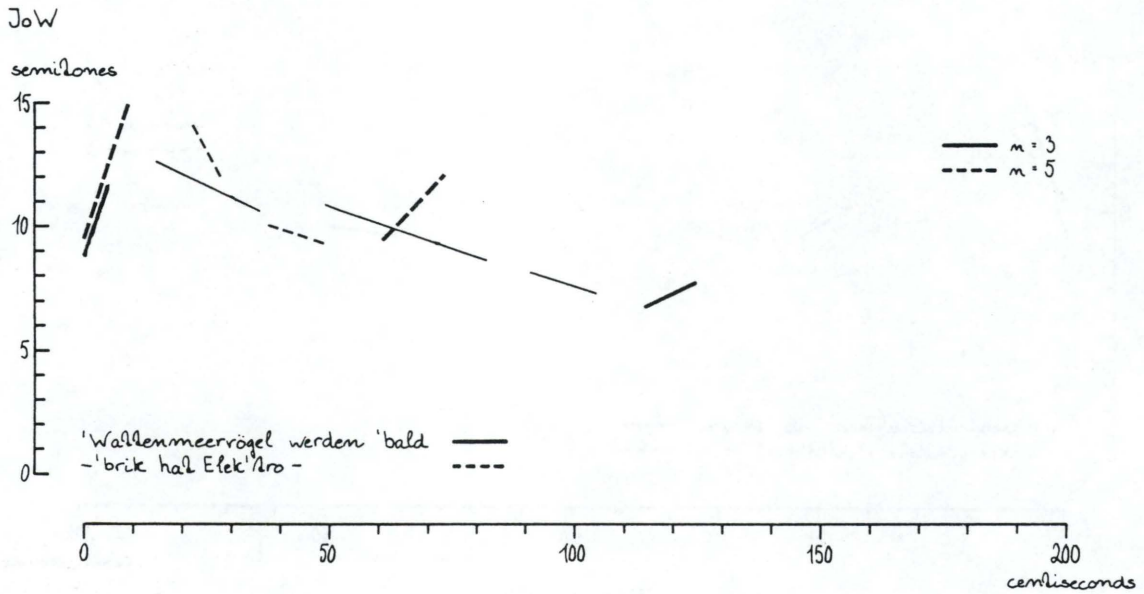


Figure 44

Figure 45

c. Long stress groups

This caption is inappropriate where 'vadehavsfugle vil' (and 'grænsehandelsbutikker') are concerned with the Danes. From dialect studies in the area, we could expect the composita to be produced with two main stresses (Jensen and Nyberg 1977, p. 53-54, Bjerrum 1948, p. 73-79), and that is how they turned out, cf. figs. 38-43, i.e. both long words are produced with two clear rising-falling patterns, which fall into their expected places on the intonation contour. Note also that the difference seen above, in section B.3, between intonation contour (prelude) slopes comes out here: 'vadehavs-' and 'grænsehandelsbu-' respectively is the second stress group in the utterance, 'brikken --' is the first one, which accounts for the different placement in the range with Tønder speakers, whose slopes slant more than with the Sønderborg speakers, where those two stressed syllables nearly coincide. JB produced a clear prosodic boundary after 'Wattenmeervögel' and stressed 'Elektronik' on the last syllable, and is left out in this section.

Particularly with the double stressed words by the Danes, it is very apparent that what shapes the Fo patterns is the stressed syllables, irrespective of where in the word the stress(es) may be located. Word boundaries as such leave no separate trace in the Fo course. The stress group patterns are bound to the left by the onset of the stressed vowel and to the right by the onset of the next stressed vowel. HS, ES and PBP offer very clear cases in point: '-brik solgte elektro-' and 'grænsehandelsbu-' would be exactly concurrent, if voicing was unbroken throughout.

The longest stress group ('-brikken solgte elektro-') with the Danes confirms the impression of stress group patterns, that the fall from the maximum is largely performed within the first and second post-tonic, and then levels out, and that this fall is more extensive in Tønder. But the two Germans, on the contrary, seem to expand the fall in time. I am not sure that MS did not produce a prosodic boundary at the NP/VP boundary in 'Die Fabrik/hat Elektronik ...', cf. the discontinuity between the maximum in '-brik' and succeding 'hat'. But JoW did not, so it is legitimate to compare the behaviour of the post-tonics in the two stress groups in fig. 44: the extent of the fall is approximately the same, but the full line edition is about twice as long, and accordingly the slope is less steep (and compares well with MS's long stress group). If this is a general feature, which previous figures do not contradict, and if we except stress group patterns before phrase or utterance boundaries, it seems that the Germans have some of Bornholm's characteristics: stress group pattern rises and falls are frequency constant, and falling slopes are adjusted in accordance with the temporal structure, which calls for a vigilant, on-line look-ahead and scanning of the composition of each stress group, in order not to miss the target, i.e. the proper offset value in the last post-tonic. Inspection of all of the utterances by the Germans exhibited here, indicates that this

offset is equal to the onset of the next stressed syllable, still excepting post-tonics prior to a phrase boundary, and final post-tonics, of course. In other words, the Fo onsets of the stressed syllables constitute the turning points, the local minima in the rising-falling stress group patterns - they set the lower limit of the prelude grid. - Since there is a limit to how rapidly Fo will change (in the absence of accentual or junctural "lows"), the fall is truncated in the shorter stress groups, as demonstrated by figs. 35 and 36.

2. STRESS GROUPS AT PHRASE AND UTTERANCE BOUNDARIES AND UNDER SENTENCE ACCENT

a. Phrase and utterance boundaries

Stress groups at phrase or utterance boundaries suffer no qualitative change with neither Tønder nor Sønderborg speakers, except that the rising stressed vowel movement may be falling, but that is probably the exception rather than the rule. Quantitative changes are apparent only with the global Tønder speakers: the narrowing of the grid, induced by the progressively lowering stressed syllables, make stress group patterns at the end of the contour less extensive than at its beginning.

Boundaries induce both qualitative and quantitative changes with the German speakers. Utterance final stress group patterns change from rising-falling ones into clean falls, i.e. the stressed vowel changes its movement from rising to falling, and the extent of the fall to the utterance final "low" is greater than in preceding stress groups in terminal contours. This fall is even greater in non-terminal contours, beginning as it does from a higher onset, with those speakers who do not prosodically signal interrogative mood with a final post-tonic rise. It is still not clear to me what status to assign to the change in stressed vowel movement before an utterance boundary: whether it is an anticipatory effect from the succeeding "low" (if so: why is the last 'V also falling in JoW's non-terminals, which end in a post-tonic rise?), or whether it is an independent utterance boundary feature. In the latter case we would have to explain the rising stressed vowels in the one-stress echo questions. Note that utterance final falls are not expanded in time (as seems to be the case with long stress groups in utterance medial position, cf. above) - the "low" is reached with the first post-tonic, and the succeeding post-tonics continue low and level after that (: 'Kassel fahren' in figs. 16-19). - Utterance medial phrasal boundaries disrupt the otherwise smooth course of the post-tonics, to the effect that the syntactic boundary is clearly localized in the Fo configuration, either by a fall-rise pattern immediately prior to the syntactic/prosodic boundary, or by a higher rise to the post-tonic in the constituent to the left and a discontinuous fall to the pre-tonic to the right of the boundary. The evidence from JoW, MS and JB seems to suggest that final fall-rises in non-terminals imply phrasal boundary fall-rises

too, but that is not so: the fourth speaker, HH, had fall-rises finally in his questions, but not at the phrasal boundary after 'Markus' in the long utterance.

b. Sentence accents

Final sentence accents are manifest only with Germans, and focal and default accents are not distinguishable: the falling pattern is maintained, but it is more extensive, starting as it does from a relatively higher level.

Stress group patterns retain their rising-falling movements in connection with non-final (focal) sentence accents with the Danes. The accented item itself carries no overt cue, but succeeding stress group patterns are subjected to a lowering in the range and a diminishing of the extent of movement, though not a complete wiping-out. Non-final sentence accents with the Germans may be upwards boosted, i.e. the stressed syllable may be higher in the range than under no-accent condition, ceteris paribus, but not necessarily so. The common feature is an extensive fall in the first post-tonic of the accented item. Succeeding stress groups continue at the low level where the accent lands them. An utterance final, post-accentual stress group will retain some of its otherwise distinct fall, cf. figs. 5, 6 and 7: 'Kappeln', 'Kassel' and 'Kamma' (broken-dotted line), where the (lexically) stressed syllable steps up slightly from the preceding unstressed syllable and performs a modest fall. The accentual fall is another example of non-expansion in time of Fo movements through unstressed syllables: Apparently, the demands of accent and boundary signals suspend the "neutral" characteristics of stress groups with the Germans. These falls from high to low in non-final sentence accents are troublesome for the phonological interpretation: I have assumed that the utterance final falls in the isolated utterances were not, per se, anything to do with sentence accents, because they are present also when no default accent is perceived, whilst a default accent simply enhances the fall by increasing its onset; nor are they terminal, because they may be present also in non-terminal contours (which is the rule rather than the exception with MS and JB) and even larger still, because the onset is yet higher (see Table IXa, MS: Ki, Kf +DA, and Q where the same word 'Kassel' is in final position; its stressed vowel increases from 7.1 through 8.2 to 9.4 semitones and concomitantly the interval from the penultimate stressed vowel decreases from -1.6 through -0.2 to +1.0 semitones, while the final low remains quasi constant at 2.1, 2.2 and 2.7 semitones, respectively). A similar difference in extent of the utterance final fall was observed between the question and a declarative with early sentence accents (with JB, cf. Table IXa: Q +SA, Km +SA): both utterances have a sharp fall from the accent, but in the question it is not as extensive, to the effect that the post-accentual level stretch runs higher in the range until the last (lexically) stressed syllable, where a final drop to "low" is executed. These facts suggested to me that utterance final "lows" were junctural, end-of-utterance cues, not specifically

accentual and not terminal either. (Another end-of-utterance cue is the final rise to "high" which accompanies some non-terminals, and which is more common with some speakers than with others.) But what do we make, then, of the early and steep falls on accented items in the terminal declaratives? They cannot be "end-of-utterance" manifestations, but must reasonably be assigned to the accent. Where is the utterance boundary cue, then (apart from the final lengthening, cf. section D. below)? We can probably claim that a slight final fall is present. This would mean that there are two "lows" involved in the system, one associated with sentence accent, and one associated with juncture, both of which are subordinate to or constrained by grosser sentence intonation features. The "low" juncture accompanies terminal intonations and some non-terminal ones (with some speakers, at least), but non-terminals may also have a "high", or maybe better: a "low-high" at the utterance boundary. In isolated utterances without perceived default accent, what we get is the uncontaminated manifestation of the juncture "low", i.e. a 4-5 semitone drop from the stressed syllable. With an added default or final focal accent, the accentual and the junctural "lows" merge, and the fall from the higher accented syllable is greater. In terminals with an early accent, the accentual low moves left with the accent and leaves little room for the manifestation of (a fall to) the junctural low (i.e. the final juncture is subordinate to the demand for suppressed or deleted Fo patterns after the accent). In non-terminals with an early sentence accent, the manifestation of the accentual low is checked or counter-acted by, i.e. subordinate to, the demand for a higher post-accentual contour than in terminals (as witnessed by JoW and JB's question), the termination of which may be with a junctural "low" (JB) or a junctural "high" (JoW). - To interpret extensive Fo falls as having exclusively to do with sentence accents, and thus to signal "last significant Fo event in the utterance", which is the position taken by Bannert (1985), is not quite satisfactory, for two reasons: Not every final fall induces the perception of an extra prominence relative to previous stressed syllables, i.e. a sentence accent (unless we want to postulate that an extensive fall expresses 'sentence accent', whether perceived as especially prominent or not - but that would make the denotation 'sentence accent' rather void). Secondly, a final fall is encountered to a greater (in non-terminals) or lesser (in terminals) degree in utterances with non-final sentence accents. - Some of this reasoning rests on rather scarce evidence, but if it is tenable it is interesting, among other things, because of the interdependence it demonstrates between tonal events at different levels in the prosodic hierarchy, in casu: sentence intonation function, sentence accent and juncture, where sentence intonation governs the realisation of the accent "low", and where sentence accent location determines the extent of the fall to junctural "low".

3. CONCLUDING REMARKS

To highlight the differences, and put them in perspective, in the alignment of segments and Fo in the prosodic stress group, which are difficult to include in the schematic summary in section IV. below, fig. 46 displays model stress groups from each of the languages/varieties investigated so far. They represent stress groups in non-final position, not under sentence accent and not preceding a prosodic phrase boundary (these remarks are crucial only for Sønderborg and German). Each frame should bring out what appear to be the salient characteristics, the prototypes. Most frames are modelled from stress groups in the long terminal declarative, but are also impressionated by the five systematically shortened ones. No speaker faithfully produces each and every stress group as fig. 46 would predict - there is a considerable leniency, a margin for play within the limits set by fig. 46. And synthetic speech would, I presume, sound dull and mechanical without a certain improvisation (whether context dependent or random) over these themes. Nevertheless, I am certain that fig. 46 does reflect pertinent differences, in range spanned, in extent of rising and falling movements, in slope of rising and falling movements, and in strategies to meet differences in stress group duration. - I also think that it is these differences which contribute more than any other single parameter to our immediate, unreflected recognition of language/regional characteristics.

At the top of the figure I have assembled those stress groups where some form of compression/expansion takes place, as indicated by the boundary arrows at the top of each frame, whereas the lower part of fig. 46 displays types where a clean truncation reduces the pattern in extent when the stress group is shortened. Note that long and short vowels onset differently in Aalborg, Tønder and Sønderborg, but their offset is constant with respect to the stress group maximum. The small arrows beneath the upper row of frames indicate the location of Fo turning points in relation to definite segmental events. Beneath each frame I have auditorily characterized each pattern in terms of movements and/or a sequence of highs and lows. Naturally, every pattern can be formally described in terms of either one or the other - the distinction in the figure is due to my own auditory impression that in some cases the movements are perceptually very distinct and heavily significant as such, in others I perceive rather a succession of levels. Some cases I cannot quite decide. The distinction is clearly correlated with the extent of the movement, and how rapidly it is performed, i.e. its slope. Thus, with Aalborg, Tønder and Sønderborg, I hear the rises as such when the stressed vowel is long, but as a "high" when it is short. Standard German, Flensburg and Copenhagen have "declining" post-tonic falls, which distinguishes them auditorily from the more extensive "falling" movements in other frames.

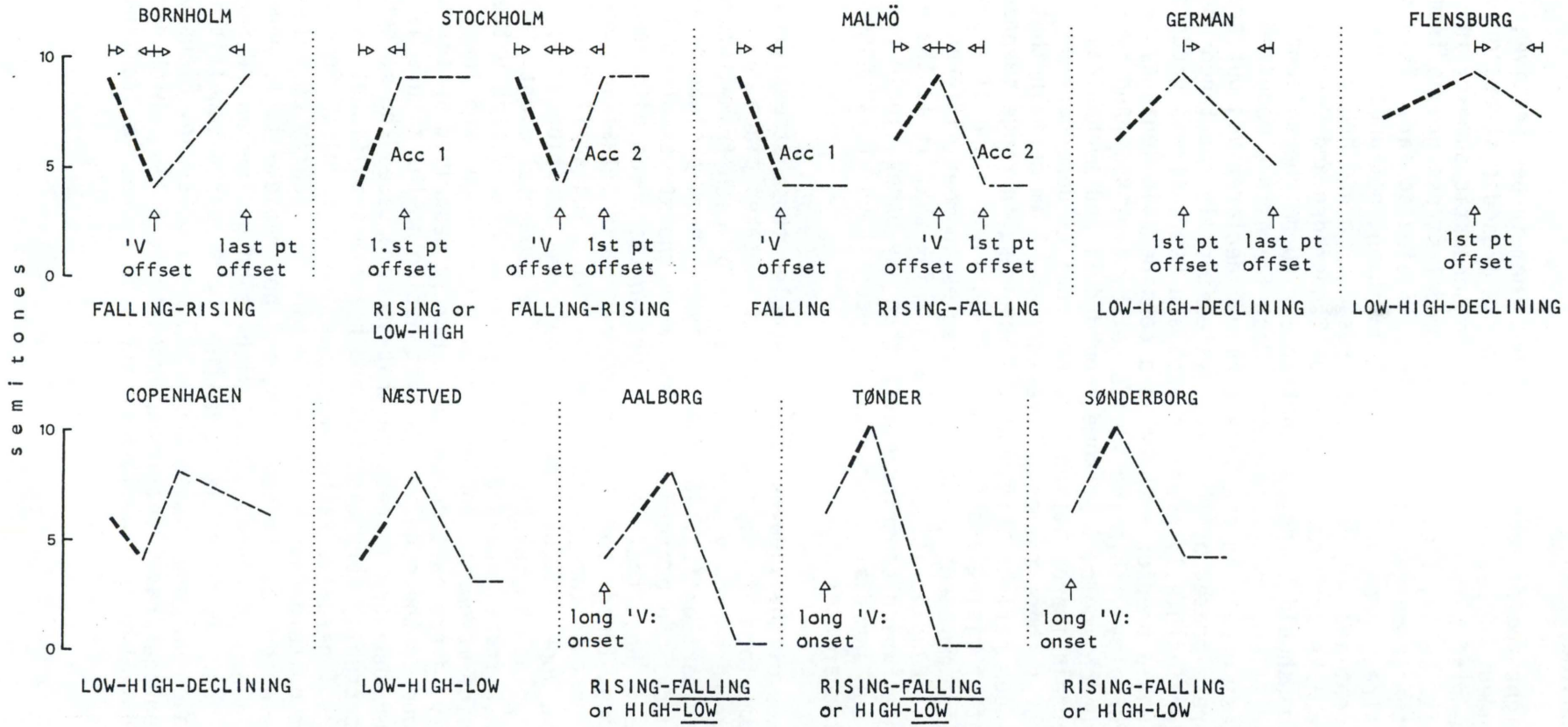


Figure 46

Model stress group patterns from ten languages/regional variants. Horizontal arrows delimit movements which may be expanded or compressed. Vertical arrows depict turning points which anchor segmental events. The patterns are characterized auditorily below each frame. See further the text.

Bornholm, Stockholm (Accent II) and Malmö (Accent I) are the only ones to have falling stressed vowels, all the others are either low, rising, or high with declining or falling post-tonic tails. For a discussion of the way I have characterized the word accent patterns in Swedish, which deviates from the - by now - standard descriptions of Gösta Bruce and Eva Gårding, see Thorsen (1988a, p. 48ff) and the references therein.

Bornholm is the most uncomprimisingly compressing/expanding sample in this collection: stressed vowel slope as well as the rising post-tonic tail are neatly adjusted to their durations, i.e. the adjustment encompasses all of the prosodic stress group. Not so with the two Swedish varieties, where a modest adjustment is performed within that part of the segmental chain which is relevant for the word accent distinction, i.e. the stressed syllable in Accent I and the stressed and first post-tonic in Accent II. Succeeding post-tonics are extended roughly level from or cut back to the word accent offset, which is what warrants the "compression and truncation" label in the schema in section IV. below. Standard German and Flensburg are similarly labelled, but here the characterization refers to the fact that the post-tonic slopes are expanded/compressed only to a point: beyond a certain steepness, the post-tonic tail is truncated.

Standard German and Flensburg patterns are similar in shape, but the movements are less extensive and slower in Flensburg. I wonder whether there are not also rather characteristic differences in vowel durations or vowel to consonant duration ratios (as I have intimated in the frames) in Flensburg versus Standard German, and whether this may not be the most significant prosodic difference between them, since I have found little else in my data that the Flensburg speaker did or did not do, in opposition to the two Standard German speakers. The same comment probably holds for Aalborg versus Tønder and Sønderborg, that vowel/consonant ratios are significantly different. Segment duration will be the object of a separate investigation I intend to undertake. Tønder and Sønderborg patterns differ mainly in the extent of the fall. Copenhagen and Næstved differ partly in the location of the stressed vowel relative to the first low point, partly in the quick movement to a perceptually rather salient "low" in Næstved. Although the turning points in the lower part of fig. 46 are time constant, the high in Copenhagen is generally located in the first post-tonic, the low in Næstved in the second post-tonic, the low in Aalborg in the first post-tonic, the lows in Tønder and Sønderborg in (or between) the first and second post-tonics.

D. FINAL LENGTHENING

Due to the rather parenthetical nature of this part of the investigation, the present section will be restricted to a mere presentation of the facts. For a thorough treatment of segment duration as a function of context, including references to the existing literature, the reader is referred to Lindblom (1978)

and Fischer-Jørgensen (1982). See Thorsen 1988a, p. 130ff, and 1988b, p. 192ff, for accounts of final lengthening in Copenhagen, Bornholm, Skanian, Stockholm Swedish, Næstved and Aalborg.

