# A BINARY TREATMENT OF THE DISTINCTIVE PROSODIC FEATURE OF QUANTITY

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The theoretical framework of generative phonology (Chomsky and Halle 1968) covers only the segmental part of the phonological aspects of the lexicon. Prosodic (or suprasegmental) features are not dealt with because "Our investigations of these features have not progressed to a point where a discussion in print would be useful." (Chomsky and Halle 1968:329).

Contributions to a development of a prosodic framework have been made since then. A binary treatment of lexical word tone was proposed by Wang (1967) and of stress and intonation by Vanderslice and Ladefoged (1972). In order to complete the phonological framework, both segmental and prosodic, quantity, the third prosodic feature (Lehiste 1970), should be treated as well.

Much work has been done on sound durations and a large variety of durational variations have been reported. The causes of the observed variations of segment durations might be labelled phonetic and phonological. Regularities of durational changes as a result of compensatory adjustments, both segmental and within words, during performance (i.e. not distinctively controlled) were studied by e.g. Lindblom and Rapp (1972), Nooteboom (1972), Slis (1972), and Klatt (1973) who tried to capture these regularities by rules. Other systematic changes of sound durations, however, are due to the speaker's voluntary control of the timing of these sounds in order to distinguish between words. Duration functioning as a controlled feature of the phonological system of a language, independent of e.g. segmental context or number of syllables in the word, is called quantity (Lehiste 1970:42). Thus quantity is a distinctive feature of lexical items, i.e. it is not predictable and should not be confused with duration or length which are properties of the phonetic manifestation of abstract

entities and can therefore be predicted.

Being supplied with the set of universal phonological features, a certain language need not use all of them but chooses a subset out of the total number. There are languages where quantity is not distinctive, for example Russian. For other languages, the status of quantity is not generally agreed upon, for example English. Again, for Spanish, it has been suggested by Ladefoged (1971:50) that the opposition of the medial consonant in pairs like caro vs carro, pero vs perro, etc. is not one of quantity but of manner of articulation, i.e. tap vs drill. On the other hand, languages such as Swedish, Finnish, and Italian make use of the distinctive prosodic feature of quantity. It may be manifested in different ways. The sound or sequence of sounds, the duration of which is controlled by the speaker for distinctive purposes, that is the domain of quantity, may differ from language to language. It can be analysed as one segment (vowel or consonant, only the vowel, only the consonant), two segments (vowel and consonant) or larger units (Lehiste 1970:42). Restrictions in the distribution of quantitative contrasts may occur, e.g. for consonants in word initial position. Besides existing minimal pairs one can usually find potential minimal pairs where one member has not received any meaning yet.

In agreement with current phonological theory and as a starting point for the outline of a binary treatment of quantity, I assume the phonological representation of lexical items (morphemes, formatives) to consist of segmental specifications (number of segments and the redundancy-free specification of their distinctive features). In addition, I postulate the prosodic representation of lexical items to contain the three features of STRESS, QUANTITY, and TONE in languages which utilize some or all of them. While lexical items are part of the grammar, words are to be found in the phonetic manifestation (the substance) of abstract structures. I propose the following scheme from

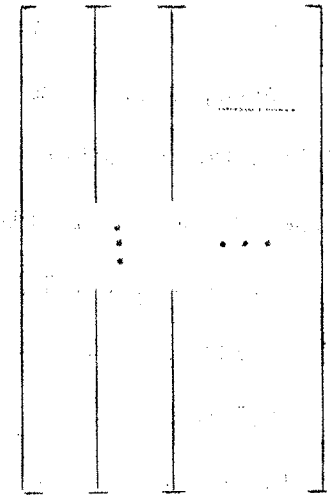
which, since it is universal, all languages may choose a certain set of features. The formalization of the segmental as well as the prosodic parts of the phonological representation of a lexical item is shown in the following figure:

/lexical item/

distinctive features:

(a) segmental
- VOCALIC
- CONSONANTAL
- SONORANT
- CONTINUANT
- ⋮
- VOICE

(b) prosodic
- STRESS
- QUANTITY
- TONE



TONE functioning here as a general label is further developed into a set of distinctive features like CONTOUR, RISE, HIGH, etc. (Wang 1967).

I do not consider the prosodic feature of QUANTITY to correspond to the tense/lax opposition of vowels which I take to be segmental and which ought not to be analysed as the feature LONG among the segmental features.

In a language with quantity, both members of a pair exhibiting distinctive durational differences contain the feature QUANTITY. One member will be specified for QUANTITY with a plus sign (+).

