KontRI Working Paper No. 21

Is a rhythm-based typology possible?

A study of the role of prosody in phonological typology

Peter Auer
(Reprint of 1993)
Address of the author: peter.auer@germanistik.uni-freiburg.de

Table of contents

List of Figures

Is a rhythm-based typology possible?
A study of the role of prosody in phonological typology.

0. Introduction

This paper investigates the possibilities of a phonological typology based on rhythmic distinctions. It starts from the assumptions that (i) a phonological typology is possible at all and (ii) that such a typology ought to be based on prosodic phenomena. Given these assumptions, it will be asked if the basic parameter for a prosodic typology should be rhythm. The question will eventually be answered in the negative on empirical and conceptual grounds, and an alternative model will be proposed which centres on prosodic units instead of rhythm in the temporal sense.

Assumptions (i) and (ii), of course, may each be questioned. For instance, one could argue that phonological structure should (or can only) be derived from syntactic or morphological typological traits, and that therefore, phonological follows from syntactic or morphological typification automatically. If one favours such a derivative status of phonology in the typology of language, one has to show that the phonology of a language correlates sufficiently with its syntactic and morphological traits in order to make its major features predictable, and that these morpho-syntactic traits are more basic than phonological ones. In fact, there are obvious links between phonology and morphology; for example, it has been argued - most probably correctly

---

* Many thanks to Peter Gebert, who helped me to work through the grammars and phonologies that are the basis of this investigation. He as well as Aldo di Luizio and Betty Couper-Kuhlen also commented on prior versions of this paper which would contain (even) more mistakes than it does without their help. As a "Working Paper", the present version should be seen as preliminary. All criticsm and all comments are most welcome.

- that vowel harmony is a phenomenon of agglutinating languages, or that fusional languages have more morphophonological rules than isolating ones[1]. There may also be links between phonology and syntax, e.g. between head/modifier (operator/operand) serialization and the location of (sentence or word) stress. Although I do not wish to rule out the possibility of such links, I want to follow a more "modular" approach here in which phonology is first of all taken to be sufficiently (though certainly not entirely) independent from syntax and morphology to warrant a typology of its own. It appears to be useful to try to classify the languages of the world in a meaningful way on the basis of the makeup of their phonologies without taking into account their syntactic or morphological classification; later steps will be necessary to compare phonological with other classifications and in order to get a conceptual hold on convergences and divergences.

The second assumption, i.e. that prosody is so central to phonology that it is more fruitful to look for basic typological traits in this area and to treat other phenomena as secondary or derived, than to look for segmental basic traits, implies a shift away from structuralist approaches to phonological typology primarily based on segment inventories. Prosody in the sense of this paper comprises the chunking of sounds or phonemes into larger units such as morae, syllables, phonological words, intonational phrases, and the supra-segmental processes defined relative to these units. In particular, the focus of this paper will be on rhythm, i.e., the temporal patterning of units such as syllables and phonological words, and the distribution of phonetically more and less emphasized elements within them.

Theories of phonological typology are rare. Of course, the languages of the world have long been classified according to dichotomies such as tone vs. accent, Druckakzent vs. musikalischer Akzent, iambic (=Romanic languages) vs. trochaic (Germanic languages), or syllabic vs. moraic[2]. As long as these dichotomies are not shown to correlate with other phonological features, however, they fail to reach typological relevance. In the few theories of phonological typology that go beyond classification, rhythm has played an important role (cf. the discussion in section 2 below). In particular, the well-known distinction between syllable- and stress-timed languages has been made the basis of some serious attempts to devise prosodically based typologies. This distinction is therefore the starting point for the present paper.

In the first section the (genuinely phonetic) distinction will be remodelled as a (partly) phonological one in order to be useful for typology. In the second section, some attempts to base

---

[1]Cf. e.g Lehmann (1973). Lehmann indeed treats phonology as a derivative of syntax (OV/VO) and morphology (agglutination). Simple syllable structure (particularly, open syllables), vowel harmony and pitch accent are seen as characteristics of agglutinating, OV languages. He has, however, no explanation to offer for this factual co-occurrence.

