

## COMPOUND STRESS IN DANISH WITHOUT A CYCLE

SR:

Accumulation.

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1. Introduction

The existence or non-existence of cyclic rules in phonology is an important issue in the current debate. Among the processes which are widely assumed to be cyclic, the graded reduction of stresses in compound words probably holds a particularly high rank. The mechanism involved was stated in such terms already by Chomsky, Halle, and Lukoff (1956), and the more recent formulation of it in Chomsky and Halle (1968) largely dominates descriptive approaches these years.

I wish to point to the fact that compound stress in Danish can be described without reference to cyclic rule application (at least in the sense in which "cyclic" is generally taken), and that this approach enables us to abandon the parameter of "degree of stress", which (unlike the abstract dichotomy [ $\frac{+}{-}$  stress]) seems to me fictitious in a description of Danish. Though I do not generalize the results to other languages, the very possibility of describing compound stress in a Germanic language in this way seems to me of interest to phonological theory in general.

The model for generating complex stress patterns which I use below, was actually outlined ten years ago in a paper using English for illustration (Rischel 1964, also cf. the much earlier outline of the hierarchical concept in Fischer-Jørgensen 1948 (1961)). However, the said paper was highly sketchy and moreover contained a number of contentions which are not directly relevant to the present issue. I shall, therefore, confine myself to mentioning the paper rather than referring to it in more detail.



## 2. The hierarchical model

We assume a basic difference between stressed and unstressed syllables, the distribution of [+stress] and [-stress] being either lexical or introduced by rule.<sup>1</sup> There must then be a device that converts [+stress] into degrees of stress (and a device that converts [-stress] into degrees of stress under certain conditions) if, for the moment, we assume that "degree of stress" is a linguistic parameter (this will be questioned later in the present paper). As shown by Chomsky, Halle, and Lukoff (1956) the grading of [+stress] is closely dependent upon the constituent structure of the syntactic surface representation (though obviously with some adjustments). If degrees of stress that are intermediate between the strongest and the weakest are considered as reduced occurrences of

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- 1) In Rischel (1970) it was shown that the stress placement in Danish formatives (morphemes) is largely predictable from their segmental structure, and that the stress placement in Danish noncompound words is (normally) found by deleting all but the last formative stress. The rules for this simple mechanism of stress assignment were presented without a sufficiently clear statement of the theoretical framework in which they are to be understood (the attempt p. 140 ff to harmonize the approach with that of Chomsky-Halle, must be considered as a failure). The stress assignment rules for formatives are most naturally understood as redundancy rules, whereas the word-stress rule is a process rule, belonging to phonology proper. It must be conceded that not all formative stresses in Danish are predictable; i.e. some formatives are lexically marked for idiosyncratic stress placement, whereas the majority are unmarked (i.e. stressed according to redundancy rules). In a reasonably realistic phonological representation stress may have to be marked more often than suggested in the said paper, but a solution cannot be found until other types of evidence in favour of more or less abstract representations have been investigated, in particular the stød (cf. Basbøll, forthcoming). - As for word stress assignment, I wish to point to the fact that the rule involved requires only a distinction of [+stress] and [-stress], which agrees with the starting-point of the present paper. (The short section on compounds (p. 138) was kept in quite traditional terms and may be disregarded.)



[+stress], the amount of reduction in each instance has something to do with the relation of the constituent involved to other constituents of the complex structure. In compounds the general rule is that stress reduction is triggered by the occurrence of a stressed constituent to the left of the constituent under consideration, and - at least to a first approximation - the effect of stress reduction is stronger the closer the connexion is between the two constituents. This can be taken care of by a cyclic approach, and indeed invites such an approach. However, the concept of cyclicity may be unnecessary here, and hence should be abandoned if it is not required for independent reasons. If stress grading depends on the syntactic "tree-structure", it may be directly deducible from this representation.