I have measured each segment in 'Kamma' (in initial and final position in isolated utterances and in utterances which invited a focal accent on 'Kamma' as well as a focal accent somewhere else in the utterance), excluding the closure of the aspirated stop, though, which cannot be delimited in utterance initial position. I have measured groups of segments in '-rí/st/erne'/, /'-rí/st/en', as indicated by the slants. There are two major segmentation problems: intervocalic /r/ in 'turísterne'/ /-rísten', which is a uvular approximant or weak obstruent, and the final vowels. The /r/-onset was determined where the intensity curves begin to drop from the preceding vowel. The final vowels are more cumbersome. They may terminate in weak breathy voice or in weak unvoiced aspiration (but rarely in creaky voice, which generally characterized the Stockholm speakers). The segmentation which offers the best uniformity across speakers and utterances is a vowel offset coinciding with the point in time where the high-pass filtered intensity curve reaches zero, which is accordingly the criterion adopted here. This corresponds physiologically to the point in time where the vibratory pattern of the vocal cords produces a source function with little energy in the upper part of the spectrum and where any energy below 500 Hz, which might be produced by 'edge vibrations' is disregarded. An objection to the effect that this cuts back precisely that phase which may constitute the final lengthening is at least partially muted by the fact that the same procedure has been employed across all speakers and regional languages, but it did indeed lead to different results. Correspondingly, the final vowel in initial words was offset at the point in time where the intensity of the noise of the succeeding fricative (/s/ or /f/) ('Kamma stammer ...'; 'Turisterne fordobler ...') rises sharply, or where the closure of succeeding /g/ ('Turisterne gør ...') has been formed, i.e. where the intensity reaches zero.

The results are presented in Table X, where the difference, in centiseconds, of the total duration of the (part of the) word in final minus initial position is given, with indication of the distribution of the lengthening in those cases where it is both statistically significant and considerable. Note that there are negative values, i.e. instances where the initial item was longer than the final item, ceteris paribus.

Final lengthening is not a stable feature of Tønder speakers, on the contrary: AS actually shortens his segments in utterance final position, compared with initial position. Sønderborg speakers are not entirely unambiguous, either, cf. HS and PBP's values on initial 'Kamma', but probably warrant a classification as generally lengthening finally. The Germans uniformly lengthen final segments, and in some cases rather considerably. Common to all instances of final lengthening

Table X

Differences in duration, in centiseconds, of (parts of) words in utterance final minus utterance initial position, based on averages of measurements by speakers from Tønder, Sønderborg, Standard German and Flensburg. Values in parenthesis pertain to cases where the number of measurements behind the average value is less than five. Differences that are statistically significant (student's one-tailed t-test) are indicated with one, two, or three stars, corresponding to levels of probability of 0.05, 0.005, and 0.0005, respectively. "'Kamma" is the word from the isolated utterance, "''Kamma" is the word under focal accent, and ",Kamma" is the word from utterances where the focal accent was located somewhere else.

	'Kamma	''Kamma	,Kamma	-rister(ne)/ -risten
AS	-4.2** ($_{o}$a)[1]			-4.6 (erne)
JC				3.7 (ster)[2]
HS	2.2 (m)			9.0*** (st)[2]
ES	6.2*** ('ama)			4.7* (erne)
PBP	-0.1			5.0*** (erne)
JoW		4.6*** ($_{o}$a)	11.4*** ($_{o}$a)	
MS				13.5*** (sten)
JB	4.3** ($_{o}$a)		5.2** ($_{o}$a)	6.5** (sten)

1) the parentheses indicate that or those segments which carry most of the difference. Underlined segments are relatively more lengthened.

2) JC and HS pre-positioned the definite article, i.e. final '-ne' is lacking.

is the fact that it hits the post-tonic segments, except with ES's "'Kamma". The 1988 investigations established final lengthening as a feature independent from pronounced final Fo movements, cf. p. 4 above and Thorsen (1988a, 1988b), which is corroborated by the German data here, since final "ˌKamma" is lengthened even though its Fo movement is greatly reduced, due to the occurrence of a focal accent earlier in the utterance. Thus, the independence of the final lengthening parameter, and its non-universality has been attested to again.

IV. SUMMARY

The parameters investigated are listed in tabular form below, including the results from previously investigated languages/ varieties.

	SENTENCE INTONATION SIGNALLING	DEFAULT SENTENCE ACCENTS	FOCAL SENTENCE ACCENTS	FOCUS BY STRESS REDUCTION OF SURROUNDINGS	FINAL LENGTHENING	STRESS GROUP PATTERNS GET TRUNCATED/ COMPRESSED
STOCKHOLM	local	compulsory	compulsory	- - -	yes, extensive	truncation and compression
BORNHOLM	local	optional	optional, frequent	- - -	no	extensive compression
MALMÖ	global	no	no	optional, rare	optional?	truncation and compression
COPENHAGEN	global	no	no	optional, never finally	yes, modest	truncation
NÆSTVED	global	no	no	rare, never finally	optional	truncation
AALBORG	global	no	no	optional, rare finally	optional	truncation
TØNDER	global	no	no	optional, never finally	yes and no	truncation
SØNDERBORG	local	no	no	optional, never finally	yes	truncation
FLENSBURG	local	optional	optional, frequent	- - -	yes	truncation and compression
STANDARD NORTH GERMAN	local and global	optional	compulsory, except finally	- - -	yes	truncation and compression

The schema speaks for itself, and the appropriate comments have been given in each of the concluding sections above. There are, however, a few features which I wish to touch upon briefly here, again. It appears that there are hardly any categorial differences between the Flensburg and the Standard North German varieties. If the present results are valid, the difference seems to lie in the shape of the Fo pattern, which spans a smaller range and reaches its maximum later with the one Flensburg speaker, than with the two Standard speakers, and where furthermore a difference in vowel to consonant ratios may be found. This presupposes, of course, that I have not accidentally hit upon a completely individual characteristic with JB. The difference between Tønder and Sønderborg seems to lie mainly in their different strategies for sentence intonation function signalling, as well as in stress group pattern differences. One feature that might contribute towards the aforementioned German-sounding Sønderborg intonation may be the systematic difference between non-final and final stress groups, the latter offsetting at a particularly low value. Besides, but this is something which awaits an investigation of durational relations within the prosodic stress group, I suspect that Sønderborg stands out from other Danish regional languages and teams up with German, in its rather fuller and thus longer (i.e. non-reduced) post-tonic syllables. On the other hand, the two German varieties stand out from Danish by a number of facts: by a weighting of individual elements within syntactic constituents, by a more direct and variable control of stress group patterns in connection with prosodic/syntactic boundaries and with declarative vs. interrogative mood, by the optional occurrence of, albeit weak, default accents, and by the manifestation of focal accents. If, in spite of these rather decisive differences between (Standard) German and (inter alia) Sønderborg, Sønderborg could still be mistaken for German in a noisy transmission, i.e. where segmental information carries insufficient cues for identification, then my assumption that stress group patterning, including timing, contributes more than anything else towards our discrimination and identification of languages/dialects/regional varieties of standard languages is supported.

The prosodic differences between these otherwise closely related languages are rather considerable and one is left to wonder why this is so. It is hardly conceivable that they be due to corresponding differences in syntax. Danish, Swedish and German are not that different syntactically, and - particularly - the materials recorded for the comparative analyses were near identical, both semantically and syntactically. It is possible, though perhaps not very likely either, that somewhat greater differences would be found in the syntax of spontaneous speech (versus read 'lab speech'), and that the prosodic systems are basically tuned to the latter speech style. This is an empirical issue, but I doubt very much that spontaneous Danish should be so much richer in structure (compared with Swedish and German) to reasonably compensate for the rather poorer inventory of prosodic parameters and their manifestation. Instead, I propose that some languages/variants

simply go down as less expressive prosodically than others. Copenhagen would then lie at the lower end of that continuum, and Bornholm and Central Swedish at the other, something which matches rather accurately the linguistically naïve prejudice that Copenhagen Danish is flat and monotonous, whereas, e.g., the Swedes sing a whole lot more.

Finally, I am aware that with time and with each new investigation in this series, modifications of previous ideas have been introduced, terminology has been adapted, and new features introduced. Thus, juncture signals were not considered in the 1988a and 1988b investigations. - In a forthcoming paper I will attempt to summarize the pertinent facts about accents, sentence intonation and junctures and consider the theoretical implications. More specifically, I will discuss these various prosodic systems with respect to two current theories about the phonology of intonation.

V. NOTES

1. However, on p. 55-56 in Thorsen (1988a) I noted that Accent II words in pre-focal position also come up with a rise - though not as extensive as under sentence accent, and I suggested that the rise might actually be part of the accent command, which is then reinforced under sentence accent. The complete lack of any rise in Accent II words in post-focal position, I suggested on p. 68, might be due to a de-stressing, which does not apply in pre-focal position. This is a matter for further investigations.

2. Only in the final stages of getting this manuscript ready for printing did a copy of the book by Hans Altmann, Anton Batliner und Wilhelm Oppenrieder: Zur Intonation von Modus und Fokus im Deutschen, Max Niemeyer Verlag, Tübingen 1989 reach me. I am sorry that I have not been able to read it in time to take it into account here.

ACKNOWLEDGEMENTS

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Institut für Phonetik und digitale Sprachverarbeitung, Universität Kiel, who helped me transform the Danish material to acceptable German and furthermore took it upon himself to listen to the recordings of the German subjects. Finally, I am grateful to Niels Dyhr, Birgitte Jakobsen and Jeanette Holtse for assistance with measurements and graphics work. - Since this is to be the last issue of ARIPUC in its present form, I doubt that I shall have the pleasure again of seeing my manuscripts transformed into their neat printed appearance through Else Parkmann's flawless typing. Actually, Else Parkmann retired a year ago, but nevertheless consented to come here and do me this favour.

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WHAT LANGUAGE DO "THE SPIRITS OF THE YELLOW LEAVES" SPEAK?: A CASE OF CONFLICTING LEXICAL AND PHONOLOGICAL EVIDENCE*

Jørgen Rischel

This paper (which in part summarizes two papers to appear in Acta Orientalia but which presents separate information as well) deals with some issues raised by descriptive and comparative linguistic work in northern Thailand. The putative Austroasiatic languages "Yumbri" and "Mrabri" (more correctly: Mlabri) have been assigned to "Khmuic" within the Mon-Khmer languages, but the relationship between these two idioms has been a controversial issue. On the basis of recent fieldwork all existing data on "Yumbri" and "Mrabri" can be shown to reflect one and the same language Mlabri in spite of wide discrepancies in notation; these do not even reveal major phonological dialect differences whereas there are conspicuously different lexical usages. This has not so far been properly understood because of difficulties in the interpretation of earlier data which were all gathered by amateurs. - As for the tentative genetic classification of Mlabri as Khmuic, the lexical evidence used to substantiate this claim now turns out to be controversial: a large number of the Khmuic words in Mlabri are rather direct reflexes of an early stage of Tin, a language that has been assigned to the Khmuic branch of Mon-Khmer. Thus, it is either the case that Mlabri and Tin are sister-languages (forming a "Tinic" branch of Khmuic) or that Mlabri has early borrowings from Tin.

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* The work on "α-Mlabri" and much of the work on Bernatzik's "Yumbri" was done in close collaboration between Professor Søren Egerod of The East Asian Department, U. of Copenhagen, and this author.

1. Introduction.

Mlabri (i.e. /mla:ʔ bri:ʔ/ 'people of the forest') is a small tribe of hunter-gatherers living in the northern part of Indochina. Of this tribe there are less than two hundred adults and children who live in the eastern provinces of northern Thailand; it is unknown to what extent and in what number there are Mlabri in neighbouring countries. The Mlabri in Thailand are now rapidly giving up their former nomadic life partly because there is not enough forest left to provide food for hunter-gatherers, which makes them dependent on villein service on the fields belonging to Miao (Hmong) peasants, and partly because the Thais have recently engaged in a program of acculturation (school training etc.).

The Mlabri speak a language (also called Mlabri) of which a brief phonetic sketch was given in an earlier issue of ARIPUC (Rischel 1982).

Some fifty years ago Hugo Bernatzik (1938) wrote a report about his encounter with a mysterious tribe called the "Spirits of the Yellow Leaves" in the mountains of Northern Thailand. He included two rather short word lists in the language of these hunter-gatherers, who according to Bernatzik called themselves "Yumbri". Later reports (Kraisri 1963) have dealt with a related language called "Mrabri", more correctly Mlabri (see, e.g., Rischel 1982), which is likewise spoken by tribal people referred to as the "Spirits of the Yellow Leaves" (= "Phi Tong LÜang" in Thai).

In linguistic handbooks one finds the designations Yumbri, Mrabri, and Phi Tong Luang; the recent language map of Thailand (1977) just gives the (correct) cover term Mlabri. However, since Bernatzik's data differ considerably from those of later sources, it has been a matter of dispute whether these terms refer to different languages or whether they all refer to one and the same language.

Kraisri Nimmanhaeminda, who had worked with the Mlabri in 1961 and 1962 (Kraisri 1963), assumed that "the Yumbri and Mrabri are the same people" and found that "the Yumbri and Mrabri languages are close to Mon-Khmer languages and they should belong to this group". The obvious difficulty with linguistic comparisons involving the older Yumbri and Mrabri data is that neither Bernatzik nor Kraisri used a professional phonetic or phonemic notation.

Smalley (1963) made an impressive attempt at a phonological restatement of both Bernatzik's and Kraisri's data, assuming that these languages were

typologically close to well-known northern Mon-Khmer (Austroasiatic) languages. He further made a lexicostatistic comparison of the Yumbri and Mrabri data on the basis of Swadesh' list, and compared these with some Austroasiatic languages including Kammu (or Khmu?) and Tin (or T'in), languages assigned to the Kammuic or Khmuic branch (on lexicostatistic evidence, Thomas and Headley 1970). Smalley concluded that Yumbri and Mrabri must be two different languages and that "the Mrabri are linguistically just as closely related to the Khmu? and the Tin as to the Yumbri". He further made the remark that he very much doubted that Mrabri and Yumbri would be mutually intelligible (Smalley 1963, p. 191).

Thus, some twenty-five years ago the prevailing opinion was that there are two languages Yumbri and Mrabri spoken by groups of the same kind of people, and that these languages belong to Khmuic. However, Ferlus (1974, p.47-48) refering to data from Laos (see below) found that Yumbri and Mrabri are undoubtedly one language which has branched into dialects because of the way its speakers live. Rischel and Egerod (1987) published evidence for an identification of Yumbri and Mrabri as one language: Mlabri, a result which is strongly at variance with Smalley's analysis of the earlier data, but which was based on new lexical data stemming from rather extensive fieldwork.

Nobody so far has suggested an alternative to the classification of Yumbri/Mrabri as belonging to the Khmuic branch, although this classification is in fact much more controversial than our identification of Bernatzik's and Kraisri's data as specimens of one and the same language. There are obvious affiliations with Khmuic, but in principle these might be due to influence from a neighbouring language on Mlabri (Yumbri/Mrabri) at some period in time, and in fact there is very strong evidence in favour of an old layer of influence from Tin, as will be shown below (also see Rischel forthcoming b).

The description and classification of an almost unknown tribal language spoken by maybe some 200 persons may seem of limited phonetic or linguistic interest. But I think the difficulties researchers have had with the proper classification of Mlabri may be of some interest also to theoreticians. It is thus the purpose of the present paper to use the Mlabri language to illustrate the obstacles and pitfalls that linguists may encounter when interpreting old fieldwork data and when attempting to classify languages for which there are no very old records available.

2. "Yumbri", "Mrabri" and Mlabri.

2.1. The transcription problem.

Rischel and Egerod (1987) gives a survey of the research done on Mlabri up to that time. In addition to Bernatzik's "Yumbri" data from 1938 and Kraisri's "Mrabri" data from 1963 there is a small word list which Michel Ferlus took down in IPA notation in Xagnabouri province of Laos in 1964 from Mlabri speakers, who according to Ferlus referred to their language as kămlua? (lua? is a name associated with several groups speaking Mon-Khmer languages). Ferlus found their language to be rather close to Kraisri's Mrabri, and in cases of disagreement between the two sources the word was often found in Bernatzik's Yumbri. Quite recently Dr. Ferlus has kindly let me study his word list, of which some specimens are given below. Furthermore, Jesper Trier (1986) has recorded the oral ritual texts of the Mlabri and given some specimens in his own transcription, with English translations.

In order to illustrate the phonetic relationship between the data in these sources and our own Mlabri data a few lexical items which happen to be shared by most sources will be cited here exactly the way they are transcribed by the various authors:

	Bernatzik 1938	Kraisri 1963	Ferlus 1964	Trier 1986	Egerod & Rischel
father	ĕmūm	merm	măm	mŏm	mɤm
mother	ĕmū	merh	mă?	mŏ	mɤ?
man	ĕyŏgn	yôŋ	-	yom	jo:ŋ
eye	mát	măd	măt	(mad)	mat
tree	lăm	lam	lăm	lam	lam
wind	rmŏt	-	rmɨt	rui-mud	rmɯt/rɯmɯt
spear	kŏt	kod	khɔt	kot	khɔt
spirit	-	wok	wɔk	wok	wɔk
die/dead	bŭl	bŭl	bɨl	bul	bɯl

[Commentary to some individual words: (1) As for 'father', 'mother', 'man' Bernatzik has an initial vowel ĕ-. It occurs in his list with several nouns and may be a particle which we know as /?at/ or /?ak/. (2) As for the word 'eye', Trier's form is translated 'to see'. (3) For 'wind' Kraisri has the Thai word lom. (4) As for 'spirit', Bernatzik has some quite different words occurring in phrases which are difficult to interpret.]

At first glance the correspondences given above may give the impression of considerable phonetic distance, such as between dialects or even between different but closely related languages. However, it is obvious that quite a few of the differences are simply artefacts of the different notational conventions the researchers have used. In fact, only two sets of data can be directly compared, viz. those of Ferlus and of Egerod & Rischel who use the IPA alphabet; it is noteworthy that these very sets are extremely alike though one was taken down in Laos twenty-five years ago, the other in Thailand during the last few years. It should be noted that Ferlus did not indicate vowel length but instead indicated brevity in some cases by an arc over the vowel (example: ŏ); Bernatzik did the same but also indicated long vowels by a stroke over the vowel symbols (such as ō). Among the purely conventional differences I should also mention the use of [y] in some sources versus IPA [j] in others, and the (inconsistent) use in Bernatzik's data of underlining to indicate more open vowel quality (e̲ being intended as a more open vowel quality than e, for example). The symbol ṅ is used in some cases by Bernatzik to indicate a velar nasal, but he sometimes writes gn instead in words that have a velar nasal in Mlabri.

However, there is no simple way to assess the phonetic or phonemic meaning of the data that is given in non-IPA notation since with the exception of Bernatzik the authors give no separate phonetic information, and Bernatzik says little more than has been mentioned already about his own notation. One may get a little closer to an interpretation by confronting a general typological knowledge (of sound systems in northern Mon-Khmer languages and of the sound system of contemporary Mlabri par excellence) with our knowledge about the various untrained authors' backgrounds. - Bernatzik and Trier are immediately comparable on this point.

Before going into details of the various authors' transcriptions I shall present the inventory of Mlabri phonemes according to a very simple-minded phonemicization, cf. Rischel 1982 and also cf. Egerod and Rischel 1987, p.36ff. (In Egerod and Rischel 1987 vowel length was not indicated since we were not sure how to phonemicize with regard to quantity; the length mark given in this paper agree with our most recent revision of the data.)

As for the vowels, Mon-Khmer languages may exhibit three or even four degrees of aperture; Mlabri has a distinction of four in the back unrounded series /ɯ ɤ ʌ a/. Moreover, there are three different sets: front unrounded, (mid or

back) unrounded, and back rounded, e.g. /i ɯ u/. This together makes for a vowel system in Mlabri which is of the same complexity as the Danish one but with very different vowel qualities:

i	ɯ	u
e	ɤ	o
ɛ	ʌ	ɔ
	a	

The consonant system (the maximal system, viz. in initial position) may be set up as follows:

ph	th	ch/ɕ	kh	
p	t	c	k	
b	d	ɟ	g	
ʔb	ʔd			
hm	hn		hŋ	
m	n	ɲ	ŋ	
hw	hl			h
w	l r	j		
ʔw		ʔj		ʔ

Word finally only the following occur in contrast: /p t c k m n ɲ ŋ lh ɕ h w l r j ʔ/.

The digraphs /hm hn hŋ hw hl/ indicate essentially voiceless consonants (given as /m̥ n̥ ŋ̊ w̥ l̥/ in my 1982-paper); the digraph /lh/ indicates a (final) lateral with devoicing increasing toward the end of the segment (in 1982 I used the symbol l̥).

Ferlus' notation of 1964 is largely - and in fact surprisingly - consistent with this representation of Mlabri, although there are some differences in individual wordforms. As for purely technical differences in notation I shall mention that he uses ɨ or ɨ for our /ɯ/, and ś for our initial /ch/ or /ɕ/ (the latter phoneme is in fact a sibilant more often than an affricate, and it is never a pure stop in Mlabri, so the representation /ɕ/ or /ś/ is preferable from the point of view of phonetic realism). As said above Ferlus does not indicate length but sometimes vowel brevity, cf.

	Ferlus	Egerod and Rischel
earth	bĕʔ	bɛʔ
mushroom	het	het
fish	kaʔ	ka:ʔ

The fact that there is <u>not</u> complete bi-uniqueness between our transcriptions could be due either to difficulties in assessing length (which is extremely difficult for Mlabri) or to differences in the linguistic usages of informants, or both. Anyway,

the phonetic similarity between his kămlua? of Laos and our Mlabri should be apparent.