[2]Cf. Trubetkoy (3./1958)

a typology on such a redefined notion of syllable- vs stress-timing will be reviewed, with some passing remarks on other prosody-based phonological typologies. In section three I will look at some genetically closely related language pairs (Italian/Portuguese, Uzbek/Turkish, Classical Mongolian/Khalkha, English/West Indian Creoles) and analyze them in terms of the phonologically redefined notion of syllable-timing vs. accent-timing in order to give an initial glimpse at the attractiveness of such a typological model. Section four contains some remarks on phonological typology in general and on the empirical basis of the study presented in section five. Section five contains the results of an investigation on the correlation of a number of phonological traits derived from the model in a preliminary sample of 34 languages, representing the major language families of the world. Finally, section six will draw some conclusions from this study and present a revised model for future research.

1. Syllable-timing vs. stress-timing from a phonological point of view

In his "Elements of General Phonetics", Abercrombie (1967:96f) has proposed the strongest version to date of a statement concerning linguistic rhythm in what is known as the isochrony hypothesis. He contends that all languages of the world are rhythmically isochronous, and can be classified as either "stress-timed" or "syllable-timed" according to the way in which their rhythm comes into being:

> Although hesitation and other pauses tend at times to disguise the fact, all human speech possesses rhythm. (...) Rhythm in speech as in other human activities, arises out of the periodic recurrence of some sort of movement, producing an expectation that the regularity of succession will continue. (...) There are two basically different ways in which chest-pulses and stress-pulses can be combined, and these give rise to two main kinds of speech-rhythm. As far as is known, every language in the world is spoken with one kind of rhythm or with the other. In the one kind, known as a syllable-timed rhythm, the periodic recurrence of movement is supplied by the syllable-producing process: the chest pulses, and hence the syllables recur at equal intervals of time - they are isochronous. (...) In the other kind, known as a stress-timed rhythm, the periodic recurrence is supplied by the stress-producing process: the stress-pulses, and hence the stressed syllables, are isochronous. (...) When one of the two series of pulses is in isochronous succession, the other will not be. Thus in a syllable-timed rhythm, the stress-pulses are unevenly spaced, and in a stress-timed rhythm the chest-pulses are unevenly spaced." (Abercrombie 1967:96f, emphasis p.a.)

Although the distinction between syllable- and stress-timed languages as suggested by Abercrombie (and before him, e.g. by Pike 1945) has engendered a considerable amount of phonetic work, this work has remained inconclusive up to the present day. It seems that in purely phonetic terms, the hypothesis is difficult to verify (cf. Auer & Uhmann 1988, Lehiste 1977, den Os 1983 and Bertinetto 1988 for overviews on past and current phonetic research).

Abercrombie himself gives six languages as examples - French, Telugu (a Dravidian language) and Yoruba (a Kwa language) for the syllable-timed type, Russian, English and Arabic for the

stress-timed type. Measurements were carried out on these languages by Roach (1982) in samples of quasi-spontaneous speech.

According to Abercrombie, syllable duration should be subject to more variability in stress-timed languages than in syllable-timed languages, for if the duration of the foot is to remain constant, it follows that syllable duration has to vary in function of the number of syllables contained in a foot. Fig. (1) shows Roach's results in testing this prediction:

(Fig. 1) *Standard deviations (ms) for syllable duration in selected languages (Roach 1982:74)*

French:	75.5	English:	86
Telugu:	66	Russian:	77
Yoruba:	81	Arabic:	76

It is easy to see that Abercrombie's distinction is not supported by the measurements. Although the highest deviation was found in English, and the lowest in Telugu (both in accordance with the hypothesis), the other four languages show standard deviations of equal magnitude.