In the following I will illustrate the working of my proposed scheme applying it to some quantity languages, especially to Standard Swedish.

The phonological system of Standard Swedish which is analysed as containing long and short vowels and consonants shows the following distribution of these segments (on the level of phonetic manifestation):

Long vowel appears:

(a) ö, gå, bedra  (...) V =//

(b) barn, bord  (...) V r C

structural condition:

C = voiced dental

(c) rät, veta  (...) V C (...)

Short vowel appears:

(a) list, klump  (...) V $C_x$ $C_y$ (...)

structural condition:

$C_x$ =/= r and

$C_y$ =/= dental

(b) sport, fors  (...) V r C

structural condition:

C = voiceless dental

exceptions: art, etc.

(c) rätt, vetta  (...) V C (...)

There may be dialectal or individual variations. They pertain to cases (a) and (b) and will not be discussed here.

| | | | | |
|---|---|---|---|---|
| Translations: | (a) | 'island'<br>'go'<br>'deceive' | (a) | 'cunning' or 'border'<br>'lump' |
| | (b) | 'child'<br>'table' | (b) | 'sports'<br>'rapids'<br>'species' |
| | (c) | 'straight'<br>'to know' | (c) | 'correct'<br>'to face' |

The length of a simple consonant following a stressed vowel (case c) is predictable from the relationship of mutual complementation (Lehiste 1970:49) between vowel and consonant: the consonant is short after a long vowel, it is long after a short vowel.

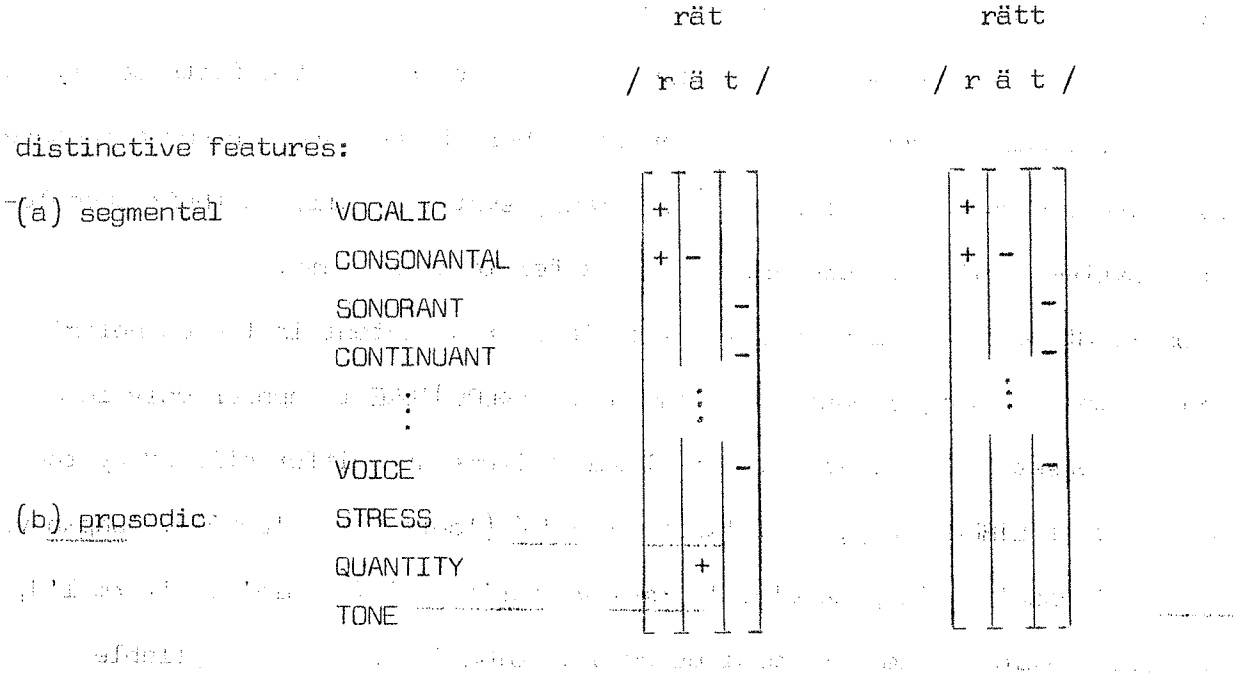
In Standard Swedish there seems to be a general stress placing rule which Linell (1972) calls Native Word Stress Rule, assigning stress to the first vowel of the word stem. Hence the final vowel of case (a) is manifested with stress.

