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Preface

This volume contains two sets of contributions to the study of sandhi in the languages of Europe.

In its first part it presents a series of papers on theoretical issues. Its second part is composed of chapters that survey sandhi phenomena in individual European languages or language areas.

The theoretical papers were - with some exceptions - presented in a Workshop on Sandhi Phenomena in the Languages of Europe which was held during the 10th International Congress of Phonetic Sciences in Utrecht, 1-6 August 1983.

The workshop was organized by Jadranka Gvozdanović and the editor of this volume. Their papers could not be presented in the workshop, but are included in this volume.

The aim of the workshop was to create a forum in which traditional and recent ideas on the topic could be discussed by specialists who combine an interest in the theoretical questions that are raised by the diverse phenomena called sandhi with expertise in a particular European language or language area. It was the organizers' hope that the discussions in such a forum would serve as a useful review of the questions that have traditionally been asked about sandhi and an evaluation of the answers that have been proposed, and which constitute the received collective understanding of the topic. But beyond that they hoped that a confrontation of different viewpoints and different language specializations represented among the invited participants would lead to the asking of new questions and thus help to focus interest on aspects of sandhi that are not thematicized in current linguistics but cannot in the long run be neglected - particularly questions about the functions of sandhi and about the typology of sandhi rules.

Both these kinds of questions arise with particular urgency when one considers sandhi phenomena in different varieties of one and the same language. In this regard, it would seem, the languages of Europe offer a particularly rich fund of documentation since their diachronic development is well known and the study of their diatopic variation well advanced. For this reason it was decided to invite a number of specialists, some of whom were unable to participate in the workshop, to contribute brief surveys of sandhi phenomena in their languages of specialization. These surveys, which compose the second part of this volume, do not

cover all of Europe. Some major Celtic, Germanic, and Romance areas and one Slavic area are represented. For other areas no specialists were found who would promise a contribution within the time limit that had to be imposed. Perhaps it will be possible in a later volume to fill some of these gaps and, at the same time, to reflect the progress that is to be expected in the understanding of the theoretical issues.

In order to promote some measure of uniformity in the survey chapters, the organizers prepared a memorandum on sandhi which was distributed to the authors as part of their guidelines and to the participants in the workshop as well. Since it is referred to in some of the contributions, it is reproduced below as an Appendix (p. 605 f.).

In the preparation of this volume I have received encouragement and moral support from Mouton Publishers. It is a pleasant duty to thank them for their patience and guidance.

I owe a special debt of gratitude to my friend Dr. Jadranka Gvozdanović, who helped immeasurably in the planning and organization of the workshop, and to whose enthusiasm and efficiency the smooth running of the arrangements was largely due. It was in no small measure thanks to her that the workshop was a success.

Contents

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Introduction: Sandhi

Henning Andersen

In lieu of a definition

Ever since its introduction into the terminology of general linguistics a century ago, the term sandhi has had what an anthropologist might call a liminal status. As a technical term without a strict definition it has been used in some kinds of discourse and carefully avoided in others. It has, so to say, been a term, but not quite a term.

By coincidence this liminal status of the word is oddly appropriate to its denotation - it refers to liminal phenomena: the junctures between segments, variation and alternations at the boundaries of constituents, or - from another point of view - the interfaces between phonetics and phonemics, and between phonology and morphology, including such truly liminal phenomena as allophones with apparently distinctive function, neutralizations with grammatical function, and so on.

It was apparently Georg von der Gabelentz (1891) who first advocated the adoption in general linguistics of the term sandhi as a cover term for all such phenomena, but he did this at a time when the systematic investigation of alternations by Mikolaj Kruszewski (1881) and Jan Baudouin de Courtenay (1895) had already shown that a differentiated conceptual apparatus was a necessity. Sandhi became the general, loose semi-term, a handy label for a diversity of phenomena that individually require more specific names. This is the usage we find in Bloomfield's *Language* (1935). The term sandhi occurs only a few times in his text. But the lemma *sandhi* in the index refers to the numerous places in the text where he discusses the plethora of phenomena the term subsumes. These span the gamut from low level phonetics through morphophonemics and lexicalized "included forms" to the expressions of grammatical content in the Celtic initial mutations. This is the extension of the term that has been current since Bloomfield (cf. Crystal 1980, Lewandowski 1975).

In this volume two contributions advocate a narrower understanding of sandhi. Ternes would like to limit its meaning to "phonetically motivated alternations, occurring at word boundaries", as in Fr. *tasse de café*

[zd] (p.16, this volume). Jongen defines sandhi as "all phonological modifications associated with a combination of signs and localized at their boundaries", explicitly excluding discontinuous modification (p.119f.).

Each of these proposals must be evaluated on its own merits and may well be found useful for language particular purposes. But the general consensus seems to approve of the established usage which includes under the term allophonic variation, neutralization, morphophonemic alternations, however conditioned, as well as internal flection; which recognizes not only segmental, but also prosodic alternations as sandhi, for instance, the Slovak rhythmic law, stress alternations in derivation or inflection, and tone perturbations; which sees no principled difference between continuous and discontinuous conditioning of alternations; and which has no difficulty accommodating vowel harmony or other vowel neutralization phenomena within its compass.

Such a broad (and loose) understanding of the term has one advantage over any strict definition, the advantage that has helped the term to survive for so long: it makes the term useful as an informal preliminary label which can be used - unlike any strictly defined term - without prejudging the issues that a given set of data might give rise to.

It was in this broad sense the term was used in the call for papers for the sandhi workshop. And it is apparently in this sense it has been understood by most of the contributors to this volume.

Understanding sandhi

Like so many other linguistic phenomena, sandhi poses problems of two kinds, problems of description and problems of understanding, which should not be separated, but which - for historical reasons - have in fact been separated for a long time.

The strong positivist current in early 20th century linguistics - which was rejected by many European structuralists, first and foremost the linguists associated with the Prague school - continued unchecked through Bloomfield and the post-Bloomfieldians into modern American linguistics. It is reflected in the traditional emphasis on description, and - as far as sandhi is concerned - it is to this current we owe the progress in the development of our descriptive apparatus, from Bloom-

field's taxonomy of alternations and the later debates over Item & Arrangement vs. Item & Process descriptions, over the rule systems of systematic phonetics to lexical phonology. But the positivist heritage is reflected, as well, in the ways in which we talk about alternations, manners of speaking which involve metaphors that are deeply alien to the nature of language.

One obvious example is the appeal to causation in the description of alternations. We continue to speak of segments "causing" other segments to be pronounced thus or so, or to be replaced or deleted - as if we were dealing with natural phenomena. Or we use less crass, but equally causational expressions, such as the late positivist "conditioning" or the machine term "triggering". Nobody, of course, understands these expressions literally in a causal sense. They are accepted because they are useful for descriptive purposes. But one can guess that it is precisely their efficacy in this regard which permits them to present phenomena as adequately accounted for even when they have not been understood.

Another example, of more recent vintage, is the "rewrite rule", which presents the picture of an entity being replaced by another entity and thereby, as it were, disappearing and, at least ideally, being unavailable for later processing further down the assembly line. We speak in this connection of "representations" - underlying, intermediate or surface - but the notion of replacement inherent in the concept of the rewrite rule obscures the fact that "representation" is derived from a three-place predicate: something represents another thing to somebody. In reality when a thing is assigned a new representation, the thing that is represented does not thereby cease to exist. It seems clear that the emphasis on efficacy of description has tended to promote a reification of representations which belies their true nature of signs.

It was precisely the understanding of language as a system of signs that made the European structuralists turn away from the mechanistic descriptions and causal explanations of the positivists. Bühlers' (1934) famous dictum "Alles an der Sprache ist Zeichen" sums up the guiding principle for the Prague school's investigations of the sound aspect of language.

The phonological studies of, for instance, Lazicius, Jakobson, and Trubetzkoy show how fruitful was this research project. Every aspect of the speech signal was viewed in semiotic terms, and physiognomic signs, social, expressive, conative, and auxiliary-sociative signs were identified (Jakobson 1962a, Trubetzkoy 1958). Jakobson showed that distinctive

features are signs (1962b). And Trubetzkoy's works contain important fragments of a semiotic theory of phonotactics.

Prague school phonology remained in many respects a torso. But when in current discussions questions of the function of sandhi phenomena come to the fore - as they do, in several of the contributions in this volume, for instance those by Andersen, Basbøll, Contini, Gvozdanović, Morin, Penny, and Vogel - it seems appropriate to remember that these questions have been addressed before. If the answers that were proposed were not entirely satisfactory and could not be integrated into a coherent theory, this is because the time was not yet ripe, and not because the questions were posed from the wrong point of view. If everything in language is semiotic, an exegetic theory of sandhi germane to the nature of language must explicate sandhi phenomena as signs, that is, determine what kinds of content (or meaning) is encoded in these elements of expression (or form).

It may well be that the time for such a theory is still not ripe. But it seems that parts of such a theory can be sketched, and for the sake of argument I will present here some thoughts on what one may call phonological sandhi.

I limit my topic by leaving out of consideration first the truly morphological alternations traditionally called internal flection (cf. Appendix, p.608; and the papers by Ternes, Morin, Penny, Awbery, Le Dû, Ó Cuív below).

Secondly I leave out non-automatic alternations, whether conditioned by lexical or grammatical content or by combinations of content features and phonological features. I have offered a survey of the varieties of such alternations, couched in semiotic terms, but viewed in a dynamic perspective, in Andersen (1980).

Thirdly I leave out the low-level processes that generate the phonetic texture of utterances, rules of syllabication, foot formation, etc., which are touched on below especially by Gvozdanović.

My topic will thus concern roughly what would traditionally be termed allophonic variation and automatic alternations. These types of sandhi I assume to be strictly phonological in the sense that both allophonic variation and neutralization imply reference to a language particular structure of phonological signs with distinctive (or diacritic) value. The existence of such language particular structures is indicated by the fact that phonological sandhi rules - despite the universal character of "natural" phonetic processes - are in fact language particular (cf. Gvozdanović below).

I find that one can define two sorts of function for phonological sandhi rules. They have a systemic function, which is iconic in that they produce distributions of feature values in utterances which reflect (as diagrammatic icons) the distinctive or allophonic value of the features in question and the markedness relations that hold between different values of the same feature (opposition). That distributional facts in this way reflect the structure of a distinctive feature system is nothing new. Linguists have traditionally exploited such facts in their analyses. But one may presume that such distributional facts are important as well in the real life of languages, specifically in language acquisition, where they offer the language learner essential information about the system that has to be inferred. Their function in this regard can be characterized as metaphonological (cf. Andersen 1979). Besides their metaphonological function, however, phonological sandhi rules have a textual function, which I will try to adumbrate here.

Textual function

Sandhi operates on different levels of representation, but its textual function on each level is to signal text cohesion.

This is illustrated very nicely in the studies by Vogel and Jongen in this volume. As Vogel shows, the linking-*r* in *r*-less dialects of English may occur between sentences and, when it does, signals that they are pragmatically, semantically and/or syntactically connected (p. 60 ff.). Also Avram's survey is relevant in this regard; (cf. p. 565). Jongen shows that sandhi rules may apply utterance-initially in an answer, to signal its cohesion with the interlocutor's question (p. 127 f.).