Let us look then at Kraisri's data from 1963. Kraisri used a notation which seems in part based on English semi-phonetic transcription. However, for the sake of readers with better command of Thai he added transcriptions using Thai letters. It turns out that these Thai transcriptions are generally more adequate and much more informative, which is not very surprising, since the sound system of Thai is typologically reasonably close to that of Mlabri. If we take the words listed above and transliterate the Thai letters to IPA symbols in accordance with Standard Thai pronunciation, the forms will look approximately as follows (for convenience our own forms are given again):

	Kraisri 1963	Egerod & Rischel
father	mɤm	mɤm
mother	mɤ?	mɤ?
man	jo:ŋ	jo:ŋ
eye	má:t	mat
tree	lâm	lam
spear	khɔ́:t	khɔt
spirit	wɔ́:k	wɔk
die/dead	bw:l	bwl

(the accent marks over some of the vowels in the transliterations of Kraisri's forms reflect his use of Thai tone marks to indicate that he has heard high or falling tone in the rendering of these words, which is probably a matter of citation intonation; as for the word 'spirit' it occurs only as the first part of phrases in his list).

It is impressive how well these words (though certainly not all words on his lists!) agree with our transcription and with that of Ferlus (see above). Kraisri was in fact transcribing the very dialect that we have documented in Egerod and Rischel (1987) and elsewhere; this is directly confirmed by the fact that we have recently had his informant Ai Pla as our informant and had our entire word list rechecked with him. Not much seems to have happened with the pronunciation over the time span of twenty-five years separating the two fieldwork sessions, although it is interesting that Kraisri uses the symbols for long vowels more often than is warranted by Ai Pla's pronunciation nowadays.

Then to Bernatzik and Trier. Being both Westerners without a professional background in the use of linguistic field methods and phonetic transcription they are in principle comparable enough to be considered together here.

Bernatzik was an Austrian (whose English was not very good, it is said), and Trier is a Dane. We would predict that both of them would either fail to notice a glottal stop consonant or not have any consistent way of indicating it. Mlabri has an initial contrast between a glottal stop and other stops, and a final contrast between glottal and non-glottal syllable termination. The prediction is borne out, cf. Bernatzik atí corresponding to (conservative) Mlabri ʔat ti:ʔ '(the) hand', bɛ̰ = Mlabri bɛʔ 'earth', Trier ŏ = Mlabri ʔɤ(:)ʔ 'to eat', tar = Mlabri ta:ʔ 'grandfather, uncle', etc.

Mon-Khmer languages have an abundance of different manners of articulation of initial stops, some of them exhibiting contrastive voicing and aspiration and glottalization and even prenasalization; Mlabri has four manners: /ph p b ʔb/ and even vestiges of a fifth: /mb/. Austrian German and Danish have only a two-way contrast between /p t k/ (which are aspirated in Danish but not in Austrian) and /b d g/ (which are voiceless). One might thus expect under-differentiation and possibly also inconsistency in the notation of the initial stops by these authors since they use ordinary letters (in Bernatzik's case with several added diacritics which, however, do not ever serve the purpose of distinguishing between manners of articulation). This also is borne out by a comparison with our Mlabri data. Bernatzik distinguishes well between /p t c k/ and /b d ɟ g/, as one might perhaps expect, but rather less so between the aspirated and unaspirated stops, cf. kɛ̰yɔ́t = Mlabri khɛj joc 'egg of wild fowl' or 'hen's egg' (depending on dialect) vs. kɛ̰k = Mlabri ke:c or ke:t 'ear', kɔ́t = Mlabri khɔt 'spear' vs. kɔ́n = Mlabri ko:n 'to snore'. (The material is too small to show further details on this.) - Trier, on the other hand, turns out to vacillate when transcribing words that occur in our data with unaspirated tenues (/p/ versus /b/ etc., a contrast that is missing in Danish) cf. his pung = Mlabri pu:ŋ 'to blow' vs. bor = Mlabri pɔʔ 'to push' vs. bung = Mlabri boŋ 'to eat (meat)' or gaep = Mlabri kɛp 'stone' vs. gaeng = Mlabri gɛ:ŋ 'windscreen', etc. The aspirates are identified with his Danish aspirates, spelled p t k: thus he writes kai = Mlabri khɛj 'egg', which is indeed predictable. As for glottalized stops these are rendered as plain stops, e.g. ding = Mlabri ʔdiŋ 'big' like ding = Mlabri diŋ 'elder sibling'.

Mlabri has voiceless nonsibilant continuants which must cause difficulties for untrained listeners. Bernatzik does not indicate voicelessness in such cases, cf. kēk lŭt = Mlabri ke:c hlu:t 'deaf', kĭ mę̆ = Mlabri ki:ʔ hmɛʔ 'new moon'. Trier has kl for the voiceless lateral in kli or klae = Mlabri hlek 'iron'.

It is a further complication that Mon-Khmer languages and also Mlabri have four oral points of articulation in stops and nasals both initially and finally, viz. labial, dental, palatal, and velar. One may here expect some difficulties with the unfamiliar palatals (which invite a transcription as clusters with "j" or "y") and also with the velar nasal in initial position. By and large Bernatzik and Trier agree with our data as regards point of articulation in consonants, though with several discrepancies some of which at least must be downright errors. - Bernatzik mentions explicitly that it is often difficult to hear the stops in final position (as indeed it is in Mlabri, which has unreleased stops in this position as is typical of languages in the area).

The vowel system of Mlabri is of about the same complexity as that of Danish, as said above, but it is certainly more complex than that of Austrian German. Because of the special character of the English vowel system even a good command of English would be of little help here. Thus we may expect Bernatzik and Trier to have had considerable difficulties in matching the perceived vowels with letters in the Latin alphabet, and we may a priori expect their vowel notations to be more or less underdifferentiating and more or less inconsistent.

The notation of vowels does indeed exhibit great discrepancies between the various sources, and it is very difficult to decide what is due only to different conventions (such as Trier's use of the letter r in "ar", "or" to indicate open vowel qualities) and what reflects genuine phonetic differences among dialects.

If we assume that Bernatzik was transcribing Mlabri the following obtains:

The Roman letter symbols "i e u o a" generally have a straightforward phonetic interpretation if compared to the spelling conventions of languages such as German. There are serious shortcomings in Bernatzik's transcription, however. Thus "ŭ" in his Yumbri wordforms may mean short unstressed /u/ or /ɯ/ (occasionally other vowels as well, though not often). There is in his transcription system

apparently no separate (simplex or complex) symbol for the highly frequent vowel phoneme /ɯ/, nor for /ʌ/; the whole series /ɯ ɤ ʌ/ of Mlabri is rendered by "u" and "o" with or without relevant diacritics.

As for Bernatzik's diacritic marks over and under vowel symbols the following information is found in the introduction to his word list (he used similar conventions in transcribing other languages, cf. Bernatzik 1947, p. 4):

(a) ´ (the acute accent) is a stress mark ("Betonungszeichen")
(b) ˘ ("hachek") indicates brevity
(c) ¯ (horizontal stroke) over a letter indicates length
(d) underlining under a vowel indicates open pronunciation, e.g. e̲ like German ä in "Mär̈chen"
(e) a dot under a vowel indicates close quality, e.g. o̩ like in German "Sohn" (sic!, but cf. below)

Comment to (d)-(e): Bernatzik's plain and underlined vowel symbols "e e̲ o o̲ o̩" tend to correspond one-to-one to the Mlabri vowels /e ɛ o ɔ ɤ/, but he seems not to be very consistent, to judge from the Mlabri correspondences. The pattern is also somewhat obscured by idiosyncratic spellings. The counterparts to Mlabri /o/ and /ɤ/ are often not distinguished, and the underlining for openness is often used in a way which runs counter to the vowel qualities in Mlabri, in particular, the symbol "o̲" is often used for Mlabri /o/ although it is meant to represent a more open vowel, i.e. /ɔ/, to judge from Bernatzik's own explanations. The following examples may illustrate the degree of overlap and mismatch we encounter in some words when comparing "Yumbri" and Mlabri:

	Bernatzik	Egerod & Rischel
penis	tǫ́n	ʔdoŋ
to see	dǭgn	dɤŋ
to be wet	tšŭkǫ́	chukkɔʔ
to be scared	krǒŭ	krʌw
to cry	bē̲t	be:c/be:t
to beat	tē̲k	tɛk

Trier has mostly i, y, u, ö, a (ar) corresponding to our /i ɯ u ɤ a/; ae occurs for /e/ and /ɛ/, u, o and å are all used for /o/, and both o and år are used for Mlabri /ɔ/. The remaining central vowel /ʌ/ in Mlabri has a variety of reflexes in Trier's notation, cf. gor = Mlabri gʌh 'here', wål = Mlabri wʌl 'to return', gam = Mlabri gʌm 'don't' (Trier: 'not'). - All of this is indeed

understandable considering the skewness of the Mlabri and Danish vowel systems in relation to each other, and considering the awkward representation of the vowels of spoken Danish in Danish spelling.

Conclusion about Bernatzik's and Trier's data as putative representations of Mlabri:

If we stick to the obvious and indisputable cognates in Bernatzik's and Trier's data and in our own data, the more or less idiosyncratic notational habits of each author may account for most of the apparent discrepancies. As for Trier's data the possibility of tying it up with our own data, in spite of difficulties with the notation, is entirely in accordance with expectations, since it has turned out that there is a strong overlap in our choice of Mlabri informants (incidentally, a photograph in Trier 1986 shows Mr Ai Som, who also served as an informant for us). We are dealing with the same dialect.

What then about Bernatzik? To the extent that we can recognize his lexical items they look like a rather distorted transcription of Mlabri, perhaps of a dialect with somewhat deviating phonology compared to our Mlabri. I shall return to this issue later.

2.2. The lexical aspect.

As said above we share informants with both Kraisri (1963) and Trier (1986), which firmly establishes the identification of all three sources as representing the same language and even the same dialect. Moreover, Ferlus' data is so very similar to ours in phonetic form that judging only from the obvious cognates one would not hesitate a moment to say that this is the same language and perhaps even the same main dialect.

The transcription of obvious Mlabri cognates in Bernatzik's data can likewise be construed to represent the very same language. On this basis we set out in 1987 to identify as many items in his list as possible, and this seemed so successful that we concluded that his Yumbri is indeed Mlabri (Rischel and Egerod 1987). More recently (Rischel 1988) I have shown that part of the residue of unexplained forms in Bernatzik's list can likewise be interpreted as Mlabri, though the relationship between Bernatzik's data and our own is not quite as simple as we had assumed.

Since several of the words could be identified as plain Mlabri we tried hard to look for Mlabri equivalents to the remaining forms. In some cases we found equivalents that seemed plausible if we allowed for gross inaccuracies and inconsistencies in Bernatzik's transcription and in some cases also for distorted translations.

With the most recent additions to our Mlabri data (from speakers of different age and with different linguistic usages) it has turned out that some of the bad matches were in fact wrong guesses on our part. One embarrassing example, which is given here to warn other field workers, is the Mlabri word for 'tooth':

It has been very enigmatic to us why B would give 'tooth' as "ătrə̱̇n̥". In our Mlabri Vocabulary (1987) the corresponding entry is /(ʔak) ʒʌŋ/. To make such forms fit we must assume either a set of multiple deviations in phonetic form across dialects (which would have no obvious parallels in other items and thus would seem less likely) or we must assume that B's rendering was unusually sloppy. We had, I think, silently worked on the latter assumption under the influence of the general secpticism about the reliability of Bernatzik's data.

This scepticism turned out to be quite unfounded as regards the entry for 'tooth', and as it turned out this is not a case of variation either. It is so that there <u>is</u> a word /thrɛ:ŋ/ meaning 'tooth'. To my great surprise Ai Pla told me that this word is current in his group in the meaning of 'lower teeth' (/ʔat 'thrɛ:ŋ/ with the particle mentioned above = B's "ătrə̱̇n̥"), whereas they would always use /ʒʌŋ/ as the general term for 'tooth'. The reason why we had not come across /thrɛ:ŋ/ long before may be that we had always pointed at our upper teeth when asking about the word for 'tooth'! - It should be kept in mind that we were working with members of a tribe which is notorious for its shyness and limited contact with modern civilization, and that we had had severe difficulties communicating with the Mlabri about their language. This was true also of a session in which we attempted to elicit forms from Bernatzik's word list. Firstly, there was the problem of explaining the meaning of the word we were searching for, and secondly, there was the difficulty of determining how Bernatzik's spelling was to be interpreted phonetically if we did not know the word in advance. The latter was a great obstacle (see later on the conjectures caused by the inclusion of -Mlabri").

In several cases we had not understood Bernatzik's forms because they were obsolete or rarely used in

the type of Mlabri we had been working with, and because of difficulties with Bernatzik's notation. A single example may suffice for illustration of the difficulties:

Bernatzik's word for 'fire': "tŝkăntūy" did not a priori look too plausible and we guessed that there must be some misunderstanding here. It was only after the publication of Rischel and Egerod (1987) that I became aware of a Mlabri word /ʔulh/ 'fire(wood)' (= B's "-ŭy") which we had not so far recorded because it was more or less obsolete in the usage of the Mlabri speakers we had consulted so far: they always used another word: /hŋke:ʔ/. Our Vocabulary already contained the word /chiŋgaŋ/ but we had not recognized that this was what Bernatzik was transcribing because the final part of his noun phrase made no sense to us (I have later established that Ferlus 1964 has /ʔulh/ as well; in fact the word is still current in the dialect of Mlabri referred to as ß-Mlabri below). It was now clear that the whole entry "tŝkăntūy" equals Mlabri: /chiŋgaŋ ʔulh/ or /ɕiŋgaŋ ʔulh/ and means 'smouldering charcoal in the fireplace' (that this is idiomatic, has been verified with informants).

The word for 'to blow' in B's list is "bŭńūy", but only the first part could be identified, viz. as /puŋ/ 'to blow'. However, with the advent of the form /ʔulh/ 'fire it became likely that Bernatzik had heard something like /puŋ ʔulh/ (/- ʔujh/?), a well-formed phrase meaning 'to blow on the fire'.

This identification of Bernatzik's word for fire-place as equivalent to Mlabri /ɕiŋgaŋ/+/ʔulh/ implies that he has used the very strange spelling "-nt" for the palatal nasal, and "-y" for Mlabri /lh/, i.e. the symbol for palatal glide instead of the unfamiliar voiceless lateral; maybe "Yumbri" had a voiceless palatal (i.e. /ʔujh/), like Tin??

Anyway, it is true of several of the lexemes in "Yumbri" that fail to resemble Kraisri's "Mrabri", that these turn out to exist in current Mlabri, though often as archaic or quite obsolete words.

Until recently it could not be decided to what extent the differences in the published data on Mlabri reflect dialect differences or changes in the language taking place over the time span of some fifty years of Mlabri studies. More recently I myself happened to meet some Mlabri speakers whom we had not previously encountered and whose linguistic usage turned out to differ significantly from that of our previous informants. There were only very minor differences in phonology, except for the prosody; by and large wordforms shared by

the two dialects could be given the same segmental transcription except for marginal differences, the most conspicuous being that the newly encountered dialect has /ɯ/ in some of the words in which the other has /a/, ex. /klɯ:r/ versus /kla:r/ 'sky'. In the following I shall refer to these two dialects as α-Mlabri (being the one previously familiar to us = the one described by Kraisri in 1963) and ß-Mlabri (being the newly encountered one).

The strange thing about α-Mlabri and ß-Mlabri is that there are very considerable differences in the lexicon, in fact to the extent that communication is rather impeded on the first encounter. There are numerous doublets of synonymous words, of which one is used in α-Mlabri, the other in ß-Mlabri. The differences encompass all parts of the lexicon.

Nouns are well represented (though not much more than other word classes) among the doublets, e.g.

	α-Mlabri	ß-Mlabri
woman	lŋguh	mɯlh
wife	mjɤ:	hmaj
water	wɤ:k	ɟrʌ:k
meat	ci:n (loanword)	thʌc
pig	cəbut	chi:ŋ
mouse	hnɛl	hwɤ:k
neck	ŋlɯʔŋlɛʔ	kukɔʔ
skin	goguh	naŋ (loanword)
blanket	pol	kncaj
brain	glɤ:ʔ ʔɔ:n	dʌm

(α literally: soft head)

There are numerous differences in verbs (and in particles) as well, e.g.

	α-Mlabri	ß-Mlabri
to speak	tʌŋ	glaʔ
to sit/stay	hŋuh	jɤ:m
to bathe	thalɛ:w	ʔɯm
to throw	dor	kɯm
to sing	malam	ʔɤh grnap
to run	ra:p	mujthɔj
to run fast	ɟəlɔj ra:p	mujthɔj ɟare:w
(to be) soft	ʔɔ:n (loanword)	biʌt
to know	mʌc	bɤ:n
to drink	wɤ:k	ɟrʌ:k

(cf. 'water' above)

or doublets of near synonyms, of which one lexical item seems to cover the whole semantic range in either α- or ß-Mlabri:

	α-Mlabri	ß-Mlabri
to eat meat	boŋ	boŋ
to eat rice etc.	ʔɤ:ʔ	boŋ
to like	mak	mak
to love	mak	hlah
to take/catch	toc	toc
to fetch/bring	ʔek/ʔec	toc
to come/come out	leh	leh
to come/approach	leh	pruk

sometimes one item is shared with (old) Thai:

to be good	ʔdi: (or thɛh)	thɛh

Still, most of the vocabulary seems to be shared, and with (extensive) lexical adjustments it is possible to communicate as if it is indeed one language. With most phrases I have elicited for ß-Mlabri it would take some substitutions for them to be possible in α-Mlabri (cf. ß-Mlabri /joc noŋ ni gɛ:ŋ/ 'there are no chicken at [our] home', which would be /chrkɛŋ hlɑ:k ni gɛ:ŋ/ in α-Mlabri), but it is easy to elicit (or make) phrases that are apparently equally understandable in α- and ß-Mlabri.

A few may suffice here:

ʔot gɛ:ŋ prem 'my house is delapidated'
ʔot ʔɛ:w be:c (α more often: be:t) 'my child cries'
ʔoh pɤ:ʔ ju:k 'I have some rice'
mlaʔbri:ʔ toc ɕo:ʔ ɟak cuʌk ʔe:ʔ 'the Mlabri takes the digging stick and digs for taro'
mla:ʔ ɟak ʔjak loŋ bri:ʔ 'the man goes to shit in the forest'
ki:ʔ ʔathʌp pmpo: 'it is full moon'

Ferlus' small vocabulary of "kămluaʔ" from 1964 is on the whole very similar to ß-Mlabri (distinctly more so than to α-Mlabri).

Let us return finally to Bernatzik. It turns out that ß-Mlabri is on many (but not all) points closer to his vocabulary of fifty years ago than is the more well-known α-Mlabri. Some of the words that are current in "Yumbri" and in ß-Mlabri but not in α-Mlabri are known to elderly speakers of α-Mlabri as more or less obsolete words. Occasionally, it is the other way round: there are some few words that are shared by "Yumbri" and α-Mlabri but seem not used or even unknown in ß-Mlabri, ex. the word for 'fur': Bernatzik p̲ōl, α-Mlabri /pol/, for which ß-Mlabri uses a quite different word: /kncɛj/, or the word for 'water' (or 'to drink'): Bernatzik wo̤, α-Mlabri /wɤ:k/ as against ß-Mlabri /ɟrʌ:k/, Ferlus /ɟrɔk/, /ɟrək/. However, such cases are few in comparison with the cases in which it is ß-Mlabri

(and Ferlus' kămlua?) that sides with Bernatzik. These correspondences are sometimes quite tricky because of the occurrence of "u" and "o" (with or without diacritics) for Mlabri unrounded vowels. Examples with Mlabri /ɯ/ are:

	Bernatzik	β-Mlabri
heavy	dyūm	ɟɯm
to throw	kūm	kɯm
tomorrow	gryú	ɟrɯw

We have not retrieved these etyma in α-Mlabri.

In some cases it is so that β-Mlabri agrees better with Bernatzik on the semantic content of a word although the word exists also in α-Mlabri. When I got access to the β-variety of Mlabri it turned out that /thrɛ:ŋ/ is here the cover term for 'teeth' in general (α-Mlabri /ɟʌŋ/ being not used at all), which agrees with Bernatzik's translation, whereas the word means specifically 'lower teeth' in α-Mlabri, as said earlier.

2.3 Conclusion about "Yumbri" and "Mrabri"/Mlabri.

We have seen that the various sources: Bernatzik, Kraisri, Ferlus, Trier, Egerod and Rischel, and finally Rischel alone (for β-Mlabri) are mutually related by a combination of similarities. There is firstly external evidence such as overlapping use of informants (Kraisri * Trier * Egerod/Rischel for α-Mlabri). Then there is internal evidence, viz. (i) phonetic similarity (Kraisri' Thai-letter version * Egerod/Rischel for α-Mlabri; further Ferlus * Rischel for β-Mlabri) and (ii) lexical similarity (Kraisri * Egerod/Rischel for α-Mlabri; further Bernatzik * Ferlus * Rischel for β-Mlabri which in part coincides lexically with α-Mlabri as documented in Rischel and Egerod 1987). - The degree of lexical similarity between the data of Kraisri and Egerod/Rischel and the data in Trier's analysis of ritual texts is less transparent.