Words of certain segmental structures (cases a and b) cannot exhibit quantitative contrasts since the length of the vowel and consonant can be derived by rule from the segmental structure of the item. The only possibility for distinctive durational differences is to be found in words with identical segmental specifications (case c). Since the feature of QUANTITY is prosodic, I specify the long member of such minimal pairs like e.g. rät vs rätt ('straight' vs 'correct') for QUANTITY.

When analysing quantity in Standard Swedish as the segmental feature LONG or TENSE, Linell, Svensson, and Öhman (1971) and Lindau (1970) do not consider QUANTITY to be a prosodic feature. Another kind of segmental analysis of quantity is suggested by Eliasson and LaPelle (1972) who derive the length of

the short vowel by doubling the following consonant in the lexical representation. Thus the pair rät vs rätt, in their analysis, would differ in the number of segments, rät consisting of three segments (CVC) and rätt of four (CVCC), the post-vocalic consonants being identical.

The phonological representation of this pair in the lexicon of Standard Swedish, in my analysis, may be formalized as follows:




Contrary to Lindau (1970), I do not assume every lexical item to have stress at all. I consider the rows for STRESS and TONE to be empty in this pair. Both prosodic features will be assigned to these items by phonological rules applying to the surface structure of some sentence.

For the present, I consider the short vowels to be the unmarked case. Therefore the vowel segment being manifested long is specified for QUANTITY by a plus sign.

It seems to me most appropriate to mark a segment and not a syllable or even a larger unit for QUANTITY because the smallest domain of this feature can be one segment as e.g. in Finnish. This solution is more satisfying from a

universal point of view: The lexical columns in languages without any distinctive prosodic feature would end with the last row of the segmental features, i.e. VOICE. The columns in the lexicon of languages, however, utilizing one or more distinctive prosodic features are longer and a certain segment would contain the specification for the utilized prosodic feature. Furthermore, I avoid the problem of defining the syllable which is probably not a concept of the lexicon of the grammar.

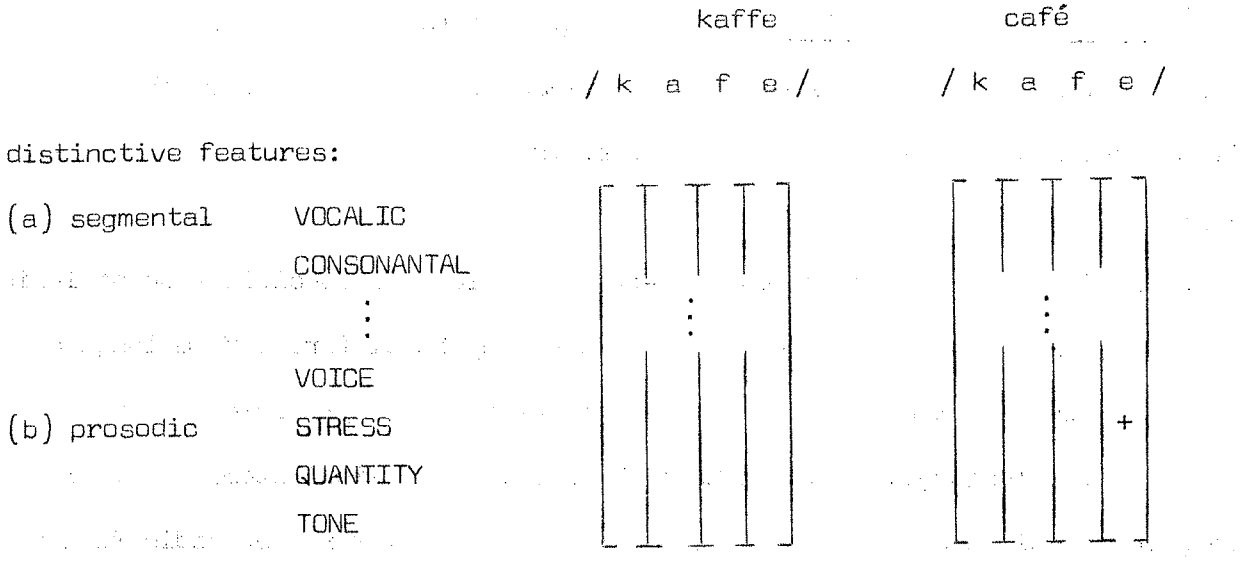
My proposed scheme seems to capture certain other phonetic facts easily and adequately. Some languages use one or the other of the three prosodic features, which are obviously available to all humans, systematically in their phonological systems, others, however, only in a few lexical items.