At the opposite end of the scale, Timberlake (1978) has shown in an analysis of some Polish dialect data that the introduction of allophonic palatalization of velars before *i* and *e* is more consistent and more advanced when velar and vowel belong to the same morpheme than when they are separated by a desinence boundary, and more consistent and more advanced when the vowel after the velar is stable than when it alternates with zero. Here is a rule which is in the process of being established, and which by its sensitivity to the difference between uniform and alternating environments illustrates how an allophonic feature

which links one segment to the following segment can signal different degrees of cohesion within the (morphological) word.

Between the two extremes illustrated by the English linking-*r* and the Polish "linking palatalization" we find a gamut of phonological sandhi rules which produce signs of text cohesion of different kinds. They produce these signs by applying to environments which include reference to the boundaries of phonological or syntactic constituents. Any rule of the general form $X \rightarrow Y/Z$ establishes a sign, Y, which at one and the same time represents X and Z. One may say that it stands for X, but that it points to Z (regardless of the overt manifestation of Z) by virtue of the reference to Z in the rule. It is an index of Z.

Basbøll's contribution below offers an account of the amount of information carried by such indexes in Danish stød sandhi (p. 82 f.). Eliasson's paper explicitly discusses the retrievability of distinctive feature information in Swedish and Norwegian sandhi (p. 284 ff.). But by and large one must acknowledge that phonological sandhi operates to distribute redundant features – either allophonic features or realizations of neutralized oppositions – in such a way that they index phonological or syntactic domains. In the case of neutralizations it is clear that redundancies in underlying representations are sacrificed and exploited for the creation of signs of textual cohesion.

In my paper below (p. 245 ff.) I mention three aspects of cohesion that seem to be signaled by phonological sandhi. Rules that apply within a domain irrespective of boundaries within this domain serve an integrative function. They produce signs of the internal cohesion of the given domain. Rules that apply at boundaries may serve a concatenative function, if they produce signs that link elements together across the given boundaries. Or they may have a delimitative function if they produce signs that do not.

In the paper below I illustrate these different aspects of phonological cohesion with types of "voicing sandhi" found in the Slavic languages. But other, perhaps more obvious examples are not difficult to find. Russian vowel reduction, by which vowel distinctions are neutralized in unstressed syllables within the phonological word irrespective of internal boundaries, is a clear example of a complex of phonological sandhi rules with an integrative function. Turkish vowel harmony, by contrast, which links morpheme to morpheme within the phonological word, is produced by sandhi rules with a concatenative function.

It is evident that sandhi rules operating on different phonological features in the same language may have different cohesive function. Their

combined effect is to create phonological texture in a sense comparable to the one in which the term texture is used in reference to discourse (cf. Halliday - Hasan 1976).

Saying that phonological sandhi serves to signal text cohesion is tantamount to claiming that it is the phonological counterpart of the text grammatical phenomena usually referred to by this term.

For those who are interested in homologies between different levels of language it may be interesting to note that the three aspects of phonological cohesion identified in the course of an analysis of Slavic sandhi phenomena seem to correspond to the three main devices for participant tracking in discourse, reflexivization, anaphora, and switch reference. Reflexivization applies within the domain of the sentence and is integrative. Anaphora and switch reference apply to mark continuities or discontinuities of participants between sentences and serve functions that may be called concatenative and delimitative.

This parallelism may strike some as a coincidence. But the deeper correspondence between the devices of the two levels of language gives pause to thought. In discourse, cohesion is achieved, inter alia, by reducing the descriptive content of a co-referring expression - whether by lexical substitution, by pronominalization or by ellipsis. Thus emptied of (part of) its content, it becomes a two-fold representation. It stands for the full content of the term it replaces and - provided it is thus interpreted - it points back or forward to the contiguous environment relative to which this substitution is licensed or obligatory. Similarly in neutralization, when, say, the final *k* in Pol. *język ainu* [-ga-] 'the Ainu language' loses its specification [−voice] and is assigned the realization [+voice] before initial vowel. The reduced final segment of *język* stands for a *k* and - if it is thus interpreted - points to the neighboring word boundary.

Admittedly, in comparisons of this kind there are always a great number of mutanda, and the account given here is sketchy and informal. But to the reader who recognizes the importance of elucidating the similarities between the different planes of language it will suggest that sandhi rules are not just a peculiar encumbrance which obscures the underlying representations of morphemes and is counterproductive from a communicative point of view. It is hardly the case - as one participant in the sandhi workshop exclaimed during the discussion - that languages "would be much better off without them". Sandhi rules may be understood as a way of utilizing redundancies in lexical representations for the production of subsidiary signs of cohesion. And they may some day

- perhaps on a par with the lexical and grammatical devices for text cohesion - be shown to conform to more general strategies in human semiotic behavior.

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Part I

Descriptive issues

A grammatical hierarchy of joining

Elmar Ternes

"... factual simplicity has often been achieved at the price of conceptual confusion."
(W. S. Allen 1972: 5)

0. Introduction

The word 'sandhi' comes from the Sanskrit *saṁdhi* and simply means 'putting together' (Bloomfield 1935: 186, fn. 1) or 'joining'. In Sanskrit grammar, two types of sandhi had already been distinguished, namely 'internal sandhi', which occurs at morpheme boundaries and results from the juxtaposition of morphemes within words, and 'external sandhi', which occurs at word boundaries and results from the juxtaposition of words within phrases or sentences.

In 19th and 20th century linguistics, including present-day usage, 'sandhi' has become a cover-term for a veritable host of the most divergent phenomena, among them assimilations or dissimilations of all kinds, allomorphic or morphophonemic alternations, atonic forms and proclitics of various sorts, elision (as in French *l'homme*), synaloepha (as in Spanish *la amiga*), French liaison, French enchaînement, Celtic mutations, Italian raddoppiamento sintattico, Tuscan gorgia, English short forms (as in *we're*), Notker's Anlautgesetze in Old High German, and many others. Most of these phenomena have, at some stage of the history of their linguistic processing, vaguely been attributed to an endeavor of achieving 'ease of articulation' (e.g. Lewandowski 1976: 589), or even, horribile dictu, 'euphony' (e.g. Marouzeau 1961: 91, with reference to French *t* in *va-t-il*).

A glance at some glossaries of linguistic terminology (e.g. Crystal 1980, Dubois *et al.* 1973, Lewandowski 1976, Marouzeau 1961, Pei 1966) confirms that the term 'sandhi' is indeed understood in a very broad sense. One may even quote in support, no less a person than Bloomfield (1935: 186ff.) who defines sandhi as "[f]eatures of modulation and of phonetic modification ... in many syntactic constructions" (186) and cites a number of rather divergent examples. As a typical specimen from a recent 'dictionary of linguistics and phonetics', one may ad-

duce Crystal (1980: 311), who defines sandhi as follows (capitalization in the original):

"[a] term used in SYNTAX and MORPHOLOGY, to refer to the PHONOLOGICAL MODIFICATION of GRAMMATICAL FORMS which have been juxtaposed ... ASSIMILATION and DISSIMILATION are two widespread tendencies which could be classified under this heading. The merit of the sandhi notion is that it can be used as a very general term within which can be placed a wide range of structural tendencies that otherwise it would be difficult to inter-relate."

In accordance with Allen (1972: 5) however, whose statement has been chosen as a motto for this paper, the present writer is inclined to regard the very generality of the sandhi notion in linguistic writing as a disadvantage rather than as a 'merit', if indeed conceptual clarity is a desirable goal in linguistic description. It therefore seems to be a mandatory prerequisite for a 'workshop on sandhi phenomena' to try to achieve more conceptual clarity by delimiting various types of 'joining'-phenomena, by arranging them with respect to their position within the hierarchy of grammatical description, and by assigning a non-ambiguous term to every one of those types. This will be the goal of the following pages.

'Joining', which is the literal translation of 'sandhi', implies that in fact any kind of syntagmatic (as opposed to paradigmatic) feature could be classified under this heading. We shall take up for discussion various syntagmatic alternations, beginning on the lowest rank of grammatical hierarchy and gradually working up the scale.

1. Allophonic variation

On the lowest level of joining is the phenomenon known in phonetics as 'coarticulation'. The articulations of any two (or more) succeeding phones usually overlap in such a way that the following phone retains an articulatory feature of the preceding one and/or the preceding phone anticipates an articulatory feature of the following one. This is an inevitable consequence of the inertia of the articulatory organs. It may have more or less clear effects. In many cases, it goes without even being noticed by the average speaker or hearer. But in other cases, it produces easily noticeable allophones, as in German *Nacht* [naxt] 'night', as op-

posed to *nicht* [niçt] 'not', where [x] retains the feature of velarity of the preceding [a], and [ç] the feature of palatality of the preceding [i]. Both [x] and [ç] represent positionally conditioned allophones of one and the same phoneme /x/ in German. This kind of joining, which takes place at the subphonemic level, has hardly ever been subsumed under the notion of sandhi. It will suffice to retain the terms 'coarticulation' for purely phonetic purposes, and (positionally conditioned) 'allophonic variation' for phonemic description.

Whereas the variation in German between [x] and [ç] is readily explicable in terms of articulatory conditions, a variation such as the one of British English /l/ in *feel* [fiːɬ] vs. *feeling* [fiːliŋ] (i.e. [ɬ] in word-final position, [l] in intervocalic position) has no immediate articulatory motivation. It may therefore be useful to distinguish between phonetically transparent and non-transparent allophonic variations.

2. Phoneme distribution

The next step on the scale of grammatical hierarchy leads on to the phonemic level. Every language has specific rules governing the stringing together of phonemes within words. It is important to note that at this stage, we consider only strings of phonemes that do not contain a morpheme boundary.

In Spanish, among the consonant clusters permitted in word-internal position are /mb/ as in *ambos* /ámbos/ 'both', and /nd/ as in *onda* /ónda/ 'wave'. The clusters */md/ or */nb/ are not permitted. This is again immediately explicable in terms of articulatory conditions: the clusters /mb, nd/ are homorganic, whereas */md, nb/ are not. Restrictions of this kind are of course language-specific, as can be seen from the German *Hemd* /hemt/ 'shirt', pl. *Hemden* /hemdən/, where /md/ is permitted as an internal cluster.

This phenomenon as well has hardly ever been associated with the notion of sandhi. It is satisfactorily treated under the heading phonotactics or phoneme distribution.

Restrictions as to the occurrence of phoneme clusters may again be phonetically transparent or not. Whereas Spanish /mb, nd/ and non-permitted */md, nb/ are readily explicable in articulatory terms, there is no immediate motivation for the occurrence of German initial /ʃtr/ as

in *Straße* /ʃtra:sə/ 'street' to the exclusion of */str/, and exactly the reverse situation in English, where one has initial /str/ as in *street* /stri:t/ to the exclusion of */ʃtr/. It may therefore be useful to make a distinction between transparent and non-transparent restrictions in phoneme distribution.

3. Morphological variation

At the next stage, it is again sequences of phonemes within words that are considered, but this time sequences containing a morpheme boundary, i.e. resulting from morphological processes. In English, the plural suffix {-s} appears as /-s/ after voiceless consonants as in *cats* /kæts/, and as /-z/ after voiced consonants as in *dogs* /dɔgz/. Consonant clusters such as */tz, gs/ are not permitted in English.