There is some evidence from the lexicon for a gross bipartition into two dialects or dialect groups, viz. α-Mlabri comprising the linguistic data of Kraisri, Trier, and Egerod & Rischel, and β-Mlabri comprising the linguistic data of Bernatzik, Ferlus, and Rischel. However, as said above, this is not a clear-cut bipartition (since Bernatzik sometimes agrees better with α-Mlabri). It should be taken into consideration that we are talking about very small subgroups of a migrating people living in a rather restricted area of northern Thailand and adjacent Laos, and that the various data represent

a time span of fifty years. The conspicuous lexical differences could well have developed in a rather short time. We may assume quite local usages, and these may have at least two different sources:

(1) recent loanwords replacing old Mlabri words: β-Mlabri has the Thai word /naŋ/ instead of α-Mlabri /goguh/ 'skin'); in α-Mlabri the Thai word /nɔ:n/ is replacing the archaic /ʔɛm/ = β-Mlabri /ʔem/ 'to sleep', etc.

(2) metaphorical expressions replacing lexemes, exx.: /joc/ means 'chicken' in β-Mlabri; in α-Mlabri this is now used only about wild fowl, the domesticated chickens (of neighbouring tribes) being called /ɠrkɛŋ/, which also means 'wing'.

This leaves a considerable residue of lexical differences such as α-Mlabri /tʌɲ/ vs. β-Mlabri /ɠlaʔ/ 'to speak' or α-Mlabri /wɤ:k/ vs. β-Mlabri /ɟrʌ:k/ 'water; to drink', or α-Mlabri /ŋlʔwŋlɛʔ/ vs. β-Mlabri /kukɔʔ/ 'neck' (/ŋlwʔŋlɛʔ/ is known but is considered rather awkward in β-Mlabri usage). It takes more research to determine how many of these discrepancies are due to loan from other languages. Some, at least, undoubtedly reflect former pairs of synonyms or near synonyms such that for each of these one member survives in α-Mlabri and the other in β-Mlabri (with or without modifications of their "original" semantic ranges).

The strange thing about α-Mlabri and β-Mlabri is that a very great part of the lexicon is shared, after all, and that they have similar syntax and phonology, in fact so similar that I have produced sentences which β-Mlabri speakers could accept and respond to (in β-Mlabri) by using my knowledge of α-Mlabri and attempting to avoid the words I knew to be current only in α-Mlabri. - In a segmental phonological transcription of the shared lexicon one hardly needs to make a consistent distinction between two dialects (let alone two languages): the majority of the entries would have the very same phonological shape. This is true of the types of Mlabri that are currently spoken; it remains a postulate, of course, that Bernatzik's strange notation should be construed to reflect largely the same type of pronunciation (with allowance for differences of detail such as exist also in modern Mlabri) rather than a more aberrant dialect. The major arguments for the former alternative are that Bernatzik's transcription can be shown to be underdifferentiating in a way which is explicable from his background, and that the inexplicable notational discrepancies between Bernatzik and the other sources are random and unsystematic so as to suggest that they are due to imperfect percep-

tion of the phonetic values in individual words, which certainly would not be surprising given the circumstances under which his fieldwork was made.

In any case, allowing for rapid lexical divergence as a consequence of the way the Mlabri are split up in small groups, it seems warranted to refer to all sources mentioned here as specimens of the same language and even the same main dialect (with subdialects such as α- and ß-Mlabri and "Yumbri"). This clashes with Smalley's (1963) definition of Bernatzik's Yumbri and Kraisri's Mrabri as two different languages which he judged to be hardly mutually intelligible. There is a real crux here.

The first question is whether "Yumbri" is clearly closer to (Kraisri's "Mrabri" and) our Mlabri than to either Tin or Kammu, the two other languages that make up the Khmuic branch of Mon-Khmer. Let us look at a couple of lexemes for which all the languages involved have obvious cognates and see how phonetically similar they are. Later in this paper numerous Mlabri-Tin cognates will be cited to show how these languages are closely related with regard to part of their lexicon but still clearly distinct from each other in phonetic form. Mlabri is much closer to Tin than to Kammu; the following two examples may give a hint as to the degree of mutual similarity (Tin = Mal dialect from my own field notes, Kammu = Southern Kammu cited from Svantesson 1983);

	"Yumbri"	Mlabri	Tin	Kammu
rain	mɛ̰	mɛ:ʔ	mi:ʌʔ	kmaʔ
foot	ăty̰ɔ̰	ʔat ɟɤ:ŋ	cʁŋ	ɟɨaŋ

(Mlabri /ʔat/ is a prenominal particle).

These examples are typical in showing that when either Tin or Kammu disagrees with Mlabri the Mlabri form (from the data of Egerod and Rischel) is the one that is closest to Bernatzik's data.

This closeness of "Yumbri" and Mlabri with regard to phonemes/letters has a counterpart in lexicon. With the data now available (which are far more extensive and more accurate than those available to Smalley in 1963) it is apparent that there is much greater similarity between Bernatzik's data and our Mlabri data than between either of these and Tin or Kammu (Lindell 1974, Svantesson 1983).

There are thus good reasons for the assumption (to which we have adhered all along) that "Yumbri" is a kind of Mlabri, and that Bernatzik's notation can be interpreted so as to be a (very imperfect)

rendering of a Mlabri dialect, whereas it is impossible for me to imagine a way of construing Bernatzik's forms to be either Kammu or Tin.

How, then, could it be that Smalley arrived at a quite different conclusion? In his paper he first emphasizes that ultimately, "questions of linguistic relationship must be solved by painstaking comparative analysis" in which one looks for regularities of correspondence, but then says that "in light of our limitations here we will have to do something more provisional, less fully diagnostic," viz. a comparison based on "basic vocabulary" (Smalley 1963, p.190). Out of the longer list of words compiled by Swadesh he found sixty-six in Kraisri's lists and fifty-eight in Bernatzik. These were compared with each other and with data from Kammu (Khmu?), from three dialects of Tin, and from the more distant Mon-Khmer languages Khamed, Mon, and Lawa, the data being all provided by Kraisri.

The result was that the Mrabri data shared 25 basic words (out of the possible 66) with Kammu (Khmu?), and 23, 22, and 21 words, respectively with the three dialects of Tin, but only 20 (out of 58 possible) with Yumbri. The total number of shared words in the lists were 35 for Mrabri and Kammu, 45 for Mrabri and Tin, and 41 for Mrabri and Yumbri. (The figures for Mlabri compared with the more distant languages were all considerably lower.) "According to these figures", says Smalley, "the Mlabri are linguistically just as closely related to the Khmu? and the Tin as to the Yumbri", even though he mentions the possibility of faults in Bernatzik's data.

A real scrutiny of this line of argument would require a comparison of Smalley's sets of shared words with a new set worked out on the basis of our present understanding of Yumbri and Mrabri, since the use of lexicostatistics is crucially dependent on the concept of "shared word", which in turn is crucially dependent on the philological analysis of each set of data. With data as idiosyncratic as that of Bernatzik we would hardly now arrive at the very same figures as Smally did.

I shall, however, argue along a different line. In my view, the glaring discrepancy between Smalley's lexicostatistic findings and our rather successful identification of the majority of Yumbri words as some kind of Mlabri, is a genuine and important fact. It shows that there is something wrong with the use of lexicostatistics, especially when it is applied to so small sets of data gathered by non-professional field workers. Not only is there the

possibility of all kinds of errors but more importantly, there is reason not to expect such small sets of data to be representative enough for a comparison of the kind that Smalley made. The most important aspect of the Yumbri-Mrabri comparison, however, is that it has now turned out that these represent a rather extreme case of lexical split between dialects that seem closely related in other respects. Lexicostatistics, it seems, was not designed to cope with this kind of phenomenon, at least not if the intention was to arrive at linguistic classifications which were congruent with classifications based on the "painstaking" comparative method (i.e., looking for regularites in cognate words), also cf. Huffman 1976.

The question remains what one shall call such varieties as "Yumbri" and present-day α-Mlabri (under which I subsume also Kraisri's Mrabri) and β-Mlabri. Ethnically, the speakers are all a kind of mlaʔbri:ʔ 'forest-dwellers'; those who speak β-Mlabri call themselves mlaʔbri:ʔ just like the α-Mlabri do (Bernatzik's term "Yumbri" may have to do with the expression /jɤ:m bri:ʔ/ '[who] live in the forest' used by the β-Mlabri). Because of the lack of agreement between phonological and lexical evidence, however, the mutual linguistic classification of the present varieties of Mlabri and of "Yumbri" becomes a paradox.

3. The relationship between Mlabri and Tin.*

As said earlier, Mlabri is generally classified as Khmuic, but it rests on shaky evidence.

As for Khmuic in itself, the pairing together of Kammu and Tin as as separate branch seems to be generally accepted, but in fact is only now that extensive, reliable data on both the northern and southern dialects of Kammu are becoming available, and for Tin the first major source is from 1978. The comparative study of this branch of Mon-Khmer thus has not proceeded very far, and the inclusion of Mlabri in the study of Khmuic will not only serve the purpose of placing this language per se but may also contribute to the understanding of the linguistic development of Khmuic as a whole. Mlabri being clearly much closer to Tin than to Kammu in terms of phonological correspondences, I have looked at the genetic relationship between these two languages in some detail.

My (very limited) first-hand knowledge of Tin stems from a field trip to three settlements in

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* This section just summarizes Rischel (forthc. b).

Northern Thailand in the beginning of 1988. As for published information on Tin the main source (and indeed the only relevant source) is the authoritative work of David M. Filbeck (e.g. 1976, 1978, 1987). In my fieldwork I first worked out my transcriptions independently of Filbeck's phonemicization of Mal and Prai because I wanted to establish my raw-data on the same kind of basis as our Mlabri data in order to make comparison as realistic as possible. I did not make definitive phonemic analyses of the Tin dialects during my brief fieldwork sessions but stuck to a semi-phonemic (broad phonetic) transcription, which I think is a reasonable starting point for genetic comparison (provided that the transcription is consistent and provided that it does not miss phonemic contrasts, an inherent danger in this kind of work). Afterwards, of course, I have consulted Filbeck's writings quite extensively both with regard to the tricky question of dialect differentiation within Tin (see below) and with respect to details of the phonemic analysis. By and large, however, I have stuck to my own semi-phonemic transcription since it does not seem to be inconsistent with Filbeck's phonemicizations of the various dialects.

This approach may seem a rather roundabout one, but it gave the advantage of having a first-hand impression of the phonetics of Tin, and I have found that Filbeck's published data and my own data supplemented each other in a felicitous way. Filbeck's historical study of Tin (1978), which is the important source, presents only a rather limited number of lexemes. His inventory, which of course was carefully selected out of the total lexicon for his internal comparison of the Tin dialects, does not by far contain all the Mlabri-Tin cognates which I needed, so my own field sessions have served a purpose in this sense as well. On the other hand, my fieldwork was limited to three villages (representing two very different dialects plus one transitional dialect). It did not include a village whose dialect Filbeck has found to be particularly conservative on crucial points (his "Mal A", which he finds to be quite close in phonology to Proto-Tin). In comparing Mlabri and Tin, data from this last-mentioned dialect must certainly be taken into consideration.

According to Filbeck (1987) Tin is in fact just a common denominator for two (clusters of) dialects, which are more properly designated as Mal and Prai, respectively. I was introduced to a Mal village (Ta Noi) in Amphoe Pua and a Prai village (Nam Phi) in Amphoe Thung Chang, both in Nan Province, i.e., the same part of Thailand where the Mlabri live,

and I worked with Tin informants in both places. By a happy coincidence I also got access to speakers of a third type of dialect: that of the village Chuun (or Cuul, in Thai pronunciation /cuun/), which Filbeck has classified as Prai with a heavy Mal superstratum. Accidentally, I had as one of my informants a very fluent speaker of Mal as well as the Chuun-dialect: a young lady who was married in Ta Noi but born in adjacent Chuun. This access to three different types of Tin was absolutely essential (though not sufficient, see above) for the comparison with Mlabri.

I attempted to collect roughly the same lexical material from the three dialects. Some of this data consisted of names of body parts and other words that are frequently used in daily life, but in addition I looked specifically for words shared with Mlabri and in particular words that would be interesting in a comparative perspective. My own point of departure when beginning to take down such wordforms was a list of Tin words which Dr. Theraphan L. Thongkum had made during a casual encounter with a Tin informant (who clearly presented something of a dialect mixture). Her list was of enormous help in getting me started and in giving hints as to the general relationship with Mlabri.

In the sections below my Tin data is used to the extent that it is relevant to show the beautiful regularity of the correspondences between Tin and Mlabri. Since much of the data is irrelevant to the comparison with Mlabri I do not reproduce my word lists as such in this paper. Those who attach much importance to the lexicostatistic aspect of linguistic comparison may perhaps find the picture as presented here rather skewed. I must emphasize that a great part of the lexicon is <u>not</u> shared by Mlabri and Tin. However, there is considerable lexical divergence even within Tin (Mal vs. Prai). As shown above the same is true within Mlabri, so it is no wonder that the relationship between Tin and Mlabri must be of a very complex nature.

The findings from my genetic comparison between Mlabri and Tin will be summarized rather briefly here; a much more detailed account is given in my forthcoming paper in <u>Acta Orientalia</u> (Rischel, forthcoming b).

<u>3.1. Regular phonological correspondences.</u>

In transcribing Tin I have used largely the same typographical conventions as for Mlabri. The vowels which Filbeck writes as ɨ,ə (our 1987 ɤ,ɐ) are here rendered as ɯ,ɤ. Then there are some interesting

finals: an unrounded mid/back offglide (in the diphthong [ɑɤ̞], rendered by Filbeck as ɤ but here written ɤ̞ (it is similar to the conservative Danish ɣ); a palatal glide (Filbeck's y) which is here written j, and a palatal glide with devoicing at the end, which I write jh (Filbeck's yh).

My impressionistic length marks may not always correspond to length (written with double vowel letters) in Filbeck's notation. Filbeck (1978) states that length is phonemic in both Tin Mal and Prai; his data shows some dialectal variation, however. - This paper only deals with segmental correspondences; quantity is not really accounted for as the analysis is controversial. On the whole, word prosody is ignored in the comparisons.

Since the final part of the syllable in Mon-Khmer words is generally more stable than the initial and medial parts it seems natural to begin with finals, then to proceed to initials, and to take the vowels last.

(i) The final stops and nasals.

Mlabri /-p, -t, -c, -k/ correspond to Tin /-p, -t, -c, -k/: Mlabri /klɤ̞p/ 'cover of container', /mat/ 'eye', /ʔec/ 'to take', /ɟak/ 'to go' = Tin /khɤ̞p/ (Prai /ŋkhɤ̞p/ with a reflex of a prefix?), /mat/, /ʔec/, /cak/.

The Mlabri nasals /-m, -n, -ɲ, -ŋ/ correspond to Tin /-m, -n, -ɲ, -ŋ/: Mlabri /lam/ 'tree', /po:n/ 'five', /peɲ/ 'to shoot', /boŋ/ 'to eat' = Tin /lam/, /phon/, /phɤ̞ɲ/, /pɔŋ/ (the correspondence Mlabri /-n/ - Tin /-n/ is weakly attested in my material but uncontroversial).

It should be added it is only in Tin Prai/Chuun that there are palatal conterparts to Mlabri /-c, -ɲ/; Mal has /-t, -n/, which is a secondary development.

(ii) Voiced nonnasal continuants in final position.

In Mlabri there is a contrast between two glides and two "liquids": /-w, -j, -r, -l/ in final position. Tin has the same inventory in some subdialects (of Mal as well as of Prai), but according to Filbeck (1976) etymological /r/ has been replaced, or is in the process of being replaced, by a glide or by zero in most dialects of Mal as well as Prai.

The three dialects I have considered for the purpose of this small study, behave differently with respect to final */r/. Quite generally, the

Prai dialect of Nam Phi' has preserved /-r/ in the speech of informants above a certain age. In the Chuun dialect and in the Mal dialect of Ta Noi final */r/ has become a glide after vowels other than /u(:)/, viz. /-w/ in Chuun and unrounded mid /-ɨ̯/ in Ta Noi. An example is Mlabri /tar/ 'rope' vs. Nam Phi' /thar/ (or /thal/), Chuun /thaw/, and Ta Noi /thaɨ̯/. This pattern is solidly established, cf. also Mlabri /pʌr/ 'to fly' = /phar/, /phaw/, /phaɨ̯/, respectively, in the three Tin dialects.

To the extent that words having final plain /l/ in Mlabri have cognates in Tin, these have either /l/ like Mlabri or zero. Mlabri /-l/ corresponds to Tin /-l/ in e.g. Mlabri /wʌl/ 'to return' = Prai /wal/.

As for final glides there is a straightforward correspondence between Mlabri /-j, -w/ and Tin /-j, -w/, cf. Mlabri /mɔ:j/ 'one', /rwa:j/ 'tiger', /(m)bra:w/ 'coconut' = Tin /mo:j/, /wa:j/, Tin Chuun /pja:w/ (with */-r-/ › /-j-/; the Tin Prai of Nam Phi' has /pha:w/ which reflects a change of prevocalic /r/ › /h/ in Northern Thai).

(iii) Voiceless nonnasal continuants in final position.

Tin has a very small inventory of final voiceless continuants. Mal (Ta Noi) has a distinction between /-h/ and a palatal glide which ends in voicelessness and aspiration, i.e. /-jh/, cf. /mah/ 'you' vs. /mphajh/ 'to flick something away', and this is true of the Chuun dialect as well, whereas pure Tin Prai has only /-h/, the words with Mal /jh/ having a stop (/-t/ or /-c/) in this dialect.

Mlabri has a a richer inventory comprising three different entities, viz. /-h/, /-ɕ/, and a more or less voiceless (but never strident) lateral /-lh/. If we take the richer inventory of Mlabri as our point of departure the following apparently regular correspondences emerge:

To Mlabri /-h/ corresponds Tin /-h/: Mlabri /mɛh/ 'you' = Tin /mah/.

To Mlabri /-ɕ/ corresponds Tin /-jh/: Mlabri /lɔ:ɕ/ 'to steal' = Tin Mal/Chuun /lɔ:jh/ (it may be, however, that this is a loanword in Mlabri). The reflex /-t/ in Prai /lɔ:t/ shows the secondary development continuant › stop.

To Mlabri /-lh/ corresponds the same Tin entity /-jh/: Mlabri /po:lh/ 'barking deer' = Mal/Chuun /phɔ(:)jh/. Again, Prai has got /-t/: /phɔ:t/.

It should be noted that Mlabri distinguishes four voiceless dentals and palatals in final position: two stops /-t, -c/ and two continuants /-lh, -ɕ/. These reduce to three in some dialects of Tin and to two in others: Chuun has /-jh/ for both /-ɕ/ and /-lh/ but /-t/ and /-c/ corresponding to Mlabri /-t/ and /-c/, respectively. The Mal of Ta Noi has reduced to two items: /-jh/ corresponding to both /-ɕ/ and /-lh/, and /-t/ corresponding to /-t/ and /-c/ in Mlabri. Finally the Tin Prai of Nam Phi' has reduced to two items in a different way: it has /-t/ corresponding to both /-ɕ/, /-lh/ and /-t/, but it has /-c/ corresponding to /-c/ in Mlabri. The only way to get order out of chaos is to take the pattern in Mlabri to be the one underlying Proto-Tin, and to assume that there was already in Proto-Tin a merger of the two entities I have represented in Mlabri as respectively /-lh/ and /-ɕ/, whereas the other mergers must be later developments (Chuun showing a strange pattern of interference between Mal and Prai, as one should expect from Filbeck's characterization of it).

(iv) Checked vs. open syllable.

The relationship between Mlabri and Tin on this point is not at all straightforward. To Mlabri /-ʔ/ corresponds Tin /-ʔ/ in some cases but open syllable with a long vowel in others, cf. on the one hand Mlabri /mɛ:ʔ/ 'rain' = Tin /miʌʔ/, Mlabri /boʔ/ 'breast' = Tin /poʔ/, on the other hand Mlabri /blu:ʔ/ 'thigh' = Tin /blu:/, Mlabri /ti:ʔ/ = Tin /thi:/. For a common proto-language we would have to reconstruct three different syllable terminations: one giving Mlabri /-ʔ/ or /-:ʔ/ and Tin /-ʔ/, another giving Mlabri /-:ʔ/ but Tin /-:/, and a third giving Mlabri and Tin /-:/. I shall not go into this intriciate matter here.

(v) Initial stops.

In Mlabri as well as in Tin, initial stops (and nasals) show a contrast between four points of articulation: labial, dental, palatal, and velar (plus predictable laryngeal /ʔ-/). Except for some complications with the palatal versus velar points of articulation there is a trivial one-to-one relationship between Mlabri and Tin:

Labial corresponds to labial: Mlabri /boʔ/ 'breast' = Tin /poʔ/, dental to dental: Mlabri /ti:ʔ/ 'hand' = Tin /thi:/, palatal to palatal: Mlabri /ɟɤ:ŋ/ 'foot' = Tin Mal /cɤŋ/, and velar to velar: Mlabri /ka:ʔ/ 'fish' = Tin /kha:/ (there seem to be only minor discrepancies with respect to place of articulation.

As to manner of articulation it is so that Mlabri has a four-way contrast between aspirated and unaspirated voiceless stops (the types /ph-, p-/), and plain and preglottalized voiced stops (the types /b-, ʔb-/).

Tin (Mal as well as Prai) has a well-established contrast between the two voiceless series: aspirated and unaspirated (the types /ph-, p-/). Both series also occur with prenasalization (the types /mph-, mp-/); the unaspirated type /mp/ has more or less voicing of the stop (even fully voiced [mb]).