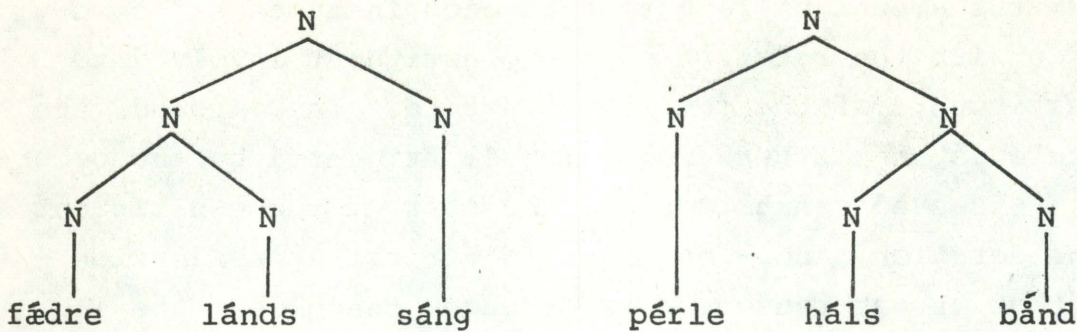
In the following I confine myself strictly to compounds with initial "main stress". The exceptions to this general pattern are few (subregularities for these will not be stated here).

Consider compounds like fædrelandssang 'patriotic song' (literally: father-land's-song') and perlehalsbånd 'pearl necklace'. The internal constituent structures of these compounds (which can be posited no matter whether the compounds are considered to be entirely or partially lexicalized), are obviously different. In the former the primary break is between fædrelands and sang (with a secondary break between fædre and lands), in the latter the primary break is between perle and halsbånd (with a secondary break between hals and bånd). However, both compounds consist of a sequence of three noun stems: a bisyllabic one followed by two monosyllabic ones. Assuming that each of these gets initial stress by rule (cf. Rischel 1970 p. 119ff) we arrive at structures which can be roughly represented like this:<sup>2</sup>

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2) I assume some readjustment by which, for example, the formative s in fædrelandssang is incorporated into the second noun.





A compound stress rule with associated conventions for stress adjustment may be considered to have the effect of reducing stresses. Under a cyclic application stress reduction would apply twice to lānds in the former compound, and to bānd in the latter, but only once to sáng in the former, and háls in the latter. This seems plausible enough, since it would not be too difficult to make phoneticians agree that the two forms are stressed like this:<sup>3</sup>

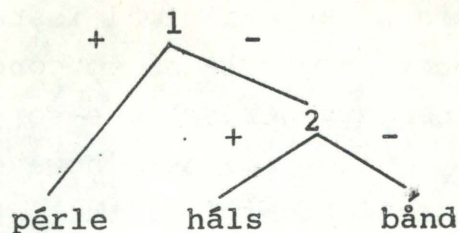
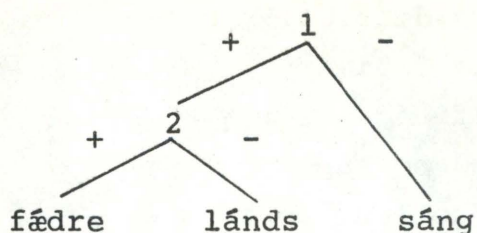
'fædre,lands,,sang

'perle,,hals,bānd

where [,,] indicates a less reduced stress, and [,] a more reduced stress. However, this very accentuation can be read off the tree structure representation, provided that we have a rule saying that left branches are given relatively more prominence than right branches in compounds. If this difference of prominence is indicated by plus versus minus we get the following representations (with omission of the N labels for simplicity):

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- 3) Alternatively, [,] might be used instead of [,,], if the syllables here marked with [,] are assumed to be reduced to "weak stress". A reduction of stresses all the way to "weak stress" might entail a process [+stress] → [-stress]. I have not considered the occurrence of such a rule in compounds in the present paper.





The degree of stress reduction cannot, of course, be determined solely by counting minusses. The convention involved must refer to the position of the minusses in the hierarchy, e.g. by assigning each minus the number of the node above it. The phonetic stress reduction would then be a function of such numbers. Since this function is unknown<sup>4</sup> I shall represent a nominal amount of stress reduction by simply indicating the hierarchical number, "2" meaning a stronger reduction than "1", etc.

Now one might imagine different ad-hoc conventions for stress reduction. The coefficients might add up, for example. Under a convention of this kind sǫng and hals above would get a reduction of the order of "1", and lands would get a reduction of the order of "2", whereas bǫnd would get a reduction of the order of "1+2" (i.e. have a stronger reduction than lands).

Another possibility would be that the degree of reduction directly reflects the depth of compounding, i.e. that the convention applies to the lowest minus in each case. Under this convention fædrelandssǫng gets stress reductions according to the pattern "0-2-1", and perlehalsbǫnd according to the pattern "0-1-2".