In Spanish, the verbal prefix {en-} appears as /en-/ before dentals as in *endurecer* /endureθér/ 'to harden', and as /em-/ before labials as in *enviar* /embiár/ 'to send'. As already noted under (2), the consonant clusters */md, nb/ are not permitted in Spanish.

Processes of this kind are sometimes referred to as 'sandhi' or, more specifically, as 'internal sandhi' (in German also 'Wortsandhi', as opposed to 'Satzsandhi' (4)). This is in conformity with usage in the grammar of Sanskrit. On the other hand, it is probably more customary to refer to these very processes as morphological (allomorphic) variation or, under specific conditions, as morphophonemic variation.

Since the term allomorphic variation (which includes morphophonemic variation) is very common and well established indeed, there is no need for a competitive term such as (internal) sandhi. It is therefore suggested not to make use of the notion of sandhi at all, in connection with purely morphological processes within word boundaries. We thereby avoid the competition of two terms for one and the same phenomenon. At the same time, we avoid the necessity for the awkward distinction of internal vs. external sandhi. And we gain in conceptual clarity by reserving the term 'sandhi' for one specific and clearly defined phenomenon only, viz. the one described under (4).

Case (3) is basically different from cases (1) and (2) because, at this level of description, both phonetic/phonemic structure and grammatical (in this case morphological) structure of the language in question are

involved. A sequence like English /ks/ in *rocks* /rɔks/ has both phonetic shape and grammatical information, whereas the same sequence in *box* /bɔks/ has phonetic shape only. It is therefore important to make a distinction here between phonetically motivated[1] and non-motivated allomorphic variation. Both examples at the beginning of this section (English plural {-s}, Spanish verbal prefix {en-}) have an obvious phonetic motivation: in the first, there is a harmonization of the feature [voice], in the second a tendency towards homorganic consonant clusters.

An example of phonetically non-motivated morphological variation is consonant gradation in Finnish:

Nom.	*kukka*	/kukka/	'flower'	-	Gen.	*kukan*	/kukan/
	luku	/luku/	'number'	-		*luvun*	/luvun/
	jalka	/jalka/	'foot'	-		*jalan*	/jalan/

Another example is from Breton. One type of inflectional prepositions has alternation of /d/ and /t/, as shown in the following partial paradigm of *evid* /evi:d-/ 'for':

Sg.	1.	*evidon*	/evi:don/	'for me'	3. m.	*evitañ*	/evitã/ 'for him'
	2.	*evidout*	/evi:dut/	'for thee'	f.	*eviti*	/eviti/ 'for her'

It does not seem to be customary to distinguish consistently between the two types of morphological variation. Although it would certainly be useful to have a terminological distinction, we do not venture to innovate at the moment. To some extent, it seems that 'morphophonemic variation' is preferably, but not consistently, used for non-motivated morphological variations. For the time being, it may suffice to distinguish simply between motivated and non-motivated morphological alternation. The notion of sandhi however should be avoided in either case.

4. Sandhi

Moving further up the hierarchy of grammatical description, we now leave the domain of the word and come to processes that occur when two or more words follow each other in a phrase or sentence. In this case, in many languages, certain phonetic or phonemic alternations take place, mainly at word boundaries. The following two examples are taken from French:

une tasse /tas/ + *de* /də/ *café*→*une tasse de* /tazdə/ *café*
'a cup of coffee'.
pas de /də ~d/ + *chance* /ʃãs/→*pas de chance* /patʃãs/ 'no luck'.

In both examples, there is regressive assimilation of the feature [voice] across word boundaries. Assimilations of this kind may also work in a forward direction (i.e. progressive assimilation), as in the following example from Breton:

bennoz /benos/ 'blessing' + *Doue* /du:e/ 'God'→*bennoz Doue* /benos tu:e/ 'God's blessing'.

Among the languages that make extensive use of alternations of this kind are the Romance languages (especially Portuguese) and the Celtic languages (especially Breton, see Ternes 1970: 68–110). German, on the other hand, lacks such features to a great extent.[2]

This phenomenon is known as 'sandhi' or, more specifically and in accordance with the grammar of Sanskrit, as 'external sandhi' (in German also 'Satzsandhi', as opposed to Wortsandhi (3)). Since, as suggested under (3), the term 'sandhi' should be avoided in connection with morphological processes, the concept of sandhi (reference to 'external' being redundant) should be restricted to phonetically motivated[3] alternations occurring at word boundaries, when two or more words are being pronounced in succession rather than in isolation (cf. the definition in Ternes 1970: 68). Indeed, the term 'sandhi' serves best here, because no other specific term has developed in linguistic description for this very phenomenon, except perhaps the rather vague heading 'sentence phonetics' which also embraces other features.

5. Initial mutations

The next step leads on to the famous 'initial mutations' of Celtic. There is no room here for describing the phenomenon in detail. We refer instead to Ternes (1977). A typical example is taken from standard Breton. The lexical entry *penn* /pen/ 'head' changes its initial consonant as shown in the following paradigm of the possessive phrase:

Sg. 1.	*va fenn*	/va fen/	'my head'	Pl. 1. *hor penn*	/hor pen/ 'our head'

2.	*da benn* /da ben/	'thy head'	2. *ho penn*[4] /o pen/		'your head'
3. m.	*e benn* /e ben/	'his head'	3. *o fenn*	/o fen/	'their
f.	*he fenn*[4] /e fen/	'her head'			head'

Thus, /p/ alternates with /f/ and /b/. It should especially be noted that alternating consonants in Celtic mutations always have the status of phonemes in the respective language, not of allophones. Minimal pairs demonstrate the phonemic status of /p/, /f/, and /b/ in Breton:

plac'h /pla:x/	'girl'	vs. *flac'h* /fla:x/	'palm of hand'
per	/pe:r/	'pears (coll.)'	vs. *ber*	/be:r/	'spit (for roasting meat)'
fank	/fãnk/	'mud'	vs. *bank*	/bãnk/	'bench'

The above example makes clear that there is no phonetic or phonemic motivation whatsoever for the alternation of the initial consonant. Conditioning is of a purely grammatical nature. Within that frame, it may be morphological, syntactical, or lexical. Generally speaking grammatical characteristics (such as person, number, gender etc.), not phonetic or phonemic shape, determine whether a word undergoes a mutation or not and, in the former case, which type of mutation applies.

Diachronic excursus

The origin of the Celtic mutations is well known from historical and comparative observations and reconstructions. They originated from sandhi phenomena as defined under (4). Since it is the initial of the second element that is affected, assimilation in sandhi must have been progressive, as in the Breton example under (4). In the course of the historical development of the language in question, the final phoneme(s) of the preceding word dropped due to regular sound changes. But - and this is the crucial point - the changes that the disappeared phoneme(s) had induced on the initial of the following word remained. From this moment on, the conditioning of these changes was not phonetic any more, but grammatical. An example of this development is described in Ternes (1977: 27-28). Another, more straightforward, example is the following one taken from Welsh.

In Welsh, the conjunction *a* 'and' causes a mutation by which initial /p, t, k/ are changed into /f, θ, x/ respectively, e.g. *tad* /ta:d/ 'father', but *mam a thad* /mam a θa:d/ 'mother and father'. From historical reconstruction, it is evident that modern Welsh *a* 'and' derives from Proto-Welsh **ak*. The phrase as a whole may be reconstructed as **mammā ak*

tatos. The original consonant cluster **kt* developed regularly into modern Welsh /θ/, both within words (cf. Welsh *wyth* /uiθ/ 'eight' vs. Latin *octo*) and across word boundaries. Then, final **-k* dropped. But /θ/ remained as the initial of the following word, as if final **-k* were still present. Since final **-k* is not recoverable syntagmatically in modern Welsh, the alternation /t/ ~ /θ/ is not phonetically conditioned any more, but grammatically. - End of diachronic excursus.

Mutations are very common in all Celtic languages. Within the grammatical system of every single language, the mutations form a highly complex system. But as mentioned in Ternes (1977), the Celtic languages are by no means unique in this respect. Similar phenomena are to be found in other languages as well, especially in West African languages such as Fula. It has been shown likewise in Ternes (1977) that French liaison and Italian raddoppiamento sintattico can be interpreted along similar lines as the Celtic mutations.[5]

Celtic mutations are sometimes misinterpreted by linguists who have no first-hand knowledge of the Celtic languages. Features similar to Celtic mutations, which do exist in other languages, have not always been investigated thoroughly enough as yet. Those features which have been investigated are usually seen isolated within one specific language family. Celtic scholars as a rule have no knowledge of the grammatical structure of West African languages and vice-versa. It is therefore difficult to suggest a terminology that would be acceptable for all languages involved. There is no doubt however that phenomena of this kind have become famous among linguists mainly from their occurrence in the Celtic languages. It therefore does not seem unreasonable to use the term that has already been common in Celtic studies for a long time, for other languages as well. We consequently suggest calling 'mutations' or, more precisely, 'initial mutations' any kind of grammatically and/or lexically conditioned alternation of word initials.

It is particularly unfortunate to extend the notion of sandhi in such a way as to include Celtic mutations, as has frequently been done, since this conceals the very nature of the mutations. It is particularly important to make a clear distinction between phonetically conditioned alternations at word boundaries (i.e. sandhi as under (4)), and grammatically conditioned alternations (i.e. mutations).

6. Incorporated mutations

That 'sandhi' is indeed not a suitable designation for the Celtic mutations also appears from their further historical development. Some mutations may even go one step further in the process of grammaticalization. Although they are in no way conditioned phonetically, it may be said that most mutations are so to speak 'triggered' by specific morphological or syntactical forms or constructions. These forms or constructions in most cases immediately precede the word which undergoes mutation. Some mutations of Celtic however may also occur on their own. In this case, the mutation by itself transforms one grammatical form into another one, without any triggering element being present. Two examples of this are given in Ternes (1977: 25). In the spoken Celtic dialects, this tendency is much more wide-spread than orthographical representations would suggest. In standard Breton, there is a regular mutation *ki* /ki:/ 'dog' vs. *ar c'hi* /ar xi:/ 'the dog', triggered by the definite article when used before a masculine noun in the singular. The corresponding forms in the Breton dialect of Scaër (Sud-Finistère) are /ki/ 'dog' vs. /çi/ 'the dog'.[6] The article itself has dropped and is not recoverable synchronically in the dialect. Absence or presence of the mutation alone determines absence or presence of 'definiteness'.

Similar examples are - I repeat - much more common in the spoken Celtic dialects than one seems to have hitherto recognized. In cases like this, mutation has even left the domain of 'joining' altogether, because there is nothing preceding or following that could in any way syntagmatically be related to it. It therefore seems justified to use a different term for mutations of this kind. In Celtic studies, it has been suggested by Oftedal (1962) to use 'projected mutations' for the 'triggered' type of mutations, and 'incorporated mutations' for the latter type (cf. also Ternes 1977: 25). Thus, a joining phenomenon which no doubt began by allophonic variation has gradually worked up the grammatical scale by becoming phonemic in the first place, then - losing its phonetic conditioning - becoming grammatically conditioned, and eventually leaving the domain of 'joining' altogether by forming a grammatical process on its own resources.

7. Final remarks

Going further up the scale of grammatical hierarchy, one finally comes to the traditional domain of syntax, where there are joining phenomena such as 'concord' and 'government'. But these are beyond the scope of the present paper.