Tin moreover has voiced initial stops occurring in loanwords from Thai, ex. /bɛ:k/ 'to carry on the shoulder' (in Mal and Chuun; Prai has /tɔ:r/). In such loanwords Mlabri has glottalized voiced stops, e.g. Mlabri /ʔbɛ:k/ 'to carry on the shoulder', which suggests old borrowing (there is plain /b-/ in Modern Thai /bὲɛk/ but */ʔm-/ › */ʔb-/ is reconstructed for Proto-Thai).

Apart from the clusters with initial nasal (which have a special status anyway since they often clearly correspond to presyllables in Mlabri) the system in Tin differs from that of Mlabri in lacking the contrast between preglottalized and plain voiced stops, whereas the pattern of voiceless stops is conspicuously similar in the two languages. This is deceptive, however. As will have been apparent already from the examples given earlier the series of aspirated and unaspirated voiceless stops in Mlabri and Tin do not line up etymologically; on the contrary there is a pervasive sound shift involved with the result that aspirated voiceless stops in Tin correspond to unaspirated voiceless stops in Mlabri, and unaspirated voiceless stops in Tin correspond to plain voiced stops in Mlabri:

Mlabri:		Tin:
p- (etc.)	=	ph- (etc.)
b- (etc.)	=	p- (etc.)

The upper type of correspondence may be illustrated by Mlabri /pɛ:ʔ/ 'three' = Tin /phɛʔ/, the lower by Mlabri /boŋ/ 'to eat' = Tin /pɔŋ/. This is irrespective of point of articulation; it is similar with velars, for example: Mlabri /kɯr/ 'thunder' = Tin /khɯr/, Mlabri /gɛ:ŋ/ = Tin Mal /kiʌŋ/.

If we compare with other Mon-Khmer languages it is immediately clear that Mlabri is closer to Proto-Mon-Khmer, i.e., Tin has undergone a sound shift changing unaspirated to aspirated, and voiced to voiceless initial stops (a shift in this direction, especially with regard to the change voiced › voiceless, is found in many Mon-Khmer languages).

As for the prenasalized and more or less voiced (unaspirated) initial stops in Tin (Filbeck's /mp-/, etc.) these sometimes occur in roots shared by Mlabri, and then as plain voiced stops. However, there is generally the additional complication that the word contains a pre-syllable in the form found in Mlabri, cf. Mlabri /ɕ(ɯ)mbɛp/ 'lip' = Tin Mal /mpɛ:p/, or Mlabri /rɯŋga:p/ 'mouth' = Mal /ŋka:p/. A similar correspondence between pre-syllable in Mlabri and homorganic nasal in Tin is observed with the consonants that have become aspirates in Tin: Mlabri /thapu:l/ 'belly', /ɕŋkɛ:r/ 'nail' = Tin /mphul/ (or /phu(:)l/), /ŋkhɛr/. Mlabri thus supports Filbeck's assumption that the complexes of nasal plus stop in Tin may have complex origins.

It is particularly interesting that Tin has a causative homorganic nasal: /mpɤl/ 'to kill' (vs. /pɤl/ 'to die'), /ŋkoh/ 'to hit (with the knuckles)'. Filbeck (1978, p. 29) suggests that "Mon-Khmer */p-/ 'causative prefix' became the nasal */m-/ in Tin" with later place assimilation. Here Mlabri gives direct proof of the origin: /pabɯl/ 'to kill' (vs. /bɯl/ 'to die'), /pagoh/ 'to cause to break'; this shows that there still was a /p/ at the time when Tin and Mlabri began to move apart with respect to the phonology of such words.

This still leaves the aspirated voiceless stops and /ɕ/ (= /ch/) in Mlabri unaccounted for. They do not fit into the overall pattern, and in fact there is a conspicuous absence of old cognates in Tin to the (not numerous) monosyllables with these initials in Mlabri (some are recent loans).

(vi) Other initial consonants.

As for nasals and oral continuants there is on the whole good agreement between Mlabri and Tin in cognate words, with the important exception of the glottal manner features. The correspondences being otherwise trivial, I shall here concentrate on that very point.

Mlabri has a distinction between voiceless and voiced nasals: /hm-/ vs. /m-/, etc., cf. /hmɯk/ 'tattoo' vs. /mɯj/ 'fat', and likewise between voiceless and voiced oral continuants: /hl-/ vs. /l-/, /hw-/ vs. /w-/, etc. In words shared with Thai the voiceless initials correspond beautifully to traditional Thai spellings (e.g. /hmɯk/ 'tattoo' and /hlek/ 'iron' = Central Thai /mʉ̀k/, /lèk/ still spelled with "hm-, hl-").

In the Tin dialects I have studied the voiceless nasals and oral continuants /hm-, hl-/ etc. all have voiced counterparts, so that there is a

merger here, cf. Mlabri /hmɛʔ/ 'new' = Tin /mɛʔ/ vs.Mlabri /mɛ:ʔ/ 'rain' = Tin /miʌʔ/. However, according to Filbeck (1978) there still is a contrast between initials such as /hn-/ and /hl-/ (or /lh-/) and /n-/, /l-/ in some Mal dialects. Anyway, Mlabri agrees with the scenario that must be posited for Proto-Tin.

Mlabri moreover has a distinction between (rare) preglottalized and plain voiced glides in initial position: /ʔw-, ʔj-/ vs. /w-, j-/. Tin has only a plain series. There is some (but in my material scanty) evidence of a merger involving a process preglottalized > nonglottalized, cf. Tin /jak/ (combined with /mpuʌt/ 'bee' to mean 'wax', literally 'dung of bees') = Mlabri /ʔjak/ 'dung, shit'.

(vii) Vowels.

Mlabri and Tin agree on a distinction between front unrounded, back unrounded, and back rounded vowels. Mlabri has four degrees of aperture, cf. the unrounded back series of contrasting vowels: /ɯ ɤ ʌ a/, whereas Tin has only three steps which may be represented as /ɯ ɤ a/ (I somewhat arbitrarily use the symbol "ʌ" for the second part of the diphthongs /iʌ uʌ/ in Tin; Filbeck writes /ia ua/, as he wants to minimize the number of phonemic symbols and thus has only one choice, viz. to assign the second part to the /a/ phoneme).

As for the correspondences within cognates it is so that Mlabri and Tin mostly agree on the vowel features front-back and rounded-unrounded. There is not the same degree of regularity with regard to degree of aperture: Mlabri and Tin sometimes agree on this point, but in other cases they differ though (as far as I can see) never by more than one step in aperture. Finally it is quite often the case that Tin has a diphthong where Mlabri has a nonhigh monophthong.

There is to some extent a many-to-many relationship between Mlabri and Tin vowels. Thus, Mlabri /ɛ/ = Tin /iʌ, ɛ, a/, whereas Tin /a/ = Mlabri /ɛ, a, ʌ/; Mlabri /ɯ/ = Tin /ɯ, ɤ/, and Mlabri /ʌ/ = Tin /ɤ, a/, whereas Tin /ɤ/ = Mlabri /ɯ, ɤ, ʌ/.

These various types of relationships may be briefly illustrated by the following examples:

Front series: Mlabri /ti:ʔ/ 'hand', /leh/ 'to come', /hmɛʔ/ 'new', /bɛ:k/ 'bear' = Tin /thi:/ ('lower arm plus hand'), /leh/, /mɛʔ/, /piʌk/;

Unrounded back series: Mlabri /kɯr/ 'thunder', /bɯl/ 'to die', /glɤ:ʔ/ 'head', /mʌc/ 'to see, /pʌr/ 'to fly', /ɟak/ 'is going to' = Tin /khɯr/, /pɤl/, /k(l)ɯʔ/, /mɤc/ (or /mɤt/), /phar/ (Ta Noi /phaɨ̯/, Chuun /phaw/), /cak/;

Rounded back series: Mlabri /mu:k/ 'to smell', /boʔ/ 'breast', /boŋ/ 'to eat', /bɔh/ 'ashes', /lɔ:ɕ/ 'to steal' = Tin /muk/, /poʔ/, /pɔŋ/, /puʌh/, /lɔ(:)ɟh/ (Nam Phi' /lɔ:t/).

This data testifies to the close genetic connection between Mlabri and Tin as regards the shared vocabulary, but the mutual relationship is such that we cannot consider the vowels of one of these languages to be the ones that occurred (in the etyma in question) in the proto-stage of the other language. It is not surprising in a Mon-Khmer context to find that it is the vowels in particular that present a complex and opaque picture.

3.2. Conclusion concerning Mlabri and Tin.

We have seen that even on the basis of limited data it is possible to establish a rather well-defined network of phonological correspondences between Mlabri and Tin (there is in most cases much more evidence for the regularities I have dealt with in this paper than is apparent from the presentation). Now, what does that tell us?

The phonetic comparison with Tin does not in itself give an answer to the question whether Mlabri is simply an offspring from a Khmuic ancestral language, or whether it has a different origin. On the former assumption the evidence certainly suggests that Mlabri and Tin are very closely related and together form one branch (the other being Kammu). On the latter assumption the Khmuic appearance of numerous words in Mlabri means that a substantial part of its Mon-Khmer lexicon must be borrowings from Khmuic, and that they stem from a time after the separation of Kammu and Tin.

A likely source of the old layer of shared words which have been the object of this paper, is Pre-Tin, a stage which Filbeck (1978) posits as preceding Proto-Tin (the common ancestor of Mal and Prai). However, if Mlabri reflects Pre-Tin it has consequences for the way in which this language should be reconstructed. Thus, if Mlabri has proof value (with regard to the relevant words) this means that Pre-Tin must be construed to represent a stage where this shift voiced > voiceless had not yet taken place (unlike Proto-

Tin). Comparative evidence - including old loans from Thai into Mlabri/Tin - tells us that Tin has undergone a complex Lautverschiebung:

p	>	ph
b	>	p
ʔb	>	b

whereas Mlabri altogether remains on the stage prior to this complex change. My suggestion, then, is that "Pre-Tin" may well be an adequate label for the left column in the Lautverschiebung chart, whereas Proto-Tin (as well as Modern Tin) is represented by the right column. - When confronted with Filbeck's conception of Pre-Tin this only requires minor modifications of the scenario, the proto-stage common to Tin and to the relevant lexical stratum in Mlabri being on a few points closer to Proto-Khmuic than Filbeck's Pre-Tin.

As for the finals Mlabri can likewise be shown to exhibit conservative features when compared to Modern Tin (see above concerning Mlabri /-lh/ and /-ɕ/ which have the same reflex in Tin). By and large, the consonantism in its entirety supports the notion of (a pre-stage of?) Pre-Tin as a common source. - The vowel developments are more tricky but still consistent with the idea if we assume a complex underlying vowel system which was somewhat different from both that of Modern Tin and that of Mlabri.

Altogether, Mlabri is extremely conservative in its phonology compared to most neighbouring languages, with its richness of manner distinctions in consonants and its corresponding lack of tonal contrasts.

Thus it seems that in many ways Mlabri holds the key to an ultimate understanding of the phonology of Pre-Tin and of early Khmuic in general. Mlabri is also of relevance to Thai studies because of its preservation of old sound values in loanwords. These old Thai words in Mlabri may in part stem from its association with Tin in a proto-stage.

It would be tempting to postulate that Mlabri <u>is a kind of Tin</u>, viz. a fossilized offspring of a proto-language immediately preceding Filbeck's Pre-Tin. Above, I have mentioned that Pre-Tin could be conceived so as to accomodate Mlabri. If Mlabri is indeed an offspring we should rather call its ancestor Proto-Tinic. "Tinic" would then be a sub-branch of Khmuic comprising Tin (Mal + Prai) and Mlabri. This is not far-fetched, but it leaves us rather at a loss as regards the <u>differences</u> between Tin and Mlabri that we find along

with the conspicuous lexical similarities.

One would perhaps expect these differences to be explicable in terms of influence from Miao (Hmong) since the Mlabri are now most closely associated with the Miao, but that association is less than a hundred years old, and Miao does not seem to have exerted much lexical influence on Mlabri. Mlabri is now much influenced (in phraseology and lexicon) by Northern Thai or Lao, but that does not account for its special features either (Mlabri has recent loanwords from Tin as well).

We must consider an alternative explanation of the words exhibiting regular old correspondences between (Proto-)Tin and Mlabri, viz. that these were not "originally" part of the core vocabulary of Mlabri but only represent an early superstratum from Tin.

At present too little is known about the extent to which Mlabri shares its lexicon with Tin, but off-hand the superstratum hypothesis seems quite attractive.

What kind of language Mlabri may have been prior to such an exposition to Khmuic - if that is what has happened - is so far unknown.

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SYNTAX, MORPHOLOGY, AND PHONOLOGY IN TEXT-TO-SPEECH SYSTEMS

Peter Molbæk Hansen

The paper is concerned with the integration of linguistic information in text-to-speech systems. Research in synthesis proper is at a stage where the need for systematic integration of comprehensive linguistic information in such systems is making itself felt more than ever. A surface structure parsing system is presented whose main virtue is that it permits linguists to express syntactic as well as lexical and morphological regularities and irregularities of a language in a simple and easy-to-learn formalism. Most aspects of the system are seen in the light of Danish and - sporadically - English and Finnish surface structure.

I. INTRODUCTION

In recent years there has been considerable progress in the design of automatic text-to-speech systems (henceforth TTS-systems) for many languages. The development of advanced techniques and tools for generating high-quality synthetic speech signals has gradually entailed a shift of focus in speech synthesis research from technological to phonetic aspects.

At the linguistic end of TTS-systems there has, however, been little emphasis on the development of *general* tools and formalisms, and the exploitation of insights from computational linguistics has hitherto been sporadic. All TTS-systems are faced with the problem of supplying the synthesis component with sufficient phonetic information, typically in the form of phonetic transcriptions derived from text, but there has been a tendency to use rather diverse algorithms relying heavily on language specific peculiarities instead of using formalisms and parser algorithms of a more general nature. Incidentally, in most older systems syntactic and morphological information is not exploited at all (Carlson & Granström

1975), in other systems morphological and lexical information is exploited but not combined with syntactic information (Molbæk Hansen 1983). In some of the best systems, lexical as well as morphological and syntactic information is integrated, but morphology and syntax appear as distinct components, each with its own structure and algorithm (Allen et al. 1987, p. 23ff).

As the acoustic quality of synthetic speech as such becomes comparable to that of natural speech, the need for higher level linguistic information of all kinds relevant to pronunciation increases, and it is therefore important to develop formalisms which permit linguists to express lexical, morphological, and syntactic structuring in linguistically meaningful ways, and to develop parsing systems which can cope with information expressed in such formalisms in an efficient way.

The major part of the present paper is the presentation of a *set of conventions for declaring linguistic structures* of various kinds in a *linguist-oriented* way: the declarative conventions permit the linguist to formulate lexical (including morphophonemic), morphological, and syntactic structuring in a language independent formalism which is easy to learn. The system is called SSPS (surface structure parsing system), and its main components are a *lexicon system*, a *constituent structure grammar*, and a *chart-based parser*. In SSPS no formal distinction is made between syntax and morphology: surface structures are seen as tree structures - deep of flat as the case may be - which can be described by a set of rewrite rules, i.e. a production system, whose terminal symbols are morphemes and whose root symbol may be any category which the linguist wishes to consider, e.g. STEM, WORD, or SENTENCE. The system includes a parser, which "understands" the declarations of the formalism and interprets them as a set of instructions for analyzing orthographic input and for transforming it to another format, e.g. a morphophonemic representation.

In Section II the basic declarative conventions of SSPS are introduced, the linguistic phenomena which motivate them are illustrated, and the system is classified typologically in relation to other formalisms. After this introduction the individual components of SSPS are described in detail.

In section III the use of SSPS in a TTS-system for Danish is illustrated. In particular, the use of *morphosyntactic features* to reduce overgeneration in both syntax and morphology is exemplified.

In section IV the SSPS parser is presented in outline, and I conclude the paper in section V with a brief personal comment on the possibilities of harmonizing the phonological components with the linguistic components in TTS-systems.

II. THE SSPS FORMALISM

A. Basic Properties

The core of the formalism is a *constituent structure grammar* describing what one might call "categorial surface structures". By this term I refer to surface structures viewed as arrangements of traditional, structurally motivated categories labelled word, root, stem, affix, etc.

An extremely simple grammar of this type - describing only morphological structure - might look like (1)

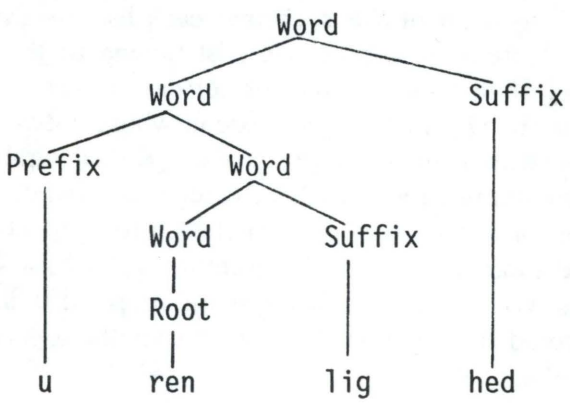
(1)

```
Word   ->   Root
Word   ->   Word Suffix
Word   ->   Prefix Word
Root   ->   ren (clean)
Prefix ->   u   (un-)
Suffix ->   lig (-ly)
Suffix ->   hed (-ness)
```

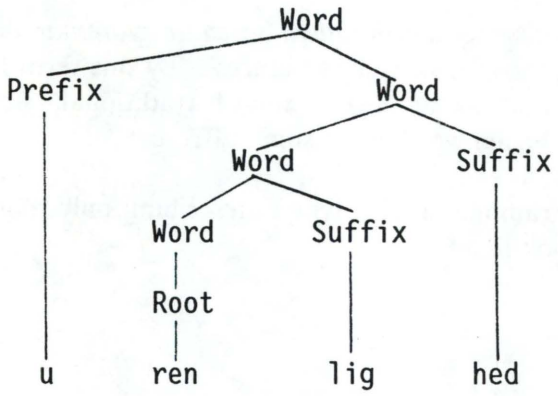
The grammar (1) has the well known formal properties of a *context free grammar*, in this case one including *recursive rules.* Such a grammar is to all intents and purposes powerfull enough to accomodate any structural type one may want to operate with in morphology and *surface* syntax.

As can easily be seen, however, the particular grammar (1) *overgenerates.* In addition to generating (or accepting) the word *urenlighed* "uncleanliness", assigning to it the structure (2), which is the natural one for this word, it will assign several other structures to it, for instance (3), thus coming out with several distinct "solutions".

(2)



(3)



Moreover, (1) will generate and accept incorrect word forms like *uuuurenligligheđ.* Clearly (1) is too permissive. On the other hand, since (2) can in fact be defended as a "correct" structural description of *urenlighed,* the recursive constituent structure grammar seems to express at least some morphological properties of Danish words in a satisfactory way, and thus should not be dismissed off hand. What is needed, of course, is some systematic way of expressing *restrictions* in the combinability of constituents.

As is well known, grammars like (1) usually leave out rewrite rules whose right side consists of a single terminal symbol (the four lower rules in (1)). Instead the *preterminal symbols*, i.e. the symbols on the left side of the rewrite symbol in rules of the latter kind, appear formally as the terminal symbols of the grammar, and any such symbol is supposed to represent an individual lexical item belonging to the category designated by that symbol. In other words, the grammar presupposes the existence of a *lexicon* whose items are marked off as belonging to one or more categories. Technically, such a lexicon can be arranged in at least two basic ways: 1. as a simple list of items each of which has one or more categorial labels, or 2. as a set of *lists* such that each list has a categorial label and such that all items in a particular list belong to the category identified by the label of that list. In the former case a terminal symbol in the grammar refers to any item in the lexicon whose categorial label corresponds with the symbol. In the latter case a terminal symbol in the grammar refers to any item of the list whose categorial label corresponds with the symbol. The former strategy is often chosen for syntactic parsing systems where the terminal symbols of the grammar refer to *word classes* like nouns, adjectives, verbs, etc. In such systems a lexical item like the English word *drink* would appear in the lexicon as something like this:

drink noun, verb

In SSPS the latter strategy has been adopted: The lexicon is partitioned into separate lists with labels of the type *prefixes*, *roots*, *suffixes*, *endings*, etc., i.e. labels referring to *distributionally defined morpheme types*, and a terminal symbol in the grammar refers to any item from lists having the symbol as its label. Thus, a rule like

```
STEM  ->  pref root
```

presupposes the existence of two lexicon partitions labelled 'pref' and 'root', respectively, and it says that a STEM may consist of an item from the former followed by an item from the latter. Since the terminal symbols of the grammar refer (indirectly) to *morphemes*, a traditional syntactic rule like

```
NP -> adj noun
```

where the terminal symbols are word classes, must be expressed in a different way in SSPS, where there is typically no lexical partitions labelled 'adj' or 'noun', since words are not in general coextensive with morphemes. If a linguist wishes to write an SSPS rule referring to a word class, he must use *features*. In several recent formalisms - see e.g. Karttunen (1986) and Whitelock (1988) - grammar symbols are not atomic as they are in the grammar (1) and in pure context free grammars. This is also the case in SSPS. Lexical entries have an internal structure comprising *a set of features* which may designate, among other things, such properties as word class, and the symbols in the grammar may refer to such features. In fact the above-mentioned rule would typically be translated into

NP -> WORD(?A) (?N)WORD

in an SSPS grammar for Danish. The contents of the parentheses express restrictions in the combinability of two consecutive constituents of the category WORD, namely restrictions referring to the feature compositions of the constituents. The technical details of these notational facilities will be described in section III.