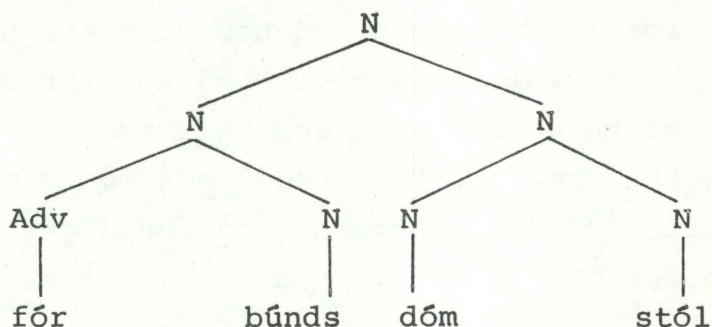
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4) A priori it need not be a linear function at all. Since I shall abandon the use of stress coefficients later in this paper, the problem is of no real interest here.



This is an empirical issue. It is a difficulty that the phonetic correlates to concepts like "primary stress" and "secondary stress" are so poorly defined. As for my own subjective judgment, however, I find no support of the former assumption, i.e. that stress reduction operates on a summation basis. If there is at all a difference between the reduction of stress on lands and bånd in the examples above, it is rather so that the former is more reduced than the latter.<sup>5</sup> This can be taken care of by a rhythmic convention applying optionally (cf. 3. below) if we assume that the basic degree of reduction is the same in both cases.

In compounds like forbundsdomstol 'Federal Tribunal' we have a more complex constituent structure which can be represented like this (with some adjustment<sup>6</sup>):



Here we get the strongest stress on fór, and the next strongest on dóm, under any reasonable convention. However, the weaker stresses on búnds and stól would differ crucially depending on the functioning of stress reduction. If it is additive (in some way), we should get less stress on stól

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5) This is a highly subjective evaluation. I do not really know how to arrive at a valid criterion for this decision.

6) Cf. note 2.



than on būnds. Again, this is at variance with my subjective judgment; there is rather a tendency in the opposite direction, which can be taken care of as suggested above.

I would suggest, therefore, that the convention for Danish reduces each stress of a compound (in relation to the leftmost stress) solely according to the order of (the number assigned to) the lowest node that dominates the constituent in question, and from which it hangs in a branch that is labelled "minus".

This convention is thus sensitive to depth of compounding and to occurrence in non-initial position under the lowest dominating node.

If now we return to the possibility of cyclic rule application it is interesting that a simple mechanism for compound stress can be devised within the Chomsky-Halle framework which gives exactly the stress reductions posited above. Hence the presentation above does not invalidate the cyclic principle; it only argues that cyclicity is unnecessary.

### 3. Structure Simplification

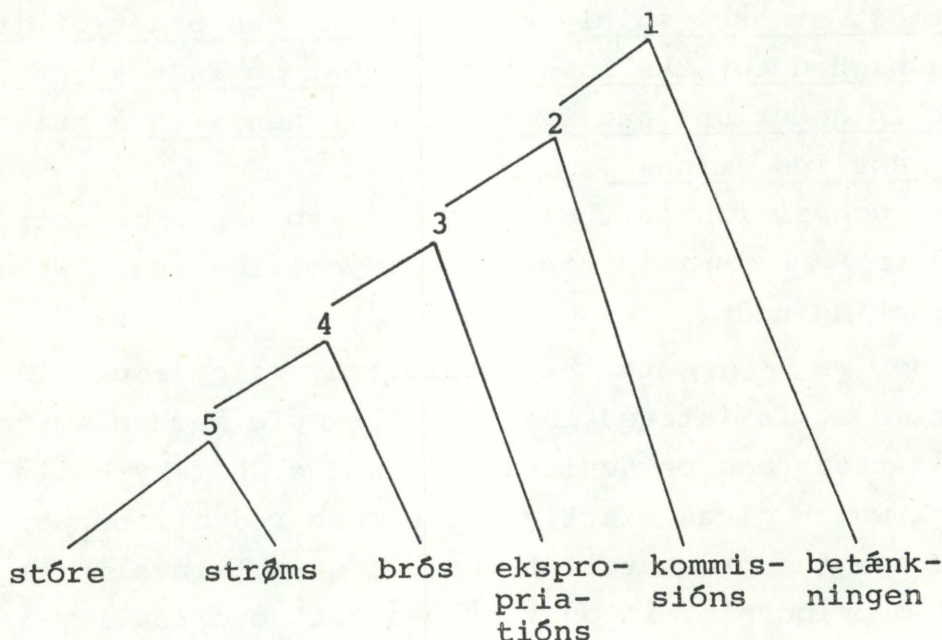
Both approaches referred to above, cyclic and non-cyclic, can be made to work ad infinitum, though it goes without saying that there is a limit to the degree of stress that are distinguished in actual communication.<sup>7</sup> In Danish it is possible to construct very complex compounds, and if these are entirely right-branching or left-branching the depth of compounding may be considerable. A fancy compound like storestrømsbros-ekspropriationskommissionsbetækningen 'the report of the commis-