We recall to mind that it has been advanced as an advantage of the sandhi notion "that it can be used as a very general term within which can be placed a wide range of structural tendencies ..." (Crystal 1980: 311). Some of the different categories of joining phenomena we have been trying to delimit, do indeed overlap in certain languages. In Spanish, for example, voiced spirants as realizations for voiced stop phonemes (i.e. [β] for /b/, [ð] for /d/, and [ɣ] for /g/) occur within morphs, at morpheme boundaries, and also at word boundaries. As a consequence, this could be seen as an instance of allophonic variation (1), but also of sandhi (4). Again in Spanish, the restrictions for the occurrence of consonant clusters, as described above, are identical both within morphs and at morpheme boundaries, and may therefore be seen as an instance of phonotactics (2), but also of allomorphic variation (3). A similar situation led to the use of 'sandhi' in Sanskrit grammar for both allomorphic variation (3) and sandhi proper (4).

Overlappings of this kind are, however, strictly language-specific. In other languages, the categories that overlap may be different, or there may be no overlapping at all. The case of Spanish voiced stops means that, in this case, there is no phonetic word-juncture. This is a typological feature of Spanish (as indeed of most Romance languages). Germanic languages, on the contrary, are usually different in this respect. A counter-example is provided by Icelandic: The phone [ð] is an allophone of /θ/ occurring, among others, in intervocalic position, e.g. *þýðing* /θi:θiŋk/ [θi:ðiŋk] 'significance'. In connected speech, word initial /θ/ remains [θ], also after a preceding word ending in a vowel.[7] The occurrence of intervocalic [θ] therefore indicates word initial position in Icelandic and serves as a marker of word-juncture.

The occurrence of various overlappings should be no alibi for lumping together under one heading the most diverse kinds of joining phenomena. For the sake of conceptual clarity (see motto), the six categories of 'joining' treated in the body of this paper should in principle be kept apart as a minimum. This does not exclude that, for the needs of the description of specific languages, it may be appropriate to make use of various cover-terms.

Notes

1. Whereas under (1) and (2), the term 'transparent' is used, 'motivated' is preferred under (3). This is in line with the superposition of phonetic shape and grammatical information in the latter case. There may well be detected, at closer investigation, a phonetic motivation for the occurrence of [ɸ] in word-final position in British English, although it is not immediately transparent. On the other hand, the alternation /kk/ ~/k/ in the Finnish example below has no phonetic motivation on the synchronic level, although it may well be transparent what has happened diachronically (in this case an influence of the opening and closing of syllables). The alternation /kk/ ~/k/ is grammatically motivated (nom. vs. gen. in specific inflectional paradigms).
2. This applies to the standard language. Some regional dialects are different in this respect.
3. See note 1.
4. *h* in *he, ho* is merely orthographical to avoid homography. Thus *e* and *he, o* and *ho* are perfectly homophonous. In these cases, the distinction of person is shown by the type of initial mutation alone.
5. For the basically different nature of Tuscan *gorgia,* see ibid.
6. The author's observation in the field.
7. This applies to words under sentence stress, such as nouns and verbs. Words which do not normally receive sentence stress, such as adverbs and pronouns (e.g. *pað* 'it, that'), may be used enclitically and then have [ð] for initial *þ: gerðu pað!*[cɛrðʏða] 'do it!' (personal communication by Magnús Pétursson).

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A note on Ternes' paper

Hans Basbøll

I certainly agree that we should all specify what we are talking about, and that the term sandhi is sometimes used too loosely. When it comes to Ternes' positive proposal, however, of delimiting the term sandhi to what happens between words, certain reservations come to mind.

If you take a typical sandhi process in Modern Danish, like the assimilation of an /n/ in place of articulation to a following stop, it occurs between words in a phrase, e.g. in *han går* where *han* may end in a velar nasal (as opposed to a dental nasal, in isolation): [hanˈgɒʔ, haŋˈgɒʔ] 'he walks'. Exactly the same process occurs, I would argue, between elements in a compound, e.g. in *sandgulv* [ˈsanˌgɔl, ˈsaŋˌgɔl] 'floor of sand'. And there may even be a hierarchy, from the minimal domain (the morpheme or the syllable), where the rule is obligatory, to the maximal domain (the utterance, say) where it only applies in fast speech or under low formality-conditions (with several intermediate domains intervening).

Another example from Modern Danish which is partly similar, partly different (and much more subject to lexical conditions), is what may be called "linking r" (although such a term is not traditionally used for this phenomenon within Danish linguistics): final /r/ is in certain contexts "linked", i.e. pronounced as a phonetic consonant ([ʁ]) and not as a glide ([e̯]), before "full vowels". The pronunciation with [ʁ] is found obligatorily before stressed vowels within the same morpheme (e.g. *karat* [kɑˈʁɑʔd] 'value'), but this is not linking, strictly speaking. The pronunciation with [ʁ] (but still not a real "linking r") also occurs optionally - favoured by a high degree of formality/distinctness - before an unstressed full vowel within single morphemes (e.g. *Tora* [toːʁɑ] (high style) or [toːɑ] (low style)). Before some derivative endings starting with a "full vowel", genuine linking (as a sandhi-phenomenon) occurs in certain conservative norms, e.g. in *lærerinde* [lɛːɐˈʁenə] 'female teacher' (conservative), cf. [lɛːɐˈenə] (less conservative) - derived from *lærer* [lɛːɐ] 'teacher' or [lɛːʁɐ] (very old-fashioned) and the suffix (fem.) *-inde* [enə], cf. *violinistinde* [violinisdˈenə] 'female violin player', from *violinist* [violiˈnisd] 'violin player'. Between words, linking only occurs in now obsolete forms of speech (to be heard e.g. in grammophone records with the

author Karen Blixen (= Isak Dinesen, Pierre Andrézel), who was born in 1885 and who spoke a very conservative (but pure Standard) language for her time: *Da min Søster og jeg* . . . [dɑmin 'søsdɒʁɒ'jɑi̯] 'when my sister and I . . .', cf. her pronunciation of *Søster* alone [søsdɒ(h)]. Some of the word internal linking r's have become lexically frozen, e.g. in *Ærø* ['ɛːˌʁœʔ] (name of an island ending etymologically in *-ø* [øʔ] 'island').

If you want to restrict the term sandhi, e.g. to the exclusion of phonotactic restrictions, I think it is somewhat arbitrary (and question-begging) to define its occurrence by means of the word, especially if the notion word is defined in non-phonological terms.

I would rather say that each language makes use of a small number of different boundaries (from the syllable boundary up to the utterance boundary) that serve to rank rules, i.e. delimit their domain on both sides (Basbøll 1978a). Within such a framework, it will thus be an empirical issue whether some kind of 'word-boundary' is the relevant environment, in a given language, for some process which we consider as a typical case of sandhi on independent grounds. According to my (admittedly very restricted) experience, the boundaries which are relevant for sandhi do not generally equal boundaries between words when these are defined on independent grounds (e.g. morpho-syntactically). In Danish, for example, it seems to be the case that boundaries before suffixes with a full vowel, and between the elements of a compound, are at least as strong as those surrounding words in a stress-group.

And in both Danish and French (cf. Basbøll 1978a with references), there seem to be domains for phonological rules (including sandhi-processes) both smaller and larger than the traditional word, whereas the morpho-syntactically (or lexically/semantically) defined word does not function as such a domain. In other words: the boundaries surrounding a non-phonologically defined word have no special status with respect to sandhi or to phonological rules in general, also cf. Marina Nespor's contribution to this volume. It should be added that the fact that a phonological word can in some cases be characterized as composed of certain classes of morphemes which each may be grammatically defined, is another matter (cf. Basbøll 1978b for examples from French).

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Phonological domains

Jadranka Gvozdanović

0. Introduction

One of the main issues in phonological theory in recent years has been the hierarchical structuring of phonological systems, and the question of how these nonlinear hierarchical structures relate to linear sequences of phonological segments. This contribution examines the motivation for the proposed hierarchical structures, and in some cases modifies and elaborates earlier proposals.

1. Levels in phonology

In addition to distinctive features which form sets at the linearly ordered segmental level, the phonological representation has been recently assumed (cf. Selkirk 1980) to contain a fixed hierarchy of prosodic levels, which are characterized by a constituent structure and distinguished as follows (cf. Kiparsky 1981: 245):

(1) phonological phrase
word
foot
syllable
segment.

An element at each level is composed of one or more elements at the next lower level. According to Kiparsky (op. cit.), *"each level is represented in a formally parallel fashion, by means of binary trees, each nonterminal node branching into S(trong) and W(eak)"*. Hence the term 'prosodic' for this hierarchy.

How do these prosodic levels relate to the domains determined by the phonological, morphological, and syntactic structure? Do they have an independent status, or can they be derived from the remaining parts of

the language structure - apart from their constituency and prominence as related to it? And are these prominence relations in fact independent of the morphological and syntactic properties?

The assumed specific properties of each level must be investigated against the background of the entire structure involved.

2. The phonological segment

Even though the segment is crucial to a correct understanding of the structure of the higher levels, the internal structure of the segment has not been given the required attention in the analysis of phonological hierarchy. This refers especially to the questions of which distinctive features minimally form a segment, and what is the relation between these distinctive features. These questions can be answered for the segment as a set of distinctive features only against the background of the entire distinctive feature system involved.

It is a systematic trait of distinctive features that they can participate in asymmetrical relations, as I have tried to show recently (cf. Gvozdanović 1983a, b). In an asymmetrical relation, a feature is distinctive in combination with one term of another distinctive feature, but not in combination with both its terms. It consequently implies one term of another distinctive feature, but not both its terms. The implied term is the unmarked one. It corresponds phonetically either to a "–" specification or to a predictable one. Only asymmetrical relations form hierarchies in the system, whereas distinctive features which do not participate in an asymmetrical relation, are not hierarchically ordered. (This is a more restrictive definition than Jakobson's (1962: 456) quest of distinctive feature relevance, and Andersen's (1975: 70) statement that the terms of a subordinate opposition are not combined with the marked term of a given opposition unless they are also combined with its unmarked term. In my view, if an opposition is combined with both terms of another opposition, there is no hierarchy involved. Andersen's concrete examples actually do fit into this more restricted definition.)

The distinctive features of a system are only partially ordered, as can be illustrated with the acoustic features of the Standard Serbo-Croatian system. I have analysed this system in Gvozdanović (1980) on the basis of the features proposed by Jakobson-Fant-Halle (1951), but disallow-

ing "±" specifications, which refer either to minimally opposed segments or to irrelevant specifications, and leaving out specifications if and only if they are either predictable or incompatible. In the following matrix I modify the specification of the Serbo-Croatian sonorants proposed by Gvozdanović (1980: 124) by specifying only /v/, /j/, and /r/ as [–vocalic, –consonantal] due to their opposition to the corresponding vowels, whereas the remaining sonorants are specified as [–consonantal] only. They are assumed to be [–consonantal] because they do not participate in voice assimilations, and unspecified for [±vocalic] because they can have vowels as positional variants, as demonstrated by loan words. (In addition to that, /ȅ/, /ê/, /è/, /é/, and /ȍ/, /ô/, /ò/, /ó/ are [–compact, –diffuse], which was omitted in Gvozdanović (loc. cit.) due to an uncorrected printer's error.)