The use of features does not mean that SSPS is formally stronger (in the sense of the Chomsky hierarchy) than a context free grammar: the grammar and the lexicon system could in principle be translated into a context free grammar with atomic symbols. But the advantages of relying on featured constituents are 1) that it is a natural way to express individual properties of morphemes, 2) that it is easy to modify algorithms for atomic context free parsing in such a way as to take feature restrictions into account, and 3) that such algorithms tend to be faster than parsers for atomic context free grammar-lexicon systems with equivalent strength.

The strategy of having terminal grammar symbols refer to distributionally defined morpheme types is a natural consequence of the fact that SSPS is designed to describe both morphology and surface syntax: roots, prefixes, etc. are the terminal constituents of words in much the same way as nouns, adjectives, etc. are the terminal constituents of surface sentences. The use of a single constituent structure grammar to cover both surface syntax and morphology is in accordance with - and partly inspired by - Selkirk's extended version of Chomsky's (1970) X-bar theory, cf. that Selkirk includes morphological constituents in the hierarchy of categorial types (Selkirk 1982, p. 6f). The design of SSPS is not, however, seriously committed to any specific linguistic theory.

In recent years Koskenniemi's (1983) *two-level morphology* has dominated theory and practice in computational analysis of *morphological* structure. I have argued elsewhere (Molbæk Hansen forthcoming) that this kind of analysis is not well suited to systems where the specific format of the output of the morphological component is important. In a TTS-system the output format is of course particularly important, because it is supposed to contain the phonological information in string form, more particularly as strings of morphophonemic segments and boundaries. As a consequence, the lexicon system of SSPS differs radically from that of two-level morphology, particularly in that the output strings are *entirely independent of the parser algorithm and of the rules describing orthographic alternation of morphemes*.

As the linguistic component of a TTS-system, the SSPS parser has three main tasks:
1) to *identify* input texts as sequences of morphemes in written form. In this connection orthographically alternating forms of the same morpheme must be taken into account, cf. e.g. that the morpheme {gammel} 'old' appears in two different orthographic shapes, *gammel* and *gaml*.
2) to *output* structures which contain sufficient relevant phonological information for the pronunciation of the text to be computed. This implies, among other things, the conversion of the string format of the *terminal* material, i.e. the matched morphemes, into a format which is phonetically interpretable.
3) to *confer* the identified morpheme strings with lexical and grammatic information in order to exclude incorrect analyses, such as ['man'ən 'dœˀʁ] *'the man door' as the interpretation of the input text *manden dør*, instead of the correct one: ['man'ən 'døˀʁ] 'the man dies'.

Of these tasks 3) is indisputably the most difficult one. Overgeneration, i.e. the assignment of several structures to the same input, is a problem for all parsing systems, especially for systems including morphological analysis, and it might be argued that at least derivational and compositional morphology represents an unnecessary complication for a TTS-system, since the use of a lexeme-based lexicon comprising traditional dictionary forms would eliminate most sources of overgeneration at the word level (such as the incorrect analyses *kul-tur* and *kult-ur* in addition

to the correct *kultur* 'culture'). This argument can not, of course, be rejected on the grounds that a dictionary-based, morphology-free TTS-system would need a very large dictionary, since neither memory limitations nor lexical search time would be prohibiting factors in the light of hardware and software facilities now available. But it can be rejected on the grounds that morphological knowledge as such is needed anyway, especially for the interpretation of unidentified input words such as neologisms and spontaneous formations of new compounds. In most languages the inventory of morphemes is more well-defined than the inventory of well-formed lexemes, and the morphological structure *per se* is often crucial for pronunciation. Reduction - ideally elimination - of overgeneration must be obtained by *integrating* as much linguistic knowledge as possible, not by *ignoring* such knowledge. SSPS represents a step in that direction, at least for TTS-systems.

B. The Lexicon System

Since the terminal symbols of the constituent structure grammar refer to distributionally defined morpheme types, the lexicon is subdivided into separate partitions, each comprising entries of a particular type. However, the actual inventory of *lexicon partitions* in an SSPS system tends to be slightly richer than suggested by the coarse description of the principles given in the introduction. Thus in the SSPS-based TTS-implementation for Danish there are several prefix lists, several root lists, etc. The main reason for this is that the basic morpheme types - in Danish as well as in e.g. English - form distinct classes with respect to their combinability within single words with other basic types: in general, prefixes of Latin or Greek origin do not combine with native roots and *vice versa*, and there are other combinatorial restrictions as well which can be most naturally expressed by lexicon partitioning. A few examples of these combinatorial restrictions will make this point clear. (In the examples 'Latin' stands for 'of Latin origin', etc., and 'native' stands for 'inherited from Old Danish or borrowed from Middle Low German')

Most Latin Prefixes must be followed by a Latin root, and most native prefixes must be followed by a native root: *absolution* 'absolution' and *afløsning* 'release', not **abløsning.* and **afsolution.*

Most Latin suffixes must succeed a Latin root or stem, and most native suffixes must succeed a native root or stem: *immunitet* 'immunity' and *dumhed* 'stupidity', (literally: 'dumb-ness'), not **dummitet* and **immunhed.* These correlations are somewhat asymmetric, though: **immunhed* seems (to me at least) less ill-formed than **dummitet.*

Many Latin roots do not occur without a Latin prefix: *restaurere* 'restore' vs. **staurere.*

Certain Latin suffixes, in particular *-ere*, may, however, succeed certain

native roots: *snedkerere* 'to do carpentering' (*snedker* = 'carpenter').

Certain native suffixes may, likewise, succeed Latin roots or stems: *antikvarisk* 'second-hand' (about purchase of books) and *abrubthed* 'abrubtness', cf. **immunhed* above, and cf. the English *-ness* which behaves similarly.

I do not intend to give an exhaustive treatment of these combinatorial restrictions here, but for a lexicon system relying on distributionally defined morpheme types such phenomena obviously appeal to a more fine-grained partitioning than a mere division into 'prefixes', 'roots', etc.

1. MORPHOGRAPHEMIC ALTERNATION

In addition to the division of the lexicon according to the combinatorial pattern of morpheme types, there may be a subdivision of the lexicon partitions according to the *morphographemic alternation pattern* of lexical items. Any parsing system whose input format is orthographic and whose terminal symbols are morphemes, must cope with the fact that many morphemes appear in contextually conditioned orthographic variants, cf. English *heavy - heavier, fit - fitting*. As far as Danish is concerned, roots exhibit three basic graphemic patterns: some roots show an alternation between single and double final consonants, cf. *kat - katten* 'cat - the cat'; others show an e - zero alternation before final *l, n* or *r*, cf. *konvertibel - konvertible* 'convertible' (common gender, singular, indefinite vs. plural or definite); most roots, however, are graphemically constant in all contexts, cf. *hus - huset* 'house - the house'. Likewise, certain Latin prefixes exhibit graphemic alternation (reflecting phonological processes (assimilations) in Latin): *inaugurere - immobil - irrelevant - illativ; adhærere - assimilere - allativ.*

In Koskenniemi's two-level morphology (cf. above) the elimination of such orthographic ("surface") variation is taken care of by a set of rules expressing the contextually determined correspondences between "lexical" strings and "surface strings" in a letter-by-letter fashion. In SSPS this job is done in quite a different way which will be described below; but the *information* on the alternation patterns is linked with a subdivision of the lexicon partitions. In the Danish SSPS-system, for instance, there is a lexicon partition labelled rn which contains native roots. This lexicon partition is subdivided into four groups: rnrr, whose items exhibit no alternation (*hus - huse*), rnrd, whose items exhibit alternation between single and geminate final consonant (*kat - katten*), rnrsr, whose items exhibit simple e - zero alternation before final *l, n* or *r* (fængsel - fængsler), and rnrsd, whose items exhibit geminate consonant + e - single consonant + zero alternation before final *l, n* or *r* (gammel - gamle).

Since SSPS is a *declarative* system, the main partitioning as well as the subdivision according to graphemic alternation patterns and the exact

nature of each alternation pattern must be *declared* explicitly to the system. This is done by writing lines in a *lexicon declaration text* according to a set of naming conventions. A few examples - rather than extensive prose - will make these conventions and their meaning clear. In order to inform the system of the existence of the above-mentioned lexicon partitions containing native Danish roots, we simply write the following lines in the lexicon declaration text:

```
LEX rnrr
LEX rnrd
LEX rnrsr
LEX rnrsd
```

These declarations tell SSPS that there exist four lexicon partitions and that the terminal grammar symbols rnrr, rnrd, rnrsr, and rnrsd will match items from the corresponding lexicon partition.

Although I am concerned with the lexicon here, it may be expedient at this point to mention an important convention concerning the use of terminal symbols in grammar rules, a convention which is closely linked with the lexical naming conventions: *Any terminal symbol in a grammar rule will refer to lexical items from any concrete lexicon partition whose name begins with the symbol.* In the Danish application of SSPS four other concrete root lexicon partitions are declared (and exist), namely rfrr, rfrd, rfrsr, and rfrsd:

```
LEX rfrr
LEX rfrd
LEX rfrsr
LEX rfrsd
```

containing roots of foreign (Latin and Greek) origin. The convention just mentioned means that the symbol r in a grammar rule will refer to any item from these eight lexicon partitions (since their names all begin with r); the symbol rf and the symbol rfr will refer to any item from the four latter lexicon partitions; the four-letter symbol rfrsd, on the other hand, will only refer to any item from the concrete lexicon partition rfrsd. This naming convention enables the user to chose whatever degree of concreteness he sees fit when formulating particular grammar rules containing terminal symbols, i.e. rules referring to lexical items: since the alternation pattern of items from e.g. a particular root type is typically irrelevant in connection with the formulation of a rewrite rule referring to items of the distributionally defined type in question, the linguist should not be forced to worry about such matters when writing such a rule.

On the other hand, the declarations of the lexicon partitions rnrr etc. only

inform the system of the *existence* of such concrete lexicons, and a parser confronted with an SSPS grammar and orthographic input must of course cope with orthographic alternation, so the alternation patterns must be declared to the system somehow. In two-level morphology this declaration is taken care of by rules referring to strings of pairs of lexical and surface (orthographic) characters. In SSPS the alternation patterns are linked to *lexicon partitions*. When a concrete lexicon partition has been declared in the way just mentioned, the system will assume, unless otherwise informed, that its items exhibit no graphemic alternation. Thus, the above-mentioned concrete lexicon partition rnrr, which contains non-alternating roots, needs no further declaration. But the alternation pattern of items which do alternate is declared in a particular *alternation specification text* with a syntax of its own.

This text may start with a number of lines beginning with DEF, i.e. lines defining *classes*, e.g.

```
DEF V "aeuioyæøå"
```

which declares that the symbol V in the remaining lines of the declaration text stands for any of the characters a e u i o y æ ø å.

The alternation specifications proper are declared in lines beginning with TYP. Lines of this kind express the alternation patterns of the items of certain concrete lexicon partitions. Each such line is a series of *fields*. The first field is an *identification string* which should be identical with the *final* part of the label of some lexicon partition for which the user wants to declare a particular alternation pattern: Thus, for each of the concrete lexicon partitions whose labels end in d, sr, and sd in the Danish system there is a line whose first field is the identifying string. The next fields are abstract, symbolic expressions designating a. *the identificational shape* of the items in the concrete lexicon partitions, i.e. the shape in which they appear in their concrete lexicon partition, b. *the other shapes* in which the items appear, and c. *the contexts* in which the alternants occur.

Four type definition lines and four alternation specification lines are given in (4). The last four lines in (4) describe the behaviour of items from lexicon partitions with names ending in d, from lexicon partitions with names ending in sr, from lexicon partitions with names ending in sd, and from lexicon partitions with names ending in w. (Items from the latter partitions do not alternate themselves, but their orthographic shape is relevant to the alternation pattern of preceding morphemes, and this must be declared explicitly.)

(4)

```
DEF V "aeuioyæøå"
DEF C "rtpsdfgklbnm"
DEF L "rln"
DEF W "ei"
TYP d   @I0:VC>,@M:<!W  @I1:VC=C=>,@G:>W,@M:VC=C=<
TYP sr  @I0:CL>,@G:>W,@M:CL<  @I1:CeL>,@M:<!W
TYP sd  @I0:VC=C=L>,@G:>W,@M:VC=C=<  @I1:C=C=eL>,@M:<!W
TYP w   @G:@M
```

The meanings of the *keyword symbols* appearing in these lines i.e. the symbols beginning with @ and the symbol , (comma) are:

@I0: announces the alternant found in the physical lexicon.

@I1:, @I2: etc. announce other alternants.

@G: announces a graphemic condition which must be satisfied for the alternant to be legal and which is statable on the basis of the alternant in question.

@M: announces a graphemic condition which must be satisfied for the alternant to be legal and which is statable on the basis of the alternant in question *plus* additional information based on some other part of the word in question.

, is a separator between the description of an alternant and the description of the corresponding structural condition.

The morphographemic relations themselves are declared by writing *structural descriptions* of the alternants and of their contextual conditions. A structural description is a string of a) *class symbols* representing the classes defined in the DEF lines, b) *concrete symbols*, i.e. lower-case letters representing concrete letters of orthographic strings, and c) *one or both of the symbols* < *and* > representing the left and right boundary of morphemes in an orthographic string. Each class symbol in a structural description may be *indexed* by the symbol = which designates identity, e.g. if C= occurs in a line, then all C=’s in that line refer to the same consonant.

Each class symbol (whether indexed or not), each concrete symbol, and each *parenthesized string of such symbols* is a *substructure* which may be *followed* by one of the symbols ?, +, and * designating ’zero or one occurrences’, ’one or more occurrences’, and ’zero or more occurrences’ of the substructure, respectively, and each substructure may be *preceded* by the symbol ! which designates negation (complementation) of the

strings represented by the substructure.

After this brief presentation of the formal declarative structure - a variety of regular expressions - of the alternation specification text, let us translate the lines whose first fields are the strings d and w, respectively, into normal prose, in order to make clear what these lines actually tell the system.

The line

```
TYP d   @I0:VC>,@M:<!W          @I1:VC=C=>,@G:>W,@M:VC=C=<
```

may be translated thus:

"Items from concrete lexicon partitions whose names end in d appear in the concrete lexicon partition as strings ending in a vowel belonging to the defined class V followed by a single consonant belonging to the defined class C (@I0:VC>); this alternant occurs in orthographic words on condition that some following morpheme to be checked later in the word begins with a letter that does not belong to the defined class W (@M:<!W). Such items also appear as strings ending in a vowel followed by two identical consonants (@I1:VC=C=>); this alternant is *only legal* if it is followed to the right by a letter belonging to the defined class W (@G:>W) *and* on condition that some following morpheme to be checked later in the input *is preceded by* a vowel followed by two identical consonants (@M:VC=C=<)."

The line

TYP w @G:@M

may be translated thus:

"Items from concrete lexicon partitions whose names end in w do not exhibit alternation. (This is the default assumption when no @I0, @I1, etc. are mentioned.) Such items are only legal if a condition based on earlier parts of the input (@M:) is satisfied."

The difference between the meaning of the symbols @M: an @G: should be noted: @M: expresses the fact that certain combinability restrictions depend on morphographemic factors not deducible from the knowledge of the alternation pattern of a *single* morpheme, whereas @G: expresses the fact that other combinability restrictions are uniquely determinable by such knowledge. To spell out the two examples given above: in roots exhibiting alternation between single and geminate final consonant it may be safely stated that the alternant with a final geminate can only occur before shwa-initial suffixes and endings, and before the (native) suffixes

-ig, *-isk*, and *-ing*, i.e. before *orthographic e* and *i*. This does not mean, however, that the alternant with final single consonant is *excluded* before orthographic *e* and *i*; it may actually occur before these vowels if it is followed by another root in compounds, cf. *skakentusiast* 'enthusiastic chessplayer', literally 'chessenthusiast', and *glasindustri* 'glass industry'. Therefore such alternants can only be rejected if the *e* or the *i* turns out to be initial vowels in items from lexicon partitions of the w-type mentioned in (4) (shwa- or i-initial endings and suffixes).

Such facilities make it possible to state most alternation patterns in most languages and to link them with concrete lexicon partitions. In an SSPS implementation for Finnish, for instance, the inflectional and derivational suffixes exhibiting vowel harmony would be placed in a lexicon partition with an appropriate alternation identifier, say vh, as the final part of its label, and rules of the kind shown in (4) would be set up to express the alternation pattern characterising items from that lexicon partition.

In order to give this claim substance, I will show how the vowel harmony rules for Finnish set up by Koskenniemi (1983, p. 76) would be "translated" to the SSPS formalism. The suffixes exhibiting vowel harmony would be placed in a concrete lexicon partition declared in the lexicon declaration text as, say

LEX sfvh

and there would be a section in the alternation specification text looking like this:

(5)

```
DEF Hm "aouääöy"
DEF Vnb "ääöyie"
DEF Vf "ääöy"
DEF Vb "aou"

TYP vh @I0=<!Hm*Vf,@G:Vnb!Hm*< I1=<!Hm*Vb,@G:Vb!Hm*<
```

The latter specification says that items from lexicon partitions whose label end in vh have a lexical alternant which begins with zero or more letters not belonging to the defined class Hm (the segments which are neutral in relation to vowel harmony) followed by a front vowel (@I0:<!Hm*Vf); this alternant is only legal in the input if it is preceded by a member of the defined class Vnb followed by zero or more letters not belonging to the defined class Hm (@G:Vnb!Hm*<). Such items also appear as strings which begin with zero or more letters not belonging to the defined class Hm followed by a back vowel (@I1:<!Hm*Vb); this alternant is only legal in the input if it is preceded by a member of the defined class

Vnb followed by zero or more letters not belonging to the defined class Hm (@G:Vnb!Hm*<).

These examples should demonstrate that the structural description of graphemic alternation patterns may be *declared* in a general and reasonably simple language independent format.

Thanks to the formalism the linguist need not worry about how a parser program handles the information, but it may be mentioned that a parser which "understands" these conventions can be so constructed as to avoid superfluous lexical searching in cases where the declarations mention the @G: condition: thus in the analysis of an input word like *anklage* 'accuse' the Danish SSPS parser will never try to match the first four letters with items from the lexicon partition rnrsr (because the @G: condition of the sr-line in (4) will tell it that these letters should have been followed by an *e* in order for a search in that lexicon partition to be successful if the item ends in consonant + *l*). If the parser had not exploited this information it would have looked for a match in that lexicon partition, it would have found that these letters actually match the item *ankel* 'ankle' whose lexical alternant is *ankl*, and a hypothesis to the effect that this item is a correct identification of the first part of the word would have been set up only to be rejected later in the parse. This treatment of alternation differs crucially from the strategy of analysis in two-level morphology, where lexical search is based on single-symbol identity of the initial search paths of several items (letter trees, cf. e.g. Koskenniemi 1983, p. 107ff) and therefore "blind" to the individual orthographic properties of lexical items at search time.

2. THE STRUCTURE OF LEXICAL ITEMS

The formal declaration of individual lexical items is fairly simple: An item is declared as a line containing four elements: i. an *input string identifier*, ii. an *output string*, iii. a *left feature specification*, and iv. a *right feature specification*.

The excerpt (6) from the lexicon partition endw (containing endings) in the Danish TSS-system illustrates the declaration structure for lexical items.

(6)

```
i       ii          iii       iv

en~     +0n         NCA     / NCA /
en~     -0n         NCB     / NCB /
er~     +0r         PER     / PER /
et~     +0d         NNA     / NNA /
et~     -0d         NNB     / NNB /
e~      !0          AE      / AE  /
e~      -0          PE      / PE  /
ne~     n0          PER PE  / PD  /
ene~    +0n0        SER PNO / PD  /
s~      +s          N A P   / GEN /
t~      !t          AN      / AN  /
~       `           NCA     / NCA /
```

Element i, the input string identifier, is one of the graphemic alternants of the morpheme. For items which do not exhibit such alternation this string is simply the orthographic form of the morpheme; for alternating items the input string identifier is that alternant whose structure is described as @I0 in the alternation specification text of the lexicon partition to which the item belongs, cf. above. The items in (6) all end in the ~ (tilde). This is because they happen to be endings: the tilde matches "end-of-word", i.e. any sequence of blanks or an "end-of-input" signal. In a parsing system without any distinction between morphology and syntax such a character is necessary, since any character is taken to be a relevant part of the orthographic surface structure.

The input string identifier of a lexical item may be an empty string. In the Danish lexicon system a lexicon partition declared as bssr contains items occurring as "linking morphemes" between two parts of a compound. This lexicon partition only contains three items which are declared as in (7):

(7)

```
`       #       CD  / ! /
e       -0#     CE  / ! /
s       +s#     CS  / ! /
```

The first of these items has an empty string as its input string identifier. For reasons of readability an empty string is identified as the symbol `. The "morpheme" in question is used to take care of the fact that several Danish roots appear without any (non-empty) linking morpheme.

Formally it is a genuine lexical item, and its left feature specification, CD, is in fact responsible for the accept of a compound like *vandrør* 'water-pipe' and the rejection of an ill-formed compound like **buksvand*.