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7) Cf. Householder's remark to Rischel (1964), ibid. p.93, on which I entirely agree.



sion for the expropriation for the Storestrøm Bridge (lit.: the bridge of the Great Current)' sounds funny, of course, but is in no way unacceptable from a linguistic point of view. Assume a tree structure like the following:



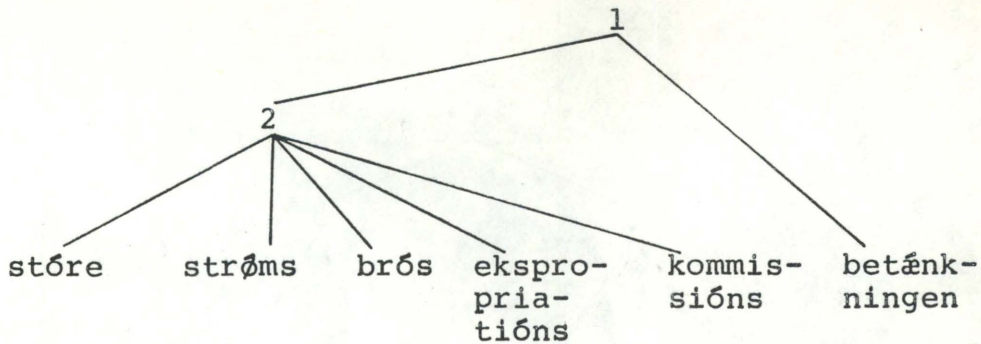
According to the alleged convention we should get increasing stress reduction from betänkningen (1st order) through strøms (5th order). Or put differently: strøms, brøst, etc. through betänkningen should have increasing stress in the order in which they are spoken. I doubt it that anybody could make a convincing performance of this theoretical stress pattern. There will necessarily be some kind of adjustment reducing the depth.

One possible type of adjustment may be described with reference to a threshold, depending to some extent on tempo and style of speech,<sup>8</sup> below which hierarchical differences vanish. Assuming, for instance, that nodes cannot be of more than second order in casual speech, the structure above would simplify into

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8) For a device related to this idea of "threshold" cf. Bierwisch (1966) p. 166 ff.

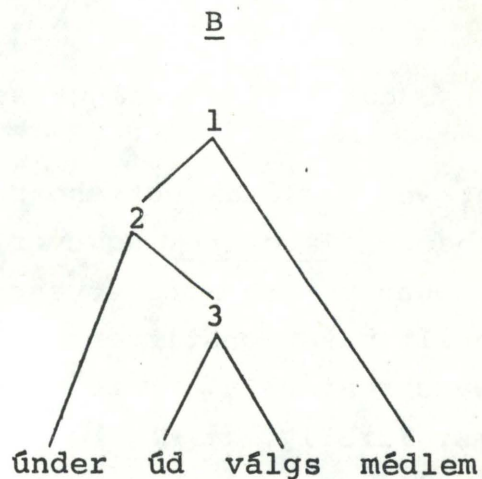
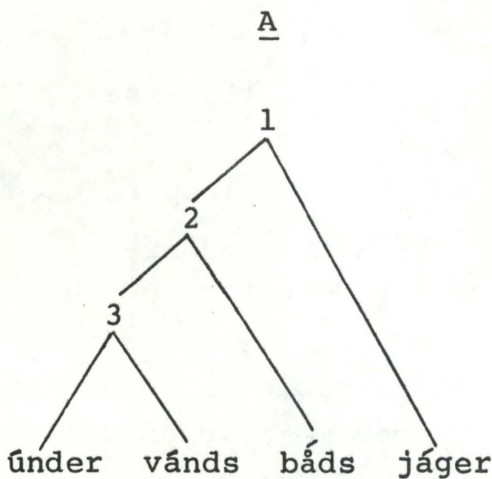




which gives 1st order reduction on betænkningen, and 2nd order reduction on the other, non-initial constituents, i.e. in conventional stress notation,