(1a) The acoustic distinctive features of Standard Serbo-Croatian, following Gvozdanović (1980: 124):

	p	b	f	t	d	s	z	ć	đ	š	ž	k	g	h	m	n
vocalic																
consonantal	+	+	+	+	+	+	+	+	+	+	+	+	+	+	–	–
compact				–	–	–	–	+	+	+	+	+	+	+		–
diffuse	+	+	+	–	–	–	–								+	–
acute	–	–	–	+	+	+	+	+	+	+	+	–	–	–	–	–
nasal															+	+
continuant	–	–	+	–	–	+	+	–	–	+	+	–	–	+		
voiced	–	+	–	–	+	–	+	–	+	–	+	–	+	–		
long																
rising																

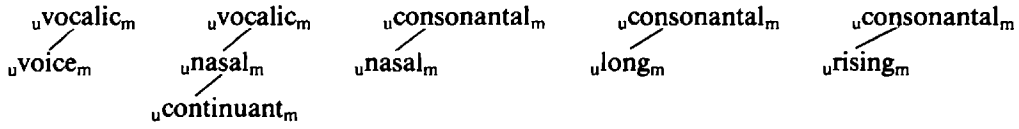
(continued)

	ń	l	ļ	v	j	r	ř	ŕ	ŕ	ŕ	ĭ	î	ì	í	ě	ê
vocalic				–	–	–					+	+	+	+	+	+
consonantal	–	–	–	–	–	–	–	–	–	–						
compact	–	–	–	–	+										–	–
diffuse	–	–	–	–							+	+	+	+	–	–
acute	+	–	+	–	+	+	+	+	+	+	+	+	+	+	+	+
nasal	+	–	–	–	–	–										
continuant		+	+	+	+	–	–									
voiced																
long							–	+	–	+	–	+	–	+	–	+
rising							–	–	+	+	–	–	+	+	–	–

(continued)

	è	é	ã	â	à	á	õ	ô	ò	ó	ũ	û	ù	ú
vocalic	+	+	+	+	+	+	+	+	+	+	+	+	+	+
consonantal														
compact	−	−	+	+	+	+	−	−	−	−				
diffuse	−	−					−	−	−	−	+	+	+	+
acute	+	+					−	−	−	−	−	−	−	−
nasal														
continuant														
voiced														
long	−	+	−	+	−	+	−	+	−	+	−	+	−	+
rising	+	+	−	−	+	+	−	−	+	+	−	−	+	+

(1b) Asymmetrical ordering of the acoustic distinctive features of Standard Serbo-Croatian:



The remaining distinctive features are not asymmetrically ordered. In the given case, [±vocalic] and [±consonantal], and [±compact] and [±diffuse] are symmetrically ordered, and the remaining distinctive features are unordered. We can see that ordering may, but need not be transitive.

In terms of the number of asymmetrical orderings, Serbo-Croatian appears to be a predominantly nonconsonantal, i.e. vocalic, language. The number of asymmetrical orderings appears to be a measure of 'vocalicity' vs. 'consonantality' of a given language, aimed at on the basis of counting segment inventories by Isačenko (1940), and on the basis of markedness conventions as proposed by Andersen (1978). The number of asymmetrical orderings provides an independent basis for terming a language either predominantly vocalic or predominantly consonantal, and for formulating a falsifiable hypothesis about expected variation along these lines, along which markedness is incorporated into the system.

What is a distinctive segment and which distinctive features can minimally form it?

Ebeling (1960: 67) assumed that phonological segments are sets of distinctive features for which the fact that they are grouped together is relevant in the sense that the same features in the same order constitute different linguistic forms according as they are grouped together differently. We can now propose a reformulation of the part of this definition

which refers to the order of the features. The paradigmatic order is given for a distinctive feature system and thus not liable to differential grouping. The syntagmatic order, on the other hand, is liable to differential grouping to the extent that this is not prevented by the paradigmatic order, and that this does not include specifications of the same distinctive feature in any order other than 'unmarked, marked' (the latter regularity, established by Andersen (1972) as characteristic of diphthongization, may apply to all segment sequences). In other words, only distinctive features which do not participate in asymmetrical relations may be grouped either together or separately, and only to the extent that this is not precluded by markedness.

For example, [+acute, +continuant, +voiced] can be grouped with [+compact] either into one set, yielding /ž/ in Serbo-Croatian, or into two sets, yielding /zj/ in the same language. This possibility of a differential grouping is restricted by the asymmetrical ordering according to which [±continuant] and [±voice] combine into sets only with those distinctive features which are unmarked for [±vocalic]. The asymmetrical ordering forms the paradigmatic context within which markedness is evaluated as relative to it. This is the case not only within the given asymmetrical ordering, but also within symmetrical orderings associated with it, as, for instance, [±vocalic] and [±consonantal] are mutually symmetrically ordered in Serbo-Croatian. In the given example, [±continuant] and [±voice] are asymmetrically ordered with [±vocalic]. This means that the markedness of [±consonantal] is in the context of [±continuant] and [±voice] evaluated against the background of the unmarked value of [±vocalic]. In the context of the unmarked value of [±vocalic], [+consonantal] is unmarked, and [–consonantal], marked. The sequence of [+consonantal, –consonantal] is then 'unmarked, marked'. In such a case, either grouping into one set or into two sets is possible, and this is exactly what is found in various languages. Whereas Serbo-Croatian has an opposition between /ž/ and /zj/, Dutch, for example, has in the given case only a sequence of two sets, i.e. /zj/, which is pronounced as [ž]. (The given sequence is also specified as [–compact, +compact], which - in the absence of asymmetrical ordering associated with that distinctive feature - directly corresponds with 'unmarked, marked' and is, consequently, also liable to grouping either into one set or into two sets.)

In the case of [±long] and [±rising], on the other hand, only association with the unmarked value of [±consonantal] is possible, due to the presence of asymmetrical ordering as shown in (1b) above. With respect

to this paradigmatic context, [+vocalic] is evaluated as unmarked, and [–vocalic] as marked. This is why speakers of Serbo-Croatian may pronounce syllabic sonorants in loan-words either as simple sonorants, or as sequences of a vowel (resembling the sonorant in its features) plus the sonorant.

We can see that a given asymmetrical ordering has a number of implications, and that the implied specifications can be filled in so that they form separate distinctive feature sets.

This regularity is of a general nature. For example, the African language Efik has no opposition between long and short vowels *ceteris paribus,* but a floating tone which is attached to a vowel specified for another tone, lengthens that vowel. A floating tone can create a vowel due to the asymmetrical ordering of tone and the unmarked value of [±consonantal] in the distinctive feature matrix, by which the specification as [+vocalic], which is unmarked in this context, can be implied in combination with tone and consequently filled in. The remaining features are copied from the neighboring vowel, and thus an additional vowel is created by implication on the basis of tone. This is why long vowels occur (only) with tone sequences in Efik (according to the data presented by Ward (1933: 29) and Cook (forthcoming)).

Within the restrictions imposed by asymmetrical orderings in a given language, grouping of distinctive features into sets called segments is distinctive indeed.

3. The syllable

According to Bell - Hooper (1978: 8ff.), the most basic and most available phonological evidence for syllables is found in the phonotactic distribution of segments which depends on sonority. Segments of a syllable are arranged in such a way that their sonority increases from the onset to the nuclear peak and decreases thereafter. It is possible to establish the following order of preference for occurrence as syllabic peaks: stop - fricative - resonant (in my terminology, 'sonorant') - vowel.

The question to be asked now is, whether this segment arrangement justifies the syllable as a phonological level or not?

The answer to this question is "Yes, it does" if sonority is at least partly independent of the distinctive features and their phonetic correlates.

The answer is "No, it does not" if it can be fully derived from the distinctive features and their phonetic correlates on one hand and universal constraints on pronounceable sequences on the other.

If the syllable can be derived from the distinctive features and their correlates, then language-specific syllable structures are fully derivable from the distinctive features of the given language. The properties of syllable structure may then still exhibit universal traits, but these are derivable from universal distinctive feature properties.

It is a well-known fact that language-specific syllable structures exist, and that the language-specific properties are derivable from the distinctive features of the given language. But are also the universal properties directly derivable from the distinctive features and their markedness (outlined in the preceding section), or should an independent sonority hierarchy still be postulated?

Farmer (1979) has posited a universal sonority scale with the following degrees of markedness: stops - fricatives - nasals - liquids - glides. Selkirk (1982) has even defined a sonority scale with fixed universal values and dissimilarity requirements of the form "position X in the onset/rhyme must be at least n points apart from adjacent position Y in the onset/rhyme on the sonority scale". The sonority scale is characterized by the following indexes: p, t, k (0.5), b, d, g (1), f, θ (2), v, z, d (3), s (4), m, n (5), l (6), r (7), i, u (8), e, o (9), a (10). Languages differ in the integer value of n.

Steriade (1982) has criticized Selkirk's sonority scale with absolute values by showing that language-specific deviations from it occur and are derivable from the distinctive features involved. Steriade has proposed a universally fixed articulatory distinctive feature hierarchy underlying language-specific sonority scales, the differences among these being due to the utilization or non-utilization of distinctive features.

(2) Steriade's (1982: 98-99) sonority scales based on distinctive features (where 'son' = 'sonorant', 'cont' = 'continuant', 'cor' = 'coronal', 'nas' = 'nasal', and 'lat' = 'lateral'; note that the features [±sonorant] and [±lateral] are used in order to distinguish the sonorants which are by Chomsky-Halle (1968: 177) distinguished on the basis of [±vocalic] and [±anterior]; Chomsky-Halle's solution seems more plausible because it is more general):

Latin sonority scale	Greek sonority scale	An impossible sonority scale
[–son, –cont, –cor]: p, k, b, g	[–son, –cont, –voice]: p, t, k	[–cont, –son, –cor]: p, k, b, g
[–son, –cont, +cor]: t, d	[–son, –cont, +voice]: b, d, g	[–cont, –son, +cor]: t, d
[–son, +cont, –cor]: f	[–son, +cont, –voice]: s	[–cont, +son, –cor]: m
[–son, +cont, +cor]: s	[–son, +cont, +voice]: z	[–cont, +son, +cor]: n
[+son, –cont, +nas, –cor]: m	[+son, –cont, +nas]: m, n	[+cont, –son, +cor]: s
[+son, –cont, +nas, +cor]: n	[+son, +cont, –nas, +lat]: l	[+cont, +son, +cor]: r, l
[+son, +cont, –nas, +lat]: l	[+son, +cont, –nas, –lat]: r	
[+son, +cont, –nas, –lat]: r		

We can see that a fixed hierarchy holds for [±sonorant] (i. e. [±vocalic] in other approaches, with a different specification of the nasals), [±continuant], [±nasal] and [±voice], whereas no such fixed hierarchy holds for [±coronal] in relation to the remaining features. This can be concluded on the basis of the scales, even though Steriade has claimed the supposed hierarchy to be universal. What is in fact universal is one part of that hierarchy - a part smaller than the intersection of Latin and Greek - and exactly the part for which asymmetrical ordering holds in a given language. By the rules of that ordering, [±coronal] is not ordered with respect to [±continuant] or [±nasal], and this lack of ordering is exactly reflected by the sonority scales.