Element ii is the *output representation* of the item, i.e. that representation of the morpheme which is concatenated with the corresponding representations of neighbouring morphemes in the parsed structure. In the TTS-system for Danish the output representation of lexical items is *morphophonemic* in the linear sense of SPE-like phonological descriptions, (Chomsky & Halle 1968), i.e. it is a *sequence of phonetically interpretable symbols optionally surrounded by boundary symbols*. This output format is a sensible choice in such a system, due to the trivial fact that the phonetic representation of a single morpheme in a specific context can not be determined independently of that context, which is the very reason why a phonological component is needed. In principle, however, any output representation is the linguist's choice.

A comparison with the format of the lexical strings which are the output representations in two-level morphology is in order here. In two-level morphology the lexical representations contain certain arbitrary symbols ("features", see Koskenniemi 1983, p. 24) whose function is to form contexts for alternation rules which influence the accept or rejection of a given item in a given word form, i.e. the lexical representations are partly determined by factors relevant to the morphemic identification, hence to the result of the morphological analysis itself. In SSPS - where graphemic alternation is declared in the *alternation specification text* - there is no connection whatsoever between the analysis and the specific format of the output representation. The linguist is free to base the output representations on whatever considerations he sees fit, but in TTS-systems some sort of morphophonemic representation is the natural choice.

Elements iii and iv are the *feature specifications* of the item. In order for the system to treat features correctly, the features - like the lexicon partitions and their alternation patterns - must be declared in the declaration text. Features are declared by entering lines consisting of the keyword FEATURE followed by a feature name which must be a string of capital letters, e.g. thus:

FEATURE NNA

Each feature name declared in the declaration text refers to a *unary feature*, i.e. to a single-valued property; in other words, the SSPS feature system is not of the *attribute-value* type used in e.g. the D-PATR formalism (Karttunen 1986). It is possible, however, to refer to *groups of defined features*, because *a feature symbol in lexical items and in grammar rules refers to all defined unary features whose names begin with the symbol.* In other words, the convention for referring to lexicon partitions holds for feature references too: if four features are defined in the declaration file as

```
FEATURE NNA
FEATURE NCA
FEATURE NNB
FEATURE NCB
```

then the feature symbol N in a feature specification in the grammar or in the lexicon refers to all four features, NN refers to NNA and NNB, NC refers to NCA and NCB, NNB refers only to NNB, etc. A feature specification in the declaration of a lexical item is a sequence of blank-separated *feature names* delimited to the right by the character /. An exclamation mark - designating "presence of all features" - is also legal as a feature specification, as in (7). This may be used to express "free combinability" of sister constituents, cf. subsection II C.

The linguist may use features for whatever purposes he likes, but for parsing purposes features can be fruitfully used to combine *combinatorial* and *categorial* properties. The combinatorial viewpoint is primarily relevant for the morphological behaviour of items, whereas the categorial viewpoint is relevant to the syntactic properties of the items and of the higher-level constituents into which they enter as terminal constituents, cf. subsection II C and section III. The division of lexical feature specifications into a right part and a left part is primarily motivated by the combinatorial properties of morphemes within the word: this division reflects the fact that many morphemes have "janus properties" from the point of view of their combinability with other morphemes. This is most obvious in the case of suffixes: a suffix like *-ning* which forms noun stems from verbal roots is entered (in its appropriate lexicon partition) as

ning *niN+ V / NCA PER CSS /

The left feature specification is here simply V which specifies that this item is combinable with left sister constituents with verbal features (features whose name begin with V) in their right feature specification, cf. section II C. The right feature specification contains features specifying the nominal properties of the suffix, namely that it acts like a common gender noun (NCA) with plural *-er* (PER) and with obligatory *-s-* as a linking morpheme when it occurs as the first part of a compound (CSS), cf. *redningen - redninger - redningsbælte* 'salvation (sing. and plur.) - lifebelt'. This "directional" use of features is related to Whitelock's (1988) treatment of "signs".

Besides expressing combinatorial and categorial properties of lexical items, the feature specifications play an important role in connection with the grammar rules, as will be made clear in the next section.

C. The Grammar Formalism

The grammar formalism permits the linguist to write a constituent structure grammar with facilities for expressing *combinability restrictions* and *feature percolation* (cf. e.g. Lau & Perschke 1987), i.e. lexical feature specifications may be moved to mother nodes under conditions controlled by the grammar writer.

The skeleton of the grammar formalism is a context free grammar, i.e. a set of rules which rewrite nonterminal symbols on the left side of the rewrite symbol (in the examples the symbol ->) as a sequence of symbols specified on the right side of the rewrite symbol. The usual notational conventions for specifying optionality and repetition are legal: + after a right-side symbol means one or more occurrences of that symbol; ? means zero or one occurrence, and * (Kleene star) means zero or more occurrences. Likewise, the usual convention of designating terminal symbols by initial lowercase-letters and nonterminal symbols by initial uppercase letters is followed. As mentioned above, terminal symbols refer to lexical items from lexicon partitions whose names consist of or begin with the symbol.

In the following I presuppose familiarity with the basic formal properties of context free grammars, and I will confine myself to explaining those properties of the SSPS grammar formalism which are non-trivial. Examples are taken from the existing TTS-implementation for Danish.

1. SYLLABLE COUNT

After the left-side symbol of a rule there may follow a number. Such a number designates the minimal number of syllables (defined as orthographic vowels) required for the structure (subtree) represented by the left side symbol to be possible. From the point of view of Danish word structure a rule like (8) expresses the fact that stems composed of a prefix and a root always contain at least two syllables.

(8)

```
STEM 2  -> pn rn
```

From the point of view of parsing this facility represents an optimization: rule (8) tells the parser not to try to build this structure if the remaining part of the input text contains less than two syllables.

2. FEATURE PERCOLATION

Every lexical item in SSPS has two feature specifications, a left one and a right one, and *so has every constituent* in the tree structures described by the grammar.

Before I describe how constituents, i.e. nodes in the tree structures described by the grammar, acquire their feature specifications, I must explain an important convention for the interpretation of rewrite rules:

(9) *It is implicitly assumed that the structure described by a rewrite rule is legal if and only if it is true of any constituent (represented by any right-side symbol in the rule) that its left feature specification is compatible with the right feature specification of its left sister and that its right feature specification is compatible with the left feature specification of its right sister. For two feature specifications to be compatible they must share at least one unary feature, i.e. the set-theoretical intersection of the two feature specifications must not be empty.*

How do constituents acquire their feature specifications? *Terminal constituents* inherit their feature specifications from the lexical items with which they match, and I will therefore illustrate the meaning of this with rule (8) considered in connection with two strings of terminal material: *ufri* and *ugå*. Since *u* appears in the lexicon partition pn, and *fri* and *gå* appear in the lexicon partition rn, rule (8) would generate both these words (and the parser would accept them) if (9) were ignored. However, the right feature specification of *u* is A (standing for adjectival features, i.e. formally any feature whose name begins with A), and features of this kind (actually features named AC, AE, and AN) are also present in the left feature specification of *fri*, but not in the left feature specification of *gå*. As a consequence, since convention (9) is actually assumed, *ufri* is a legal structure, but *ugå* is not, and the parser would accept the string *ufri* as the corresponding word, but reject *ugå*.

Nonterminal constituents acquire their feature specifications in either of two ways: *If no explicit features are mentioned in a rule* (cf. below), a set of default conventions guarantees that any nonterminal constituent gets both a left and a right feature specification. These implicit conventions may be stated as follows:

(10) *Any mother constituent acquires the right feature specification of her rightmost daughter.*

(11) *Any mother constituent copies her left feature specification from her right feature specification.*

Principles (10) and (11) represent *implicit feature percolation*.

(10) expresses "rightheadedness" as a default principle (Selkirk 1982).

This principle guarantees, for example, that suffixed words like *redning* get the feature specification of their right member, in this case that the stem as such gets a right feature specification with the features NC etc., (cf. above) percolated from *-ning*.

3. EXPLICIT FEATURE MANIPULATION IN RULES

A basic grammar symbol is a string of letters, the first of which is upper-case if the symbol is nonterminal, otherwise lower-case. Before and after a basic grammar symbol a *modifier* may appear. A modifier is either a *percolator* or a *restriction*. A percolator is one of the symbols ^ >. A restriction has the following formal syntax:
a left parenthesis + an optional *restrictor sequence* + a right parenthesis.
A restrictor sequence consists of one or more *restrictors* separated by semicolons.
A restrictor consists of a *restrictor operator* optionally followed by a *restrictor operand.*
A restrictor operator is one of the symbols = # ? % : & + -.
A restrictor operand consists of one or more *feature symbols* separated by commas.
A feature symbol is a string of capital letters or an exclamation mark, i.e. its formal structure is that of lexical feature specifications.

A restrictor sequence which mentions features refers to the features of the left feature specification of the constituent in question if the restrictor sequence is written at the left side of the basic symbol, and to the right feature specification if it is written at the right side of the symbol. A basic grammar symbol with a right-sided restriction may, for instance, look like this:

STEM(:NN,PN)>

where the basic symbol is STEM which is modified by the right-side restriction (:NN,PN) and the percolator >.

The function of percolators and restrictions is to override the above-mentioned default conventions concerning the combinability of sister constituents and the feature percolations to mother constituents. Let me illustrate the most important functions of such explicit modifiers:

Explicit percolation may be *horizontal* (designated by the percolator symbol >) or *vertical* (designated by the percolator symbol ^). Explicit horizontal percolation copies the feature specification of a constituent to the corresponding feature specification of its right sister, carries out a logical AND-operation with the sister's feature specification, and leaves the result, i.e. the intersection of the two original feature specifications, as the sister's feature specification. A rule like

Word -> STEM> endw

declares for instance, that if STEM has inherited the right feature specification AAA BBB and endw has inherited the right feature specification BBB CCC, then, in the subtree described by the rule, endw must have the right feature specification BBB (due to the explicit horizontal percolation). Word, too, must have the BBB as both right and left feature specification, due to default feature percolation from the rightmost daughter (10) and to the copying convention (11).

Explicit vertical percolation is used to override the default "rightheadedness" principle. A rule like

NP -> ^N^ PP

makes N the head of NP in that both its left and right features (instead of the features of the rightmost daughter PP) are percolated to the mother NP. Note that this is the natural description of e.g. English noun phrases like 'the man with the red hat'. The entire noun phrase has the features of 'man', including e.g. features designating *3. person* and *singular* which are relevant for subject-verb agreement in English. Rightheadedness is predominant in morphology, it is not so frequent in syntax. The rule

NP -> ^N PP

overrides the principle that a mother copies her left feature specification from her right feature specification. In this case NP gets the left feature specification of N (due to explicit percolation) and the right feature specification of PP (due to implicit percolation).

The restrictors all have an operator and a feature operand. In the explanations given below of the functions of restrictors the following abbreviations will be used:
CON = the basic grammar symbol representing the constituent subject to the restriction.
OF = the original, i.e. inherited or percolated, feature contents of the relevant (left or right) feature specification of the constituent in question.
GF = the feature operand of the restrictor.
RF = the feature contents of the relevant feature specification resulting from the operation. Note that OF etc. have the formal syntax FFF (in the case of a single unary feature) or FFF,GGG,... (in the case of a combination of unary features) where FFF and GGG are feature symbols.

The operators =, #, ?, and % express *conditions for the acceptability* of the constituent in the subtree corresponding to the rule.

CON(=GF) means "CON is only legal if OF = GF"
CON(#GF) means "CON is only legal if OF =/= GF"

CON(?GF) means "CON is only legal if GF is included in OF"
CON(%GF) means "CON is only legal if GF is not included in OF"

The operators :, &, +, and -, express *explicit deviations from the default feature specifications* of the constituent in question.

CON(:GF) means "assign GF to RF"
CON(&GF) means "assign the intersection of OF and GF to RF"
CON(+GF) means "assign the union of OF and GF to RF"
CON(-GF) means "assign (OF minus GF) to RF"

If there are several (semicolon-separated) restrictors in a restrictor sequence, the operations may be thought of as being carried out in the order left to right. Thus CON(&FFF,GGG;-HHH) means "replace the original (inherited or percolated) contents of the right feature specification of CON with the intersection of those contents and FFF,GGG; then subtract HHH from the result and assign the new result to RF". Regarded as a declaration of the legality of a constituent in a subtree, such a restrictor series should be interpreted as the *final result*, i.e. the declaration says that the constituent is legal if the relevant feature specification has the contents which would be the result of this series of operations.

After this *tour de force* through the main formal properties of the lexicon and grammar formalism, we are in a position to study their use in the description of Danish surface structure.

III. SSPS AND DANISH SURFACE STRUCTURE

In this section I will illustrate the use of the SSPS formalism in declarations of morphological and surface syntactic structures in Danish. The rules and declarations may also be interpreted as instructions to the SSPS *parser*, cf. section IV.

I will illustrate various aspects of the SSPS formalism by presenting a sample SSPS grammar (12) which describes simple sentences as having a rather "flat" structure. Some of the constituent names refer to *fields* in Diderichsen's (1962) structural *field grammar* which is of the "slot and filler" type (Winograd 1983, p. 79). For ease of reference the rules of the grammar are numbered.

(12)

```
1  S     2  ->     NP(:!) (?VFA)WORD NP?(:!) PREP?
2  NP    2  ->     DETR?> (-N)DESC? KERN(:!) PREP?
3  PREP  2  ->     prep NP
4  DETR  1  ->     detr
5  DETR  2  ->     detr?> NUM(&A,PE)
6  DETR  1  ->     NP geni(:!)
7  NUM   1  ->     numri numr*
8  DESC  1  ->     (?A)WORD+
9  KERN  1  ->     (?N,P)WORD
10 WORD  1  ->     STEM endw
11 WORD  2  ->     STEM bssw(:!) (:!)STEM endw
12 WORD  3  ->     STEM bssw(:!) (:!)STEM bccw(:!) (:!)STEM endw
13 STEM  1  ->     rnr
14 STEM  1  ->     STEM snr
15 STEM  2  ->     pnr(?V) (?V)STEM
16 STEM  2  ->     pnr(?V) (%V)STEM(:VED,VET)
17 STEM  2  ->     pnr STEM(-V)
```

These 17 rules describe simple sentences, partly in field grammar terms, with an NP (the subject) in the "front field" (Diderichsen's *fundamentfelt*), with a finite verb as the only filler in the "verbal field" (Diderichsen's *nexusfelt*), and with an optional noun phrase (the direct object) followed by an optional prepositional phrase in the "content field" (Diderichsen's *indholdsfelt*).

The meanings of the non-trivial constituent names of the NP are the following:
DESC is a "descriptor field" (Diderichsen's *beskriverfelt*)
DETR is a "determiner field" (Diderichsen's *bestemmerfelt*)
KERN is a "kernel field" (Diderichsen's *kernefelt*)
The names of the nonterminal morphological constituents are self-evident, I hope. The terminal symbols refer to items from the lexicon partitions listed in (13):

(13)

```
prep     prepositions
detr     determiners (articles, quantifiers, etc.)
numr     numeral morphemes
numri    numeral morphemes occurring initially
geni     the genitive ending
endw     declensional endings
rnr      native root morphemes
bssw     linkers in simple compounds
bccw     linkers in "deep" compounds
snr      native suffixes
pnr      native prefixes
```

A remark on the use of features will help the reader to better understand some of the examples given in this section.

Formally, a declared feature name signifies nothing but the existence in the system of a certain unary feature, and it is the SSPS user's responsibility to use features consistently and meaningfully. A special hint for users of SSPS is, however, in order here: in many cases the same feature may be used with different interpretations in morphology and syntax, since these two levels - though formally indistinct in SSPS - are in most languages complementary as to the roles of features. There is nothing to prevent the user from using a feature XX as, say, a conjugation class marker in morphology and as, say, a marker of definiteness in syntax. Endings play a particular role in this respect in the SSPS description of Danish used for the TTS-parser: Since left and right feature specifications are distinct, endings may be assigned morphologically relevant left features and syntactically relevant right features.

The features mentioned in this section are listed in (14) with two interpretations, one for morphology (M) and one for syntax (S).

(14)

	M	S
VFA	past tense in -te	finite verb
PE	plural in e	indefinite noun, plural
PD	plural in er	definite noun, plural
AC	adjectival zero	common indefinite adj. sing.
AE	adjectival e	definite or plural adj.
AN	adjectival t	neutral indefinite adj. plur.
NNA	neutral noun in zero	neutral indefinite noun, sing.
NNB	neutral noun in e	neutral definite noun, sing.
NCA	common noun in zero	common indefinite noun, sing.
NCB	common noun in e	common definite noun, sing.

In the grammar (12) rules 1 - 9 describe the syntactic part of such structures. Rules 10 - 17 describe the "morphological" part. I do not intend to explain every detail in (12), but I will comment on a handful of characteristic properties of a some of these rules.

The restrictor (:!) after the initial NP in rule 1 declares that a noun phrase combines freely with a finite verb. This is the SSPS way of stating the fact that there are no agreement-like dependences between subject and verb in Danish.

The *finite verb* is represented by the symbol (?VFA)WORD in rule 1, i.e. the word class property of the category WORD appears as a feature (VFA meaning "finite") which is percolated from the internal constituents of the category, ultimately from lexical items. Likewise, note the identification of a *noun* as a (N,P)WORD, i.e. a word with the (left) feature symbols N or P in rule 9. These symbols "unify" nominal features referring to singular and plural declensional classes which are relevant in the morphological part of the grammar, but this "unification" is accomplished simply by the "abstract" use of feature symbols made possible by the naming conventions mentioned in section II. In this case all unary features whose names begin with N or P are covered, but the only thing that matters from a syntactic point of view is to identify a noun as such, so the full "morphological" specification is simply left out here; cf. also the identification of *one or more adjectives* as (?A)WORD+ in rule 8.

Another illustrating aspect of this grammar is the treatment of the dependency between the constituents DETR, DESC, and KERN in the NP of rule 2. A Danish noun phrase is either definite or indefinite. The definiteness is expressed in either of two ways, depending on the structure of the NP: if the noun phrase consists of an isolated noun, the definite form of that noun (*manden* 'the man' vs. *mand* 'man') is responsible for the

definiteness. If, however, the NP is modified by a determiner followed by an adjective, the definiteness or indefiniteness is expressed solely by that determiner, and in this case the noun is always in the indefinite form, whereas the form of the adjective depends on the determiner. If the determiner is *indefinite*, the adjective must agree in number and gender with the *noun*: *en god mand* 'a good man'; *et godt skib* 'a good ship'; *nogle gode skibe* 'some good ships', and this is also the case if there is no determiner at all: *godt vejr* 'good weather', *god kaffe* 'good coffee', *gode skibe* 'good ships'. If the determiner is definite, however, the adjective must agree in *definiteness* with the *determiner*: *den gode mand* 'the good man'; *det gode skib* 'the good ship'.

I will show in some detail how the choice of features in the lexicon and the manipulation of features in the grammar may be combined to take care of these phenomena.

Consider the following fragments from lexicon partitions (LP's) in (15).

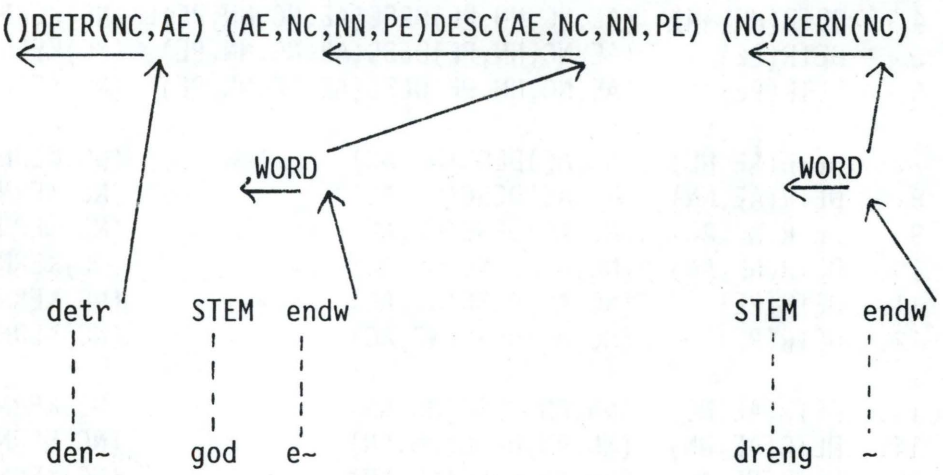
(15)

```
LP: rnrr (* non-alternating roots *)
god       go:d        ! / AC AN AE /
dreng     dræN        !  / NC PE CE /


LP: detr (* non-alternating, unstressed determiners *)
den~      dænh%       !  / AE /
det~      de%         !  / AE /
en~       enh%        !  / NC AC /
et~       eth%        !  / NN AN /
de~       di%         !  / PE /
nogle~    nol0%       !  / PE /


LP: endw  ( *endings* )
~         '           NC / NCA /
~         '           NN / NNA /
~         '           AC / AC /
e~        -0          AE / AE NC NN PE /
e~        -0          PE / PE /
t~        +t          AN / AN /
ne~       n0          P  / PD
```

Consider next the NP 1. *den gode dreng* 'the good boy': due to principles (10) and (11) of section II, and due to the fact that no rules below the NP-level in (12) override these principles for the structure in question,

the lexical feature specifications of the terminal constituents of this NP are percolated through the "middle" constituents (STEM and WORD) to the higher constituents DETR, DESC, and KERN, as illustrated in (16) where - for reasons of space - the irrelevant feature specifications at the top level and the feature specifications of the terminal (lexical) and middle constituents are omitted.