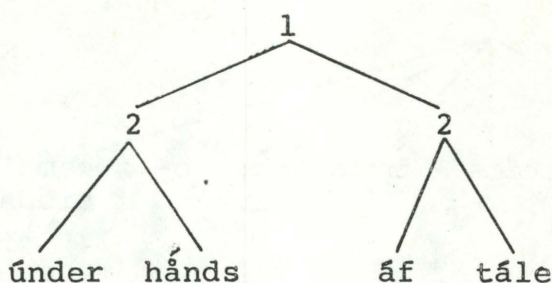
'store+,strøms+,bro+ekspropria,tions+kommis,sions+be,tænkningen

To what extent (under what conditions) such node collapsing actually occurs, could be studied by observing the neutralizations among different hierarchical structures that occur in a given type of speech. With the threshold referred to above we should get a neutralization of the structures in A and B below, whereas A/B would remain distinct from C:<sup>9</sup>



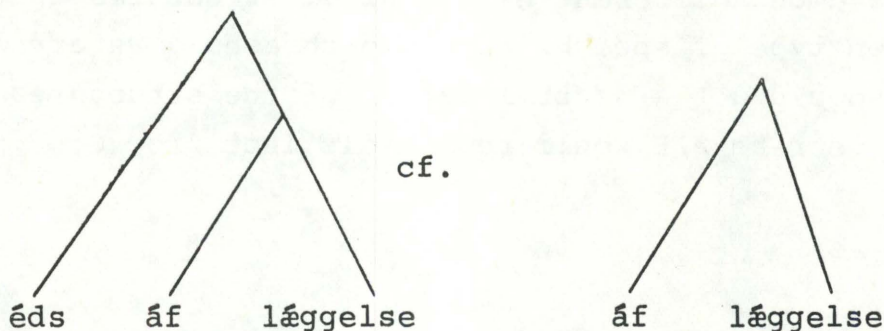
9) The words mean 'submarine chaser', 'member of a sub-committee', 'private agreement'.



C

In rapid speech the reduction (and neutralization) may well go even further. Data throwing light on this would deserve close study.

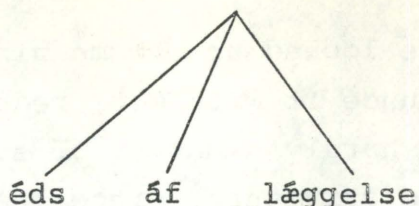
The pattern is complicated by a tendency, in some constructions, to perturbate the relative stresses of constituents. This occurs very clearly in a form like edsaflæggelse 'taking the oath', which has the structure



so that we should expect the stress on áf to be less reduced than that on læggelse. However, the form edsaflæggelse can be pronounced with more stress on the ultimate than on the antepenultimate constituent.

Synchronically, there are several possible explanations of this. Firstly, it may be suggested that we have an optional simplification of the structure to a one-node structure

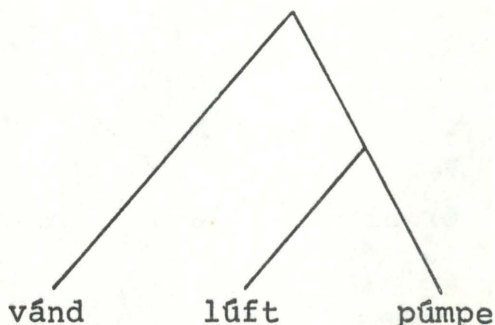




This should give full stress on éds, and evenly reduced stresses on áf and læggelse, according to the convention given earlier. Now it may be assumed that there is a phonetic tendency to replace similar stresses on successive constituents by an alternation of relatively stronger and relatively weaker stresses; such a tendency toward contrast would reduce áf, and enhance læggelse, as required.