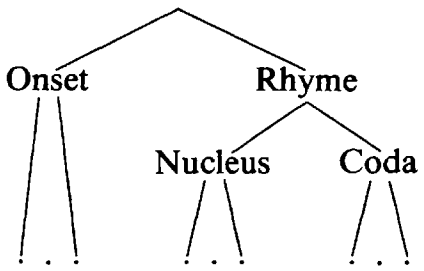
Another property of the sonority scales is that a "–" specification is less sonorous than the corresponding "+" specification. This can be formulated as a regularity by which an unmarked specification is less sonorous than the corresponding marked specification (cf. also Gvozdanović 1985b).

In the case of [±nasal], however, that order is reversed. Why? Because there is no universal ordering of [±nasal] and [±continuant], and languages order them in different ways. In Serbo-Croatian, for example, the nasals can positionally be realized as vowels (cf. e. g. [film̩], which is bisyllabic), and there is no reason to assume that they are [–continuant]. Their analysis as [+continuant] eliminates the possibility of analysing [±continuant] as dominating with respect to [±nasal], because the marked specification for [±continuant] combines with both specifications for [±nasal]. [±nasal], on the other hand, can be analysed as dominating with respect to [±continuant], because it combines only with [+continuant]. In Russian, on the other hand, there is no reason to analyse the nasals as [+continuant]. They are [–continuant], and [±continuant] can be analysed as dominating with respect to [±nasal] because the marked specification for [±continuant] combines only with the unmarked specification for [±nasal]. In its treatment of [±continuant] and [±nasal], Russian thus resembles Greek and Latin, whereas Serbo-

Croatian differs from these languages. This is reflected not only in a different treatment of the nasals (cf. [filṃ] as bisyllabic in Serbo-Croatian, and [f, il, m] as monosyllabic in Russian), but also in the treatment of [±continuant] throughout the segment inventory. Being a surbordinate distinctive feature, it is more liable to variation (cf. Gvozdanović 1983 b), and syllabification in Serbo-Croatian is ambiguous in this respect. A word like [pòstaviti] 'place' may be syllabified either as [pò-sta-vi-ti] or as [pòs-ta-vi-ti] (where (`) denotes the short rising tonal accent).

We can conclude that syllable structure is directly derivable from the asymmetrical orderings characteristic of a given distinctive feature system (which - as far as relevance to sonority scales goes - seems to involve orderings which are parallel in the articulatory and acoustic features). Syllable structure may be viewed as a constraint on segment sequences by which the distinctive features which participate in asymmetrical orderings are distributed in the order 'unmarked, marked'. In this way the syllable structure schematized in (3) can be analysed further.

(3) Syllable structure according to Kiparsky (1981: 249), following Hockett (1955):



Whereas onsets are characterized by unmarked (i.e. "–" and predictable) specifications for the dominating distinctive features as compared with rhymes, which are marked (i.e. "+"), within the rhyme markedness reversal takes place and the "+" specification is evaluated as unmarked, and the "–" one as marked. Markedness is thus sensitive to the paradigmatic and syntagmatic context, and determinant for segment distributions.

The syllable is thus derivable from the distinctive feature ordering and markedness. It is restricted by morphological boundaries (in Dutch, for example, a consonant at the end of a prefix does not syllabify with the following stem-initial vowel) and by syntactic ones (in Kabardian, for example, an immediate constituent boundary prevents an otherwise automatic [ə] insertion if both constituents contain two or more consonantal units; cf. Anderson (1978: 51) on Kuipers 1960).

In addition to language-specific properties of syllable structure derivable from language-specific asymmetrical orderings, languages have specific constraints on linear sequences. For example, Japanese does not allow any consonants in its rhymes, but does allow sequences of two identical vowels there (with the exception of the Kagoshima dialects). Serbo-Croatian, for example, does allow consonants in its syllable codas, but either does or does not allow vowel sequences in its rhymes, depending on the dialect (cf. Gvozdanović 1983 c). Such constraints on allowable sequences are not fully derivable from the distinctive feature system, but are language-specific in the same way that grammatical constraints can be language-specific and idiosyncratic, for example, the question whether a language expresses personal endings on the verb or not.

Due to the distinctive feature constraints and markedness in relation to them, which are in principle universal but have language-specific elaborations, and due to language-specific constraints on sequences, it is for each language in each case either predictable or indeterminate which distinctive feature sets can, and which cannot, belong to the same syllable (e. g. in Standard Serbo-Croatian, two vowels always belong to two syllables, and in the absence of a vowel, any nonconsonantal segment which is not [–vocalic] acquires a vocalic realization which is unmarked for it, and becomes a nucleus; the fricatives, on the other hand, are indeterminate as shown above).

Asymmetrical ordering of distinctive features is a nonlinear phenomenon. It allows for nonlinear distributional phenomena as reflected in the syllable structure, where the evaluation of those distinctive features which participate in asymmetrical orderings is predictable. We have seen this illustrated on the basis of syllable onsets in several languages, but in fact the entire syllable structure, with rhymes included, reflects these orderings in a comprehensive way. Asymmetrical ordering, which equals implication, and the markedness constraint on sequences, make it possible for phonological rules to imply the syllable structure without necessitating a separate level of the syllable. The syllable structure in fact follows from the nonlinear organization of the phonological system.

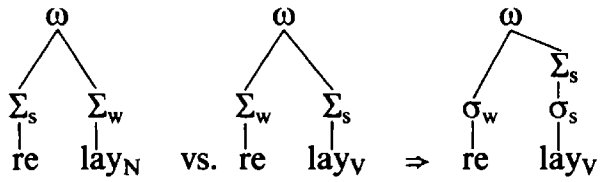
4. The foot

The foot is a unit of prosodic prominence. It is characterized by an alternation of weak and strong syllables, in either order, connected with the segmental features of vowel duration and vowel quality, or with the syllable structure in the sense of simple vs. complex rhymes, depending on the language under investigation.

In English, for example, the basic foot is bisyllabic, consisting of a strong and a weak syllable in that order, and monosyllabic feet can occur at constituent boundaries only. A monosyllabic foot can be either strong or weak, and consequently at the word level either accented or unaccented, depending on restrictions in terms of vowel quality and syllable structure, as Selkirk has established (1980b: 572). According to Selkirk, it is generally the case that an open syllable containing a lax vowel may not be an accent foot on its own, whereas a syllable containing a tense vowel must always be either an accent foot on its own, or the strong syllable of a binary foot (cf. the *Ti* and the *ro* of *Ticonderoga*). A lax closed syllable has a much freer distribution. It may be a foot on its own, as with the first syllable of *Victrola* or the second syllable of *gymnast* (as well as the first), or it may be part of a bisyllabic foot, as with the second syllable of *modest* or of the foot *anec-* of *anecdote*.

However, a tense vowel is always either an accented monosyllabic foot or the strong syllable of a bisyllabic foot *only in the surface representation*. Selkirk (1980b: 590–591) has discussed the vowel of the Latinate prefixes *de-*, *re-* etc. and argued in favour of its being [+tense] in the underlying representation, even though it occurs in the weak position and is reduced in the surface representation of the verbs containing such prefixes. She proposes treating such cases by means of a Prefix Defooting transformation, accompanied by Vowel Detensing, which is restricted to such (zero suffix) verbs as compared with their corresponding nouns.

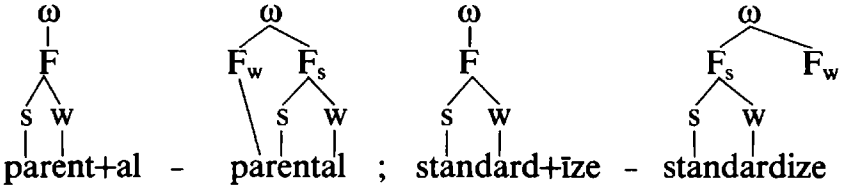
(4) Prefix Defooting transformation according to Selkirk (1980b):



(Here 'ω' denotes the prosodic word, 'Σ' denotes the foot, and 'σ' the syllable).

Similar cases of morphologically conditioned change of the prosodic structure have been discussed by Kiparsky (1983), who proposes viewing the English affixes causing an accent shift onto the stem as ordered at a different, higher, level than those not causing it. An example of the first type is the suffix *-al* in English, and of the second type, *-ize*.

(5) Foot assignment according to Kiparsky (1983):



(Kiparsky omits the syllable symbol 'σ', and denotes the foot by means of 'F').

It follows from the accounts of the English accent system mentioned above that in addition to a large amount of predictability, given the tense vs. lax vowel specification, the syllable structure and the boundaries involved, the crucial points of the prosodic structure still have to be specified in the lexical representation. The lexical representation must contain information on whether the feet of a prosodic word are mutually arranged as strong - weak or weak - strong (cf. rélày$_N$ vs. reláy$_V$, and állỳ vs. allý, but Dùndée vs. níghtingàle, with (ˊ) denoting primary, and (ˋ) secondary accent). And not only that. In Selkirk's approach, the lexical representation must also contain information on whether the feet are monosyllabic or bisyllabic (cf. *gýmnàst* vs. *módest*).

Let us examine Selkirk's statement that both *módest* and *gýmnàst* contain a lax vowel in the second, closed, syllable (henceforth: a lax closed second syllable). It is the weak syllable of a bisyllabic foot in *módest,* and a monosyllabic foot in *gýmnàst.* Let us examine this statement by comparing *gýmnàst* with *reláy,* the latter, according to Selkirk, with an underlying tense vowel in the first syllable, because of its being tense in *rélày.* Why not then compare *gýmnàst* with *gỳmnásium,* the latter with a tense vowel in the second syllable? If we compare *gýmnàst* with *gỳmnásium,* then the second syllable of *gýmnàst* can be viewed as unspecified for [±tense] due to the, lexically specified, accent shift. According to a general markedness convention, a vowel unspecified for [±tense] shows up in such cases as lax, and phonetically lengthened in a closed syllable at a prosodic word boundary. This is, then, the difference between the second syllable of *módest* and that of *gýmnàst:* the former is [–tense],

whereas the latter is unspecified for [±tense]. There is apparently a regularity in English by which a syllable which is unspecified for [±tense] due to a prosodic shift forms a foot of its own at a prosodic word boundary. This can account for the secondary accent in *gýmnàst,* due to the monosyllabic foot there, but why can it not account for *reláy,* where the so-called 'defooting' occurs? In my opinion, the reason for this can be seen in the restrictions on prominence in terms of the syllable structure formulated by Selkirk (1980b). The first syllable of *reláy* is an open syllable - and an open syllable with a lax vowel cannot have any prominence in English, as correctly stated in Selkirk's general remarks.

In the approach I am proposing here, lexical representation contains maximal feature specifications of the segments pertaining to a form, on the condition that each maximally specified set of distinctive features must occur in at least one of the corresponding surface forms. In other forms, distinctive feature specifications may become predictable due to the newly surrounding segments, or due to higher-level phenomena. One of the latter is the prosodic structure, by which a [+tense] vowel becomes unspecified for [±tense] if it occurs in a form where it is neither an accent foot nor the strong syllable of a binary foot. According to a general markedness convention, it shows up as lax in the phonetic, or surface, representation. If occurring in a closed syllable at a prosodic word boundary, it is phonetically implemented as lengthened and perceived as having a secondary accent.