While Standard Swedish uses QUANTITY to a great extent in the phonological part of the grammar, I postulate STRESS and (WORD)TONE to appear only in a limited subset of the lexicon, Some lexical items are differentiated by the placement of STRESS only, e.g. 'kaffe vs caf'é ('coffee' vs 'café'), 'Japan vs ja'pan ('Japan' vs 'Japanese'), 'formel vs for'mell ('formula' vs 'formal'), etc. Some lexical items are manifested with STRESS placed on a syllable contrary to the general stress placing rules which I assume for the phonological component of Standard Swedish, e.g. ka'bin ('cabin'), ka'nel ('cinnamon'), to'mat ('tomato'), vä'sentlig ('essential'), etc.

In certain lexical items (WORD)TONE, which is not considered a feature of their phonological representation in the lexicon, is manifested contrary to word tone assigning rules (Öhman 1965, Elert 1972), e.g. blǻbär ('bilberry'), trǻdgård ('garden'), ríksdag ('parliament'), etc. manifested with Accent 1 (acute).

The above mentioned cases are real exceptions, that is stress and word tone are idiosyncratic properties of these items and have to be learned separately.

For the lexical representation of Standard Swedish items which utilize all three prosodic features, I consider the prosodic rows to be empty in all cases captured by rules. However, where a certain prosodic feature functions distinctively in a certain item, that feature is specified in the lexicon. As an example, the phonological representation of the pair kaffe vs café differing in the placement of STRESS is indicated as follows:




The first item kaffe is not marked for any of the prosodic features. Stress is placed on the first vowel /a/ at some point of the derivation in accordance with the general stress assigning rules of Standard Swedish. This stressed vowel is not specified for QUANTITY and in the context C__C... it will be manifested short. Word tone (Accent 2 or grave) is predicted by rule.

The second item café, however, is specified for STRESS on the second vowel /e/ because stress occurs irregularly on this vowel. This stressed vowel preceding a word boundary needs not be specified for QUANTITY because it fulfills one of the structural conditions for long vowels (case a). The word tone assigning rules correctly generate the Accent 1 (acute) from the stress placement on the final vowel.

These deviations might be due to

(a) segmental influences (vowel hight, manifestation as monophthong or diphthong, manner and place of articulation of the following consonant, the voicedness of the consonant, etc.),

(b) position in higher level units (compounds, phrases, etc.),

(c) different prosodic patterns (statement, question; neutral or emphatic mood, etc.),

(d) speech tempo, etc.

By way of conclusion an outline will be given of the phonological specification for QUANTITY of some lexical items of a few languages exhibiting quantitative differences.

In Finnish, where the domain of quantity is a non-initial vowel or consonant, every long segment is marked. In Danish and Dutch, the long vowel has to be specified because the domain of quantity is the vowel. Italian, however, shows durational differences of the consonant. Hence the consonant is marked for QUANTITY. In languages with mutual complementation (Lehiste 1970:49), e.g. Standard Swedish, Norwegian, Bavarian, the domain of quantity is the sequence of vowel and consonant. A long vowel is always followed by a short consonant, a short vowel by a long consonant. As consonant duration does not seem to be a primary cue for perception of these contrasts (Hadding-Koch and Abramson 1964, Bannert 1972), the vowel will be marked for QUANTITY even in these languages. The dashes indicate the segments of columns of the items.

| distinctive features: | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Finnish | t | u | l | e | t | uu | l | e | t | uu | ll | e | t | u | ll | e | | | |
| (a) segmental | | | | | | | | | | | | | | | | | | | |
| (b) prosodic | | | | | | | | | | | | | | | | | | | |
| QUANT | _ | _ | _ | _ | + | _ | _ | _ | + | + | _ | _ | _ | + | _ | | | | |

| | | |
|---|---|---|
| Danish | | m i l e  m i ll e |
| | (a) segmental | |
| | (b) prosodic | |
| | QUANT | _ ± _ _  _ _ _ _ |
| Dutch | | t ie n  t i n |
| | (a) segmental | |
| | (b) prosodic | |
| | QUANT | _ ± _  _ _ _ |
| Italian | | p o l o  p o ll o |
| | (a) segmental | |
| | (b) prosodic | |
| | QUANT | _ _ _ _  _ _ ± _ |
| Bavarian | | W ie s n  w i ss n |
| | (a) segmental | |
| | (b) prosodic | |
| | QUANT | _ ± _ _  _ _ _ _ _ |

This paper should not be considered more than just a very preliminary and incomplete outline. It will be elaborated and extended later.

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