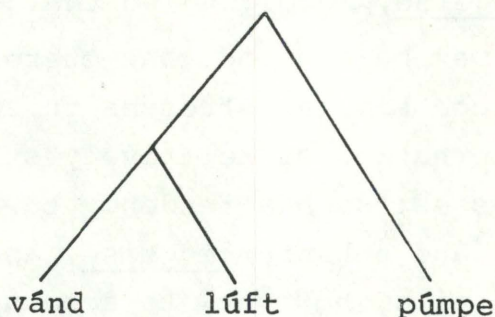
This explanation fails, however, to account for the fact that the tendency to perturbation is not equally strong in all forms, e.g. perlehalsbånd (see above) could hardly occur with stress perturbation. In this respect we are better off if we connect the deviating accentuation with the fact that aflæggelse contains a succession of adverb plus verb, since constructions involving adverb plus verb or verb plus adverb have special prosodic properties anyway. Compounds containing adverb plus verb sometimes have non-initial stress (regularly with +lig, cf. af'tagelig 'detachable') and thus break the most basic rule of initial compound stress. I shall not go further into this here.

There are other cases, however, where it seems to me possible (in my own idiolect, at least) to have stress perturbation though the structure involves no adverb plus verb. Take a technical term like vandluftpumpe. This means 'water jet air pump' i.e. according to meaning criteria the structure should be



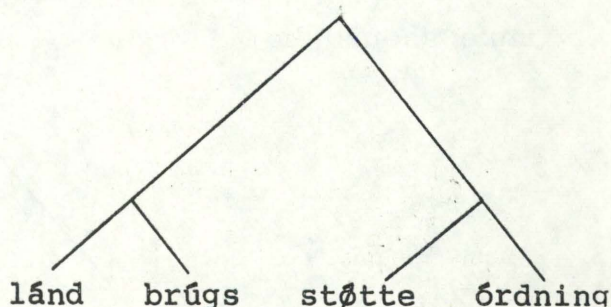
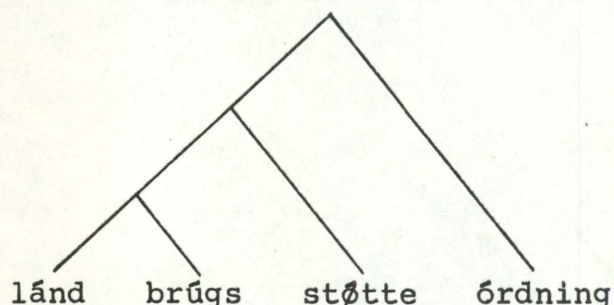


However, even if I have looked up the meaning of the word, I am inclined to pronounce it with more reduction on lúft than on púmpe. This is hardly a matter of simplifying the structure to a one-node structure, since the technicality of the term does not invite casual pronunciation, but rather a straightforward readjustment to



I suggest that there exists a tendency to reinterpret backward compounds of the former structure as compounds of the latter structure.

Note that the effect of this restatement is that we get an alternation of degrees of stress, rather than a monotonous decrease of stresses. This tendency to avoid stress monotony may also seem to operate in cases where the constituent structure is genuinely ambiguous, e.g. if we take the compound landbrugsstøtteordning which can be read as [landbrugsstøtte][ordning] ([arrangement of] [financial support of agriculture]) or as [landbrugs][støtteordning] ([arrangement of financial support][for agriculture]), it seems "easier" to pronounce the latter option, viz. structure B below.





Again, the preferred alternative provides rhythmic alternation, and in this case it moreover reduces the depth of compounding.

It is interesting to note that the preferred analysis posited for these forms has the same effect as structure simplification combined with a phonetic tendency toward rhythmic alternation of the stresses on successive constituents (cf. above). It also has the same effect as destressing of adverbs internally in compounds (cf. edsaf-læggelse). Thus, until considerably much more is known about the ways in which different compound structures are distinguished or fail to be distinguished phonetically, we cannot decide what is really going on in the forms with superficial stress "perturbation".

#### 4. Abolition of "degree of stress" as a linguistic parameter

Throughout this paper I have referred to "degrees of stress" (disregarding unstressed syllables, i.e. syllables which are not assigned a [+stress]), but I have deliberately avoided any discussion of the meaning of the phonetic label "degree of stress". Thanks to our phonetic tradition it is not difficult to communicate by means of such terms, and I have therefore found it practical to use the terms without any definition whatsoever.

The question of the parameters of stress is crucial the moment we want to give the convention stated in 2. above in an exact form. It may be possible to find a reasonable correlate to stress at the level of speech production, but the signalling of constituent structure is known to be highly complex, at least in English (see Scholes 1971 with references), where it includes both intensity and pitch changes as well as separation in time (i.e.