Accent alternations in English are relatively restricted, and there is a large amount of predictability, to be captured in terms of the strong - weak alternations within binary feet, and a possibility of having monosyllabic feet at word boundaries. The only characteristic which is not simply computable is the position of the main accent on stems and the capacity of affixes to affect it or not. This crucial point of the prosodic structure forms part of the lexical representation. All of the remaining regularities are predictable at the level of the phonetic representation. They can be formulated in terms of general rules, which can as such be kept out of the individual lexical representations.

This statement is not restricted to English. Vogel - Scalise (1982) have shown that an analysis of secondary accent in Italian does not necessitate reference to any foot assignment in the underlying representation, but can be stated rather by means of general rules regulating the strong - weak alternations, in addition to lexical marking of the main accent. In a different way, Malikouti-Drachman and Drachman's paper in this work-shop discusses regularities of the strong - weak alternations in

Dimotiki Greek in relation to the prosodic word and what they call 'the prosodic intonation', showing the general and automatic character of foot assignment in Greek as well.[1]

5. The prosodic word and its relation to the phonological word

The prosodic word has been defined by Selkirk (1980b: 570) as being constituted by a sequence of one or more feet or superfeet (a superfoot being a strong foot followed by a weak syllable in English, i.e. $\Sigma_s{}^{\Sigma'}\sigma_w$), joined in a right-branching structure. The domain of the prosodic word in English equals the simple non-branching stem and any stem affixes. There is a distinction between cohering and non-cohering affixes, and only the former form part of the prosodic word: the cohering affixes syllabify together with the stem, whereas the non-cohering ones do not. In English, *-ic* is a cohering suffix, and e.g. the prosodic word *rhythmic* is pronounced with a syllable-onset [m], whereas *-y* is an example of a non-cohering suffix, and e.g. *rhythmy* is pronounced with a syllable nucleus [m̩], as the prosodic word boundary directly following it, and preceding the *-y*, prevents the former from becoming a syllable onset.

Syllabification is consequently viewed as indicative of the domain of the prosodic word, within which prominence relations are operative. This statement, valid for English, does not hold for all languages, though. In Serbo-Croatian, for example, prominence relations have a domain which does not coincide with that indicated by means of syllabification. Syllabification treats prepositions and other proclitics (cf. below) as non-cohering, whereas prominence relations treat them as cohering. This can be seen from the occurrence of the falling tonal accents, in the standard language, bound to the initial syllable of the prosodic word (for a discussion of variation in this respect, see Gvozdanović 1985a), which in such cases occur on the proclitic, as illustrated below.

(6) Syllabification and prosodic word boundaries in Standard Serbo-Croatian:
ovcu 'a/the sheep, accusative', [ôvcu], is syllabified as [ôv-cu];
nad ovcu 'above a/the sheep, accusative', [nȁdōvcu], is syllabified as [nȁd-ōv-cu]

(with (ˆ) denoting the long falling tonal accent, (ˇ) denoting the short falling tonal accent, (¯) denoting vowel length, and (-), syllable boundaries).

In Serbo-Croatian, syllabification is consequently indicative of major morphological boundaries. It is indicative of the boundary between a proclitic and the following morphological word, but it is not indicative of the boundary between a morphological word and the following enclitic, as in the following example, where the proclitic does not syllabify with the following morphological word (and the sequence [ts] occurs with a boundary between its constitutive parts), whereas the enclitic does syllabify with the preceding morphological word (and a syllable onset [c] occurs corresponding to [ts] at a proclitic boundary).

(7) Syllabification and morphological word boundaries in Serbo-Croatian:
od sad se 'from now on itself', [òtsace], is syllabified as [òt-sa-ce]

(with (ˋ) denoting the short rising tonal accent).

True, some speakers of Serbo-Croatian simplify the situation by not syllabifying enclitics with the preceding morphological word either, but this cannot be considered the normal pronunciation rule.

If syllabification is not necessarily indicative of the prosodic word in every language under consideration, how can the prosodic word be defined then?

It obviously need not equal the morphological word, which can be isolated or separated from the remaining parts of the sentence without a change of the syntactic structure. As a language-specific matter, the prosodic word can comprise either more or less than a morphological word, or be equal to it.

A prosodic word comprises more than a morphological word if it includes clitics, which may be called 'bound morphological words', since they do not occur in isolation (i.e. they cannot form an utterance on their own), and can be separated from the remaining parts of the sentence only in a limited number of cases. As a language-specific matter, clitics are adpositions, short pronominal forms, auxiliaries, particles, and determiners at various levels. They have in common that they have no lexical accent marking of their own.

Some languages, such as Serbo-Croatian, distinguish between proclitics, which precede a morphological word with a lexical (i.e. inherent) accent marking, and enclitics, which follow the first constituent in a sen-

tence. This can be illustrated by example 7 above, where *od* is a proclitic, and *se* an enclitic. The Serbo-Croatian proclitics have less restricted placement possibilities, i.e. they are relatively free, in comparison with the enclitics. The proclitics are distinguished from the enclitics prosodically in that only the proclitics are accentable, for they may attract the accent from a following morphological word with a lexical marking for a tonal accent. In Serbo-Croatian, the tonal accent is a feature of morphemes, which can be erased when different morphemes are put together. This erasure means that a distinctive tone becomes predictable, i.e. unmarked, as a morpheme feature in combination with another morpheme. Due to a general markedness convention, the tone which is unmarked for [±rising] shows up as phonetically falling (for a justification of tone contours rather than levels, see Gvozdanović 1980: 24ff.). I have argued elsewhere (cf. Gvozdanović 1983 c: 79–80) that an initial falling tone which alternates with the rising tone in the lexical marking can in such cases be seen as unmarked for [±rising]. This absence of distinctive tone is equivalent, phonetically, to an initial falling accent, for this implements a preceding prosodic word boundary, which is always either high or rising in Serbo-Croatian, cf. Gvozdanović 1980: 99). If now a morphological word with an alternating falling tonal accent is combined with a proclitic, the prosodic word boundary is shifted to the left of the proclitic, which thus automatically acquires an initial falling tonal accent itself, due to the initial prosodic word boundary. As distinguished from the alternating falling tone, the nonalternating falling tone in Serbo-Croatian must be seen as distinctively [–rising]. This is responsible for a different retraction onto the proclitics, as illustrated below.

(8) The Serbo-Croatian tonal accents on the proclitics:
čaša 'a/the glass, nominative' [čȁša]
čašu 'a/the glass, accusative' [čȁšu]
u čašu 'into a/the glass' [ùčašu]
glava 'a/the head, nominative' [gláva]
glavu 'a/the head, accusative' [glâvu]
u glavu 'into the head, into one's mind' [ùglāvu]

(ˋ) denotes the short falling tonal accent, (ˊ) denotes the short rising tonal accent, (ˆ) denotes the long falling tonal accent, (´) denotes the long rising tonal accent, and (¯) denotes unaccented vowel length.

The proclitics differ from the enclitics also in that only the proclitics can be used contrastively and consequently bear the sentence accent

(whereas for the enclitics, only their corresponding full forms can be used contrastively). Whenever either a proclitic or the following morphological word is used contrastively, there is a prosodic word boundary between the proclitic and the following morphological word, so that we can speak of two prosodic words, as illustrated by (9b) below.

(9) Contrastive usage treats proclitics as separate prosodic words:
a. *bez čaše je* 'lit. without glass is, i.e. it is without glass' [bèščašēje];
b. *bȅz čaše je* 'lit. *without* glass is, i.e. it is *without* glass that it is' [bȅš čäšēje]

(Here (ˈ) denotes the sentence accent).

We can see that the neutral division into prosodic words can be overruled by the higher-level domain of sentence intonation and accent as expressing contrast.

If a morphological word with a lexical tonal accent marking of its own is not surrounded by clitics, then it either equals the prosodic word, or is larger than the corresponding prosodic word. As a language-specific matter, the prosodic word can comprise less than a morphological word in derived words and in compounds. In Serbo-Croatian, a compound consisting of a determinans and a determinatum forms a single prosodic word, whereas in other cases each stem with its suffixes, if any, forms a separate prosodic word, as illustrated by example (10) below.

(10) Prosodic analysis of Serbo-Croatian compounds:
crvena 'red, definite, feminine' [cr̂vena]
kapica 'hood, diminutive, feminine' [kȁpica]
Crvenkapica 'Little Red Riding-hood' [crvènkapica] (with a falling tonal accent of the determinatum retracted onto the determinans)
Jadran 'Adriatic' [jàdrān]
plastika 'plastic' [plàstika]
Jadranplastika 'name of a plastic factory, i.e. not a sort of plastic' [jàdrāmplastika]
radio 'radio' [râdi̯o]
tehnika 'technics' [tȅhnika]
radiotehnika 'radiotechnics' [râdi̯otȅhnika].

On the basis of examples (9) and (10) above we can conclude that the phonetic implementation rules specifiying voice and place assimilation in consonants are operative throughout a unit which can be defined as

equaling a morphological word with any surrounding clitics, irrespectively of its prosodic analysis. For Serbo-Croatian, the morphological word with the surrounding clitics can be called 'the phonological word'. It has a constant definition and it is independent of the prosodic word, which must be defined as the unit within which the prosodic phenomena are operative.

Serbo-Croatian is not an isolated case of a language distinguishing the prosodic word from the phonological one. A comparable example is Savo Finnish, where vowel harmony is operative throughout the phonological word and thus indicative of its domain (comparable to that in Serbo-Croatian), whereas the prosodic word, equaling the domain of the tonal phenomena there, is restricted to the syllable or syllables containing the first two vowels of the word (cf. Chelimskij 1977: 19).

Another example of non-coincidence of the prosodic and phonological word is found in Turkish. Like Savo Finnish, Turkish has vowel harmony which is operative throughout the phonological word. Prosodically, Turkish has bound accent at the end of the prosodic word, implemented by means of a pitch rise. The bound accent precedes certain morphemes, such as personal endings, even though they do undergo the vowel harmony rules, which make them belong to the same phonological word as the preceding morpheme, as illustrated by the examples given in (11) below.

(11) Turkish vowel harmony indicates the domain of the phonological word:
- if the vowel of the first syllable of a word is a back vowel, so are the vowels of subsequent syllables;
- if the vowel of the first syllable of a word is a front vowel, so are the vowels of the subsequent syllables;
- unrounded vowels are followed by unrounded vowels within the same word; and
- rounded vowels are followed by low unrounded or high rounded vowels.

gelirim 'I come'
geliyorum 'I am coming'
geleceğim 'pertaining to my future coming'
geleceğim 'I shall come'
adam idi / adamdi 'it was the man'
deniz 'sea'

alti 'its underside'
deni̲zalti 'submarine'
The bound accent is indicated by means of underlining.
In *ada̲mdi*, we have one prosodic word and one phonological word, whereas in *deni̲zalti*, we have one prosodic word and two phonological words.

We can conclude that the prosodic word is a level of the prosodic structure which is autonomous with respect to the grammatical structure, and must be defined for each language under investigation. The phonological word, on the other hand, is as a rule fully derivable from the grammatical structure (in the way outlined by Chomsky - Halle (1968: 368) already, but with language-specific elaborations). The prosodic and the phonological word may coincide as a language-specific matter.

6. Higher-level prosodic domains

Against the background of Chomsky - Halle's (1968: 366-367) discussion of the boundaries which characterize syntactic clusters created around a major lexical item, Selkirk (1980b) has offered the following definition of the phonological phrase:

(i) an item which is the specifier of a syntactic phrase joins with the head of the phrase;
(ii) an item belonging to a nonlexical category, such as Det, Prep, Comp, $Verb_{aux}$, Conjunction joins with its sister constituent.