(16)



(16) shows what the structure *just below the NP-level* would have looked like if the right-percolator (>) to the right of DETR and the "subtractor" restrictor (-N) to the left of DESC in rule 2 had not been there, that is if rule 2 had looked like

2 NP 2 -> DETR? DESC? KERN(:!) PREP?

All the lower level constituents simply percolate their right feature specifications to their mothers according to (10), and the mothers copy their right feature specifications to their left ones according to (11), as indicated by the arrows.

Consider now the following NP's of which most are illegal:

2. **det gode dreng* 3. **en gode dreng* 4. **et gode dreng* 5. **de gode dreng* 6. **nogle gode dreng* 7. **den god dreng* 8. **det god dreng* 9. *en god dreng* 'a good boy' 10. **et god dreng* 11. **de god dreng* 12. **nogle god dreng* 13. **den godt dreng* 14. **det godt dreng* 15. **en godt dreng* 16. **et godt dreng* 17. **de godt dreng* 18. **nogle godt dreng* 19. **den gode drenge* 20. **det gode drenge* 21. **en gode drenge* 22. **et gode drenge* 23. *de gode drenge* 'the good boys' 24. *nogle gode drenge* 'some good boys' 25. **den gode drengene* 26. **det gode drengene* 27. **en gode drengene* 28. **et gode drengene* 29. **de gode drengene* 30. **nogle gode drengene*

On the assumption, still, that rule 2 has been changed in the indicated way, the situation at the level in question for these structures may be schematized as in (17):

(17)

1.	DETR(AE,NC)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(NC)KERN
2.	DETR(AE,NN)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(NC)KERN
3.	DETR(NC,AC)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(NC)KERN
4.	DETR(NN,AN)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(NC)KERN
5.	DETR(PE)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(NC)KERN
6.	DETR(PE)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(NC)KERN
7.	DETR(AE,NC)	(NC,AC)DESC(NC,AC)	(NC)KERN
8.	DETR(AE,NN)	(NC,AC)DESC(NC,AC)	(NC)KERN
9 .	DETR(NC,AC)	(NC,AC)DESC(NC,AC)	(NC)KERN
10.	DETR(NN,AN)	(NC,AC)DESC(NC,AC)	(NC)KERN
11.	DETR(PE)	(NC,AC)DESC(NC,AC)	(NC)KERN
12.	DETR(PE)	(NC,AC)DESC(NC,AC)	(NC)KERN
13.	DETR(AE,NC)	(NN,AN)DESC(NN,AN)	(NC)KERN
14.	DETR(AE,NN)	(NN,AN)DESC(NN,AN)	(NC)KERN
15.	DETR(NC,AC)	(NN,AN)DESC(NN,AN)	(NC)KERN
16.	DETR(NN,AN)	(NN,AN)DESC(NN,AN)	(NC)KERN
17.	DETR(PE)	(NN,AN)DESC(NN,AN)	(NC)KERN
18.	DETR(PE)	(NN,AN)DESC(NN,AN)	(NC)KERN
19.	DETR(AE,NC)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(PE)KERN
20.	DETR(AE,NN)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(PE)KERN
21.	DETR(NC,AC)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(PE)KERN
22.	DETR(NN,AN)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(PE)KERN
23.	DETR(PE)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(PE)KERN
24.	DETR(PE)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(PE)KERN
25.	DETR(AE,NC)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(PD)KERN
26.	DETR(AE,NN)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(PD)KERN
27.	DETR(NC,AC)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(PD)KERN
28.	DETR(NN,AN)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(PD)KERN
29.	DETR(PE)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(PD)KERN
30.	DETR(PE)	(AE,NC,NN,PE)DESC(AE,NC,NN,PE)	(PD)KERN

Of the illegal NP's 13 - 18 and 25 - 30 would be rejected as they should: 13 - 18 would be rejected because the right feature specification (NN) of DESC is not compatible with the left feature specification (NC) of KERN (cf. principle (9)), and 25 - 30 would be rejected for similar reasons. But there would still be considerable overgeneration: the illegal NP's 2-8, 10-12, and 19-22 would be accepted, because any two contiguous right and

left feature specifications are compatible (share at least one unary feature).

Consider now the effect of (and the motivation for) the restrictions of the "real" rule 2, namely the right-side horizontal percolation (>) of DETR and the left-side "subtractor" restrictor (-N) of DESC, cf. (18), where the illegal structures are marked with *.

(18)

1.	DETR(AE,NC)	(AE,PE)DESC(AE,NC)	(NC)KERN
2.	DETR(AE,NN)	(AE,PE)DESC(AE,NN)	(NC)KERN *
3.	DETR(NC,AC)	(AE,PE)DESC(NC)	(NC)KERN *
4.	DETR(NN,AN)	(AE,PE)DESC(NN)	(NC)KERN *
5.	DETR(PE)	(AE,PE)DESC(PE)	(NC)KERN *
6.	DETR(PE)	(AE,PE)DESC(PE)	(NC)KERN *
7.	DETR(AE,NC)	(AC)DESC(NC)	(NC)KERN *
8.	DETR(AE,NN)	(AC)DESC()	(NC)KERN *
9 .	DETR(NC,AC)	(AC)DESC(NC,AC)	(NC)KERN
10.	DETR(NN,AN)	(AC)DESC()	(NC)KERN *
11.	DETR(PE)	(AC)DESC()	(NC)KERN *
12.	DETR(PE)	(AC)DESC()	(NC)KERN *
13.	DETR(AE,NC)	(AN)DESC()	(NC)KERN *
14.	DETR(AE,NN)	(AN)DESC(NN)	(NC)KERN *
15.	DETR(NC,AC)	(AN)DESC()	(NC)KERN *
16.	DETR(NN,AN)	(AN)DESC(NN,AN)	(NC)KERN *
17.	DETR(PE)	(AN)DESC()	(NC)KERN *
18.	DETR(PE)	(AN)DESC()	(NC)KERN *
19.	DETR(AE,NC)	(AE,PE)DESC(AE,NC)	(PE)KERN *
20.	DETR(AE,NN)	(AE,PE)DESC(AE,NN)	(PE)KERN *
21.	DETR(NC,AC)	(AE,PE)DESC(NC)	(PE)KERN *
22.	DETR(NN,AN)	(AE,PE)DESC(NN)	(PE)KERN *
23.	DETR(PE)	(AE,PE)DESC(PE)	(PE)KERN
24.	DETR(PE)	(AE,PE)DESC(PE)	(PE)KERN
25.	DETR(AE,NC)	(AE,PE)DESC(AE,NC)	(PD)KERN *
26.	DETR(AE,NN)	(AE,PE)DESC(AE,NN)	(PD)KERN *
27.	DETR(NC,AC)	(AE,PE)DESC(NC)	(PD)KERN *
28.	DETR(NN,AN)	(AE,PE)DESC(NN)	(PD)KERN *
29.	DETR(PE)	(AE,PE)DESC(PE)	(PD)KERN *
30.	DETR(PE)	(AE,PE)DESC(PE)	(PD)KERN *

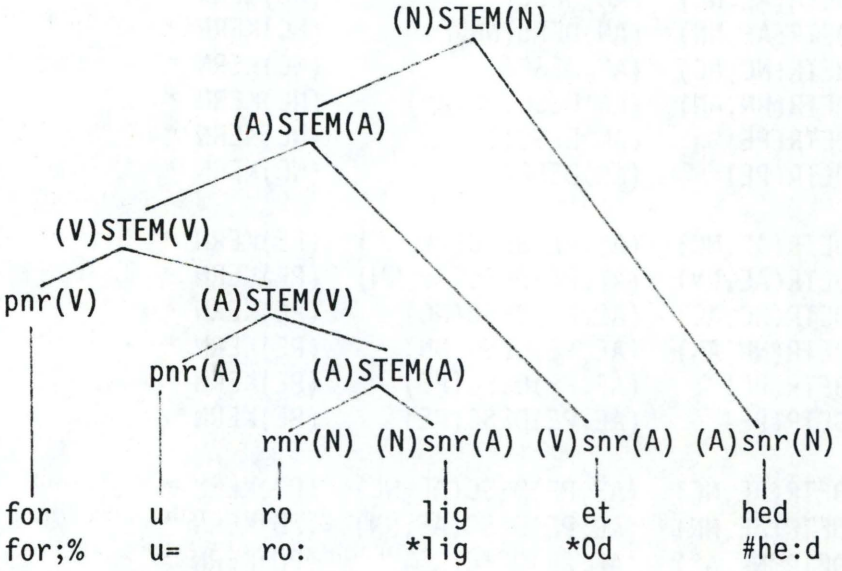
Thanks to the restrictions of rule 2, all the legal structures are accepted,

and all the illegal ones are rejected.

I am aware that this may be hard to see from the grammar (mainly because of the implicitness of feature percolation), but I only use this example to demonstrate the ability of SSPS to express rather complicated dependencies in a compact way. Incidentally, this property is relevant to the speed of the parser, which depends more on the number of rules to try than on the conceptual complexity of the rules. Note that the percolator > and the restrictor (-N) in rule 2 are not just ad hoc formal devices: the natural linguistic interpretation of the horizontal percolator > may be formulated thus: "If the determiner field and the describer field are both present, they *combine* to form the definiteness value of a Danish noun phrase", and the natural linguistic interpretation of the restrictor (-N) may be formulated thus: "If the determiner field and the describer field are both present, nominal agreement features of the describer field are *ignored* in a Danish noun phrase".

In the *morphological* part of the grammar (12) attention should be paid to rules 15-16. These rules are recursive and describe the structure of such "deep" morphological structures as (19), where both the input and output formats of the terminal constituents are shown, and where the most relevant (abstract) left and right features are shown in parentheses.

(19)



Notice the restrictors in rules 15 and 16. In normal prose, what rule 15 says is: a STEM may consist of a native prefix with verbal right features followed by a native root; if the root has verbal left features, normal rightmost daughter percolation takes place, i.e. the STEM will be a verbal

stem like *be-søg* 'visit'. This guarantees that STEM will have the conjugation class of the root *søg*, in particular it will be marked for the past ending *-te* (the feature VFA in its morphological interpretation, cf. (14) above).

Rule 16 says: a STEM may consist of a native prefix with verbal right features followed by a native root; if the root has no verbal left features, its right feature specification will be the combination (VED, VET) which are percolated implicitly to the mother STEM. This rule caters for the fact that many nominal and adjectival roots (and stems) may be "verbalized" by verbal prefixes, and that such verbs have the *unmarked conjugation* (past tense *-ede* and past participle *-et*), as expressed by the features VED and VET, cf. e.g. *afkviste* 'to cut off twigs', literally "to off-twig".

These comments have, I hope, served as good illustrations of the expressive facilities of SSPS, and of the linguistic meaningfulness (interpretability) of restrictors and percolators.

IV. THE SSPS PARSER IN OUTLINE

The parser used in the Danish TTS-system is tuned to the SSPS formalism. I will limit myself to outlining its main general features. The parser is based on the *active chart* principle (Earley 1970; Winograd 1983, p. 116ff is a good introduction), and proceeds in a *top-down, depth first, first rule first, first solution only, left to right* fashion.

The top-down principle was chosen on empirical grounds: a bottom-up version exists and has been used, but tests showed that the overgeneration of hypotheses at the lower level characteristic of bottom-up parsing exceeded the overgeneration near the top of the top-down version considerably. This undoubtedly has to do with the inclusion of morphology, which means that the terminal constituents are not given in advance, but must be identified during parsing. For the same reason, optimizations à la Wirén (1987) are not possible.

The depth first and first rule first principles were chosen because they are easy to combine with the principle of selecting the first solution found, and because they enable the user to order his grammar rules according to e.g. his knowledge of the frequency or probability of certain structures. This is possible because the parser simply processes the subtrees in the order of the corresponding rules in the grammar. Most Computational linguists today would contend that the grammar writer should be allowed to write his grammar without considerations of how a parser would handle the grammar in connection with input (the principle of purely *declarative systems*). I agree in the sense that the grammar writer should not be *forced* to consider how a parser or any other program "understanding" the formalism will treat a specific input. But SSPS *gives the grammar writer the*

option to exploit the first rule first principle in that he *may* order his rewrite rules in such a way as to arrive at a preferred structural interpretation first, which is quite different from being *forced* to consider parsing schedule. This possibility is important in a practical TTS- system, because only one solution should be handed down to the phonological and phonetic components and further down to the synthesis component. The first rule first principle is also well chosen in connection with unidentified input: The TTS-system *must* "say" something, and this requirement may be met by putting very "permissive" root symbol rules at the *bottom of the grammar*, so that they are tried after all "structured" rules, cf. a rule like

S -> (:!)WORD(:!)*

which simply says: "let any sequence of words be accepted". This is the SSPS way of arriving at preferred structural interpretations in cases of ambiguous input without necessarily rejecting improbable or downright illegal structural interpretations in cases of ill-formed input. To take an example: why should not a TTS-system for Danish assign the "pronunciation" [dɛn'go:ðə'sgi:b'sɑjlʌ]? to an improper input sentence like **den gode skib sejler*? Most Danish speakers would read it aloud that way.

The left-right strategy may not be the best one, cf. that "island parsing" seems to give good results in other fields of recognition of structure, especially speech recognition.

For the benefit of readers familiar with chart parsing, I may add that the evaluation of restrictions takes place in connection with the "subsumption" of complete edges by active ones: active edges about to "clone" themselves check the restrictions and act according to the results, which often is that the cloning is cancelled.

The parser performs fast enough to be functional in the TTS-system, where the bottleneck as far as execution time is concerned is still the synthesis component.

The inclusion of syntactic rules has meant a considerable reduction of misinterpretations of input which is ambiguous from a *word-level* point of view: in Danish heterophonic homographs (*hul, bad, så, dør, bred*, etc.) typically belong to different word classes (and thus have different feature specifications, cf. section III), and can therefore in many cases be disambiguated by a moderate surface syntactic analysis. With the grammar (12) and the present morpheme lexicon which comprises about 9000 - judiciously featured - items, the parser finds the correct interpretation of e.g. the input sentence "en mand med en *hul* røst bag en *bred dør* med et *hul dør*" 'a man with a hollow voice behind a wide door with a hole (in it) dies'.

V. PHONOLOGY IN TTS-SYSTEMS

The transformation of the linearized morphophonemic parser output strings to a phonetic transcription is described in another formalism, namely a trimmed and otherwise adapted phonological version of the SPL-language described by Holtse (1982) and closely related to the older SPE-like formalism of Carlson & Granström (1975). I will not describe the formalism here, since its properties are in a sense trivial, especially to readers familiar with TTS-methodology.

Rather, I would like to stress the fact that the extremely linear conception of phonology implicit in SPE-based formalisms is becoming obsolete in view of recent phonological theories, and, more importantly, in view of the hierarchical structure of both morphology and syntax. The SSPS framework permits the user to express hierarchical structuring of surface syntax and morphology, but the projection of such information on a line (in the form of more or less fancy (strings of) boundary symbols, cf. the examples of output formats in previous sections) is not particularly elegant, and it entails a good deal of clumsiness in formulations of e.g. phenomena like syntactically and semantically conditioned *unit accentuation* in Danish (see Rischel 1982).

One of the most important tasks for present-day speech technology is to design phonological (and phonetic) formalisms permitting the user to express the relations between syntactic surface structure and prosody - in particular stress patterns - in appropriate ways.

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INSTITUTE OF PHONETICS

JANUARY 1, 1988 - APRIL 30, 1988

I. PERSONNEL OF THE INSTITUTE

PROFESSOR:
Jørgen Rischel, dr.phil.

ASSOCIATE PROFESSORS:
Børge Frøkjær-Jensen, cand.mag. (seconded to the Audiologopedic Centre)
Peter Holtse, cand.phil.
Birgit Hutters, cand.mag.
Niels Reinholt Petersen, cand.phil.
Nina Grønnum Thorsen, Ph.D.
Oluf Thorsen, cand.mag.

RESEARCH FELLOW:
Peter Molbæk Hansen, cand.mag.

TEACHING ASSISTANT:
Jan Leon Katlev, Ph.D.

ENGINEERS:
Otto Bertelsen, M.Sc.
Preben Dømler, B.Sc.

ENGINEER ASSISTANT:
Svend-Erik Lystlund

SECRETARY:
Else Parkmann (retired as of April 1st)

GUEST RESEARCHER:
Eli Fischer-Jørgensen, dr.phil.h.c.

II. PUBLICATIONS BY STAFF MEMBERS AND GUESTS IN 1988

Eli Fischer-Jørgensen: "Gedächtnisworte", Gedächtniskolloquium für Eberhard Zwirner, Antwerpen 9-12 April 1986, H. Blume (ed.), Beiträge zur quantitativen Linguistik, p. 28-30

Eli Fischer-Jørgensen: Stephen Anderson, Phonology in the Twentieth Century (Chicago 1985) (review article), Phonetica 44, 1987, p. 192-195

Eli Fischer-Jørgensen: "Svend Smith (1907-1986) Necrologium", Phonetica 44, 1987, p. 258-260

Eli Fischer-Jørgensen: Iz vystuplenij na otkrytii XI meždunarodnogo kongressa fonetičeskix nauk, Tallin 1987, Fišer-Jorgensen, E. (selection of the opening speeches as the 11th Congress of Phonetic Sciences, Tallin 1987), Voprosy Jazykoznanija 2, 1988, p. 123-126

Björn Granström, Peter Molbæk Hansen and Nina Grønnum Thorsen: "A Danish text-to-speech system using a text normalizer based on morph analysis", Working Papers 34 (Sidney Wood, ed.), 1988, Lund University, Department of Linguistics, p. 55-58

Peter Molbæk Hansen and Peter Holtse: "Talegenkendelse og talesyntese", Psyke og Logos 2, 1988, p. 307-336

Birgit Hutters: "Clinical use of nasal airflow in the assessment of the velopharyngeal mechanism", Working Papers 34 (Sidney Wood, ed.), 1988, Lund University, Department of Linguistics, p. 68-71

Niels Reinholt Petersen: "The role of intrinsic fundamental frequency in the perception of singing", Working Papers 34 (Sidney Wood, ed.), 1988, Lund University, Department of Linguistics, p. 99-102

Nina Grønnum Thorsen: "Default accents and focal sentence accents", Working Papers 34 (Sidney Wood, ed.), 1988, Lund University, Department of Linguistics, p. 120-124

Robert Bannert and Nina Grønnum Thorsen: "Empirische Studien zur Intonation des Deutschen und Dänischen, Ähnlichkeiten und Unterschiede", Kopenhagener Beiträge zur germanistischen Linguistik 24, 1988, p. 26-50

III. GUEST LECTURES AND SEMINARS

April 26: Sidney Wood, Lund University: "Vowel reduction in Bulgarian"

May 24: Peter Ladefoged, UCLA: "What the mind tells the tongue to do"

May 26: Jacques Terken, IPO Eindhoven: "Intonation synthesis for Dutch text-to-speech application

November 4: Rolf Lindgren, Stockholm University: "Fonetisk variation i tal"

November 18: Richard Schulman, Stockholm University: "The production and perception of shouted speech"

IV. PARTICIPATION IN CONGRESSES, ETC.

Michael Bundgaard participated in the 7th FASE Symposium, Speech '88, Edinburgh, August 22-26

Peter Molbæk Hansen participated in the COST 209 Seminar on Speech Synthesis, Munich, February 16-17, and in an Ordbogskonference, held by Afdeling for Datalingvistik, Handelshøjskolen i Århus, Fuglsø, June 8-9

Birgit Hutters, Niels Reinholt Petersen, and Nina Grønnum Thorsen participated in the Second Swedish Phonetics Conference in Lund, May 5-6 and gave papers, cf. above under publications

Jan Katlev guest lectured at Århus University on September 19th and at Odense University on September 22nd: "På vej mod en økofonologi". He also participated in the 2. Møde om Udforskningen af Dansk Sprog, Århus, October 13-14 and gave a paper: "En drøftelse af 'sjuskefonologi' i moderne københavnsk rigsmål, illustreret ved reduktionsderivationerne for [dew]"

Jørgen Rischel participated in a meeting on lexicography in Fuglsø, June 8-9, and gave an invited causerie on lexicographic aspects of Greenlandic and of a tribal language in Indochina. Jørgen Rischel also participated in the Phonologische Tagung in Krems, June 30-July 7, and gave a plenary paper on "Areal features and diachronic phonetic universals". He also participated in a Mon-Khmer workshop in Lund on October 6 (as part of the International Sino-Tibetan Conference) and gave an invited paper: "Mlabri/Yumbri ("Phi Tong Luang"): A case of lexical split"

Nina Grønnum Thorsen participated in a meeting in Munich, October 7-8, about "Schwerpunkt Intonation".

V. INSTRUMENTAL EQUIPMENT OF THE LABORATORY

The following is a list of instruments that have been purchased or built during 1988.

TAPE RECORDERS:
1 walkman professional, Sony, type WM-D6C

LOUDSPEAKERS:
4 headphones, Sennheiser, type HD 530

MICROPHONES:
1 microphone, Sennheiser, type MKE 2-6

EQUIPMENT FOR PHOTOGRAPHY:
1 oes medical camera, Olympus, type SC16-10

EQUIPMENT FOR EDP:
1 coprocessor, Intel, type 80387/20

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