"disjuncture"). On the basis of the limited data available<sup>10</sup> it may be assumed that pitch jump is an important correlate of stress in Danish, and "disjuncture" is undoubtedly an essential marker of constituent structure also in this language.

Now the question is: do we want our stress rules to give an output in which each syllable is assigned a "degree of stress" represented by a coefficient? Since these coefficients must undergo a highly complex transformation into different parameters before we arrive at anything that can be measured phonetically, the assignment of stress coefficients seems to me warranted only if there is a solid basis for assuming that these coefficients represent a significant level of linguistic specification. As far as Danish is concerned, at least, it does not seem to me intuitively meaningful to specify coefficients of stress the way this is done in Chomsky and Halle (1968) and elsewhere, or for that matter, to specify stress degrees by symbols like ['], [„] and [,], though, as said above, such representations have a communicative value among linguists who know what they refer to.

In my opinion indications of graded stresses are linguistically significant only indirectly, namely by defining types of constructions. Hence it seems to me superfluous to introduce such representations if the constructions themselves contain sufficient information without being transformed into representations with graded stresses. In order to specify the parameters that signal the structure of compounds it would seem appropriate to have recourse to two types of linguistic information, viz. the location of the syllables marked as [+stress] and the location and order of the constituent boundaries. But this is indeed what the adjusted phrase-marker presents after application of the stress redundancy rules.

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10) Eli Fischer-Jørgensen has made some instrumental research on the prosodic characteristics of Danish compounds. Her results indicate that shift of pitch is an essential correlate to "stress". (Personal communication.)



I should prefer, therefore, to replace the convention outlined in 2. above by a convention which specifies more useful phonetic parameters. This means that the expression "reduction of nth order" should be replaced, e.g., by information referring to pitch jumps and temporal relations. The pitch change and temporal distance between the stress points of consecutive constituents would be assumed a priori to be lesser the higher the order of the node involved, e.g. in fædrelandssang (see 2. above) the first two constituents should be specified as spoken on almost even pitch and closely adjacent to each other, whereas in perlehalsbånd this would apply to the last two constituents. In so far as a valid set of conventions could be set up, this type of phonetic characterization would seem to me immensely much more satisfactory for Danish than an appeal to fictitious concepts like "stronger" or "weaker" reduced stresses. - The "main" stress of a (normal) compound is simply the leftmost occurrence of the category [+stress]. A "secondary" stress of a (normal) compound is secondary by virtue of not being the leftmost occurrence of [+stress]. The vocal effort or intensity contour of the word may exhibit a peak associated with the first occurrence of [+stress], or a more complex pattern depending on the constituent structure, but this is not inherently the most interesting feature of accentuation though it should be built into the convention, of course, like other parameters. The interesting question is not how to specify degrees of stress as a parameter, but how to choose the phonetic parameters (= instructions to the speech-organs, auditory parameters, or what?) which should be specified by the "stress" convention.

The direct consequence of the contentions stated above is that the output of the phonological component must take the form of a hierarchical representation (i.e. a tree structure or its equivalent: a bracketed representation).



The phonetic conventions, whatever they are, operate on this hierarchical representation. The tree structure is not necessarily congruent with a syntactic surface representation, since various readjustments take place, but surface syntax and lexicon together make it deducible by rule.

It has been argued quite recently by Charles Pyle (1972) that there are no phonological rules (conventions) that replace formative boundaries by boundary markers, i.e. that boundary markers do not exist as phonological units. Pyle argues that the jobs which boundary markers (junctures) do in current formulations, should actually be assigned to the formative boundaries. I agree, since the introduction of boundary markers would be entirely redundant once the adjusted constituent structure (which defines the location of such boundary markers) is present for rules to refer to. There is, however, a problem with lexical items, since "formative" boundaries are marked (i.e. have a phonological effect) in some cases but not in others. If one does not insert boundary markers to indicate the marked boundaries, it is necessary to have rules (triggered, at least in part, by lexical idiosyncracies) which delete boundaries that have no phonological effect. The consequences of such an approach must be investigated.

One is, quite generally faced with the serious question: what kinds of readjustment of boundaries do we have to assume? I think the answer to this question depends on how lexicon is assumed to be organized and how lexical insertion is assumed to take place. Without a theory about lexicon there is no point in discussing whether the constituent structure that is relevant to phonology on different levels has a more or less direct relation to surface syntax.



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