Besides the nonlexical items, which show up as clitics, the phonological phrase comprises also the phrase specifiers, and it is here that the distinction between the phonological word and the phonological phrase comes in - in the languages where it is relevant. In French, for example, 'liaison', which is a case of morphologized sandhi reflected in the syllabification properties, appears to be operative within a phonological phrase (cf. Morin - Kaye 1982, and Booij in this volume) which is not distinguished from the phonological word. In Dutch, on the other hand, consonant voice assimilation occurs in a significantly higher number of cases within a phonological word than across word boundaries within a

phonological phrase (cf. Van Hooff - Van den Broecke 1983), though it remains to be seen whether the two domains are in fact different.

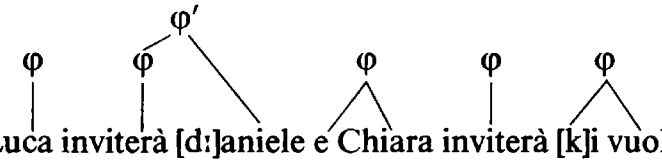
The phonological phrase is directly derivable from the grammatical structure, and the prosodic phrase is isomorphous with it, unless it is dictated by a contrastive sentence accent in a way parallel to the case of the prosodic word delimitation discussed above (see 5).

Besides the phonological phrase (φ), a derived phonological phrase (φ′) has been defined by Nespor - Vogel (1980) in order to capture both segmental and prosodic Italian sandhi phenomena, which occur obligatorily within φ and optionally within φ′:

> *φ* construction: join into a *φ* any lexical head (X) with all items on its non-recursive side with the maximal projection and with any other nonlexical items on the same side;
> *φ′* restructuring: a nonbranching *φ* which is the first complement of X on its recursive side loses its label and is joined to the *φ* containing X under a new node labeled *φ′*.

In example (12), the word initial consonant is doubled following the final accent of the preceding word if both words occur within a *φ* or *φ′*, but not across *φ′*.

(12) Italian sandhi ('raddoppiamento sintattico') according to Nespor-Vogel (1980):



'Luca will invite Daniele and Chiara will invite whoever she wants.'

The optional relevance of *φ′* to Italian 'raddoppiamento sintattico' is paralleled by its optional relevance to French 'liaison', which is conditioned sociolinguistically: 'liaison' can occur within the entire *φ′* in elevated French (cf. Morin - Kaye 1982: 294). Italian optionality must be investigated further.

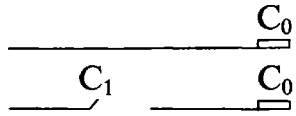
The concept of 'restructuring' in the case of *φ′* as compared with *φ*, which was taken by Nespor - Vogel to correspond structurally to the observed optionality, must be investigated further in regard to its triggering factors. This 'restructuring' may be conditioned either sociolinguistically or systematically, as due to the information structure and its contras-

tive value in the sentence, which is reflected in the sentence intonation. This systematic possibility is always present in a language, but it may be revealed either by means of intonation alone, as in non-elevated French (cf. Morin - Kaye 1982: 303), or additionally by means of sandhi, as in Italian.

(13) Intonation contours on a lexical head followed by its non-branching first complement on the recursive side in French (from Morin-Kaye 1982: 303):

apporte le lit 'bring the bed'

##apporte##le#lit##



(##) denotes a phonological word boundary, and (#), a morphological word boundary.

Intonationally, there would be φ' 'restructuring' in the upper example in (13) with a unifying intonation contour, and none in the lower example lacking a unifying contour. As Morin - Kaye point out, each phonological word in French can function as an intonational unit. This, however, has no bearing on 'liaison'.

We can conclude that in French, too, prosodic domains are autonomous with respect to the grammatical structure - though restricted by it. The prosodic domains in French have no bearing on 'liaison', which is a matter of morphological sandhi, but they do appear to coincide with the domain for 'enchaînement', which is a matter of phonological sandhi reflected by syllabification, which is operative throughout the φ'.

An example of phonological sandhi operative throughout an intonation unit - even across the boundaries of φ' - is found in the place assimilation of nasals to following consonants in Dimotiki Greek, which is discussed by Malikouti-Drachman - Drachman in this workshop (they refer to it as the 'prosodic intonation').

What is the intonation unit and how does it relate to the utterance? Selkirk (1980b) defines the intonation unit (I) as the domain over which an intonation contour is spread, and the highest level, the utterance (U), as the span between two pauses in connected speech. Both I and U are right branching.

Nespor - Vogel (1982: 231 etc.) have elaborated on the syntactic factors which are relevant to I and U construction as follows:

I construction

(i) any displaced syntactic constituents, parentheticals and non-restrictive relative clauses obligatorily form at least one I;

(ii) starting with the first φ/φ' of a sentence, join as many φ/φ' as possible into an I until either a) the end of the maximal projection of an N is reached, or b) another $\overline{S}$ begins; once such an I is formed, proceed in the same way until the end of the main sentence is reached; join any remaining φ's at the end of a sentence into an I;

U construction

join all I's in a root sentence (most generally the highest category of syntactic structure) into a U.

Following Wheeler's (1981) Branching and Prominence Constraint, by which right branching trees are labelled weak - strong and left branching trees strong - weak, independently of whether or not their nodes branch, Nespor - Vogel have established that prominence relations within I and U are predictable given the type of syntactic branching.

In spite of these correspondences, I and U are still not simply derivable from the syntactic structure, as can be concluded from their formulation of I restructuring, which runs as follows:

I restructuring

a) eliminate very short I's by joining them with adjacent I's;

b) eliminate very long I's by breaking them down into shorter I's.

Nespor - Vogel (1982: 234) write that they are not yet sure exactly what factors determine restructuring, and that these may include "other than strictly linguistic considerations (e.g. physiological limitations, perceptual strategies, stylistic considerations)". It is our task, though, to sort out the considerations which are linguistic in the sense that their presence invariably invokes a unifying intonation contour, whereas their absence invokes a break of the intonation contour, from other considerations which are either automatic or nonsystematic. This is a task for the future investigation of intonation units.

Urestructuring has been formulated by Vogel (this volume) as partly, though - according to the author - presumably not fully, dependent on the following factors:

U restructuring

adjacent U's may be joined into a single U when a) they are produced by the same speaker, b) they are directed to the same addres-

see(s), and c) there is a syntactic relation (ellipsis, anaphora), or a semantic relation *(and, therefore, because),* or a pragmatic relation between the U 's in question.

We can see that the term 'restructuring' in the context of φ', I, and U, refers to the relation between prosody and syntax, as these prosodic domains have originally been defined on the basis of syntactic units, but are apparently not in all cases derivable from them in a straightforward way.

An alternative approach to the higher-level prosodic domains would be to investigate their phonetic correlates in intonation and any other possible clues, such as pauses, and to relate these phonetic correlates to any semantic, syntactic or pragmatic factors which are associated with them in a constant way, and which do not occur in the absence of these clues. In doing this, one must keep in mind that syntactic factors are a formal relation means in a way comparable to intonation which is a prosodic relation means, and that linguistic investigation must relate these units of form to the corresponding semantic and pragmatic units of meaning.

A linguistic analysis which is based on the unity of form and meaning would speak of restructuring only if it can be shown that factors of the same type are involved in the construction of the higher-level prosodic domains and in their restructuring, so that the latter can be derived from the former. Further linguistic research is needed in order to show whether this is the case in the prosodic domains discussed above.

Concerning the relation between I and U, it can be seen that U is defined as a higher-level domain with respect to I. Further phonetic investigation of U must show whether it is in fact a higher-level I, characterized by a corresponding intonation contour.

Recent investigations of intonation show that intonation units can in fact be hierarchically structured. Martin's (1978) investigation of French shows that this is done by means of rises and falls of different amplitude. Termination of a major intonation unit is signalled by a [+amplitude] fall, whereas embedded intonation units within that major unit are terminated by a non-amplitude fall.

The elements of French intonation established by Martin (these are contours, their amplitude and timing) have parallels in other languages. In Dutch (cf. Collier - 't Hart 1978), amplitude seems to signal the hierarchy of intonation units, and timing with respect to the lexically accented syllable signals both predictable prominence given the syntactic

branching (of the type discussed by Nespor - Vogel 1982) and distinctive prominence on an I if the intonation rise or fall is early in the accented syllable, or it signals prosodic boundaries if the rise or fall is late.

Further investigation must establish meaningful correlates of the prosodic intonation units described above, which are hierarchically structured and as such related to the prosodic hierarchy which proceeds from I to U as the highest-ranking prosodic domains. The relevant formal intonation elements are obviously rises and falls, which open and close intonation units, respectively, and are further distinguished by their timing and/or amplitude. In addition to this, there is a phonetically predictable declination line showing what the extent of the U is (which is restricted by the sameness of the speaker and the addressee, but not, for instance, by sentence boundaries, as shown by Vogel in this volume).

7. Conclusions

Some of the prosodic domains distinguished by Kiparsky (1981: 245) and extensively discussed in this paper are fully derivable from the phonological and the grammatical structure, whereas others are autonomous. I propose to reserve the term 'level' only for the autonomous prosodic domains.

The prosodic domains which are derivable from non-prosodic levels, but which must be defined for each language under investigation, are: the syllable, the foot, and the prosodic phrase. The syllable is derivable by means of rules stating possible distinctive feature sequences provided grammatical boundaries are taken into account. The foot is derivable from the lexical accent marking, the segmental features of the syllable nuclei involved, and the prosodic word boundaries. Finally, the prosodic phrase is derivable from the grammatical structure.

The derivation rules of these domains which are fully derivable in terms of other levels of the language structure must be stated for each language under investigation. In other words, 'derivable' means 'analysable in terms of other units by means of a general rule'.

The segment, as a set of distinctive features, is a level of the phonological structure, referred to by the remaining phonological and prosodic domains.

The phonological domains are defined as the domains within which

various types of rules involving distinctive features are operative in such a way that they affect either locally neighboring segments or segments which are neighboring in a sequence based on the same dominating distinctive feature. An example of the latter is found in vowel harmony, which is linear within a distinctive feature dimension in the sense that it affects an entire vowel sequence (such that so-called 'neutral' vowels, due to a lack of feature specification, are transparent to such a generalization without stopping it). The phonological word and higher-level phonological domains are derivable from the grammatical structure.

The autonomous prosodic domains, or levels, are the prosodic word, the intonation unit (at least in some languages comprising the derived phrase φ'), and the utterance, which participate in a hierarchical structure.

The phonological domains are formally expressed by means of segmental sandhi phenomena (involving vowel harmony and various types of assimilations, or feature neutralizations). The prosodic domains are expressed by means of prosodic features and their sandhi phenomena (cf. Basbøll's contribution in this volume), which may be paralleled by segmental sandhi, depending on the language under investigation.

Sandhi thus formally indicates domains within which sets of semantic and relational features are put together in a language, either due to a grammatical unit with its possible hierarchy, or due to pragmatic organization of the information units in a speech situation.

Note

1. Unfortunately the workshop paper by Angeliki Malikouti-Drachman and Gaberell Drachman could not be included in this volume. (Editor's note.)

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