A second prediction following from Abercrombie's definition of syllable- vs. stress-timing is that the duration of the foot should vary to different degrees in the two groups of languages: deviation should be significantly higher in syllable-timed languages than in stress-timed languages, for only in the latter case will syllable compression compensate for larger numbers of syllables in the foot. Again, Roach's measurements (which were carefully controlled for tempo changes, position of the foot in the intonation phrase, and final lengthening) did not yield any support for Abercrombie's hypothesis.[3] On the contrary, more variability was found in stress-timed languages than in syllable-timed languages:

[3]Roach measured the duration of each tone group without prehead and tail; the duration was divided by the number of feet in order to reach the ideal isochronous interval, which was then compared with the actual durations of feet.

(Fig. 2) *Mean deviations of foot duration (ms) from predicted value in selected languages (Roach 1982)*

French:	617	English:	1267
Telugu:	870	Russian:	917
Yoruba:	726	Arabic:	874

If we accept Roach's methodology, Abercrombie's hypothesis must be regarded as refuted, at least as far as his six examples are concerned.[4] However, instead of arguing on the phonetic level for or against Abercrombie's hypothesis of isochrony, a different line of reasoning is possible according to which syllable- and stress-timing must be regarded as constellations of phonetic and phonological (and possibly even morphonological) features, which, taken together, define the rhythm of a language. Contrary to Abercrombie, the two types of languages are then characterized by a set or network of parameters instead of only one (duration), and the distinction is transferred from the purely phonetic to a mixed phonetic and phonological level.

The parameters defining prototypical syllable- and stress-timed languages can be arrived at deductively from the assumption that languages will either tend to keep the syllable or the foot/ phonological word constant in duration. Together, the parameters provide a testable model of stress-timing and syllable-timing. "Duration" may be understood phonetically (as in the traditional conception of stress- and syllable-timing) or, more importantly, phonologically. In the latter case, durational constancy is equated with constancy according to some metric such as morae, CV- or x-slots within the domain of the syllable or the foot. However, as the "foot" is a prosodic category of relatively little phonological interest and of primarily phonetic motivation (defined as the interval between one phonetically emphasized syllable up to the beginning of the next; cf. below, p.110), it is useful to complement it on the phonological level by the prosodic category "phonological word" (defined, e.g. in English, as the morphological simplex including clitics, i.e. as the "rhythmic group"). With these definitions in mind, the distinction between syllable- and stress-timing can now be redefined. It should be remembered that we are explicating a deductive model the empirical status of which is not yet at stake.

A first feature of stress-timing languages is an immediate consequence of their tendency to keep the duration of the foot/word constant. Although a number of different 'strategies' are available to reach this end, an important one surely is that, compared with accent syllables, non-accented syllables are reduced. This reduction may be phonetic and/or phonological, depending on

[4] On closer inspection, Roach's way of proceeding is not entirely unproblematic; in particular, he disregards the so-called P-centre effect in his measurements, which may therefore be biased. One may also object that his texts were picture descriptions, and that he used one native speaker of each language only. It may bei the case that such a task, which requires a high degree of cognitive work, may show less rhythmicity than other verbal genres.

whether we think of phonetic or phonological duration. Phonetically, non-accented syllables tend to have central or massively centralized, short vowels; phonemically, they permit fewer contrasts than accent syllables, i.e. there is "neutralization". In particular, long phonemic segments (long vowels or geminate consonants) will not be allowed in non-accented syllables, as they would enhance the quantitative differences between mono- and polysyllabic words. A perceptual correlate is this: since in a stress-timed language stress guides the listener to syllables of perceptual and cognitive prominence, a maximum of information tends to be concentrated in these syllables. For this reason, the maximum of phonemic contrasts will be found in these syllables. In contradistinction, in a prototypical syllable-timing language, accented and non-accented syllables are treated much the same; there is no phonemic reduction, and phonetic reduction is comparatively small.

If syllables are to carry tone, they are best suited for this purpose if their sonority is high, i.e., if they have no reduced, but full vowels. Only syllable-timing is therefore (prototypically) compatible with tone-assignment to all syllables. (Tone may occur in a stress-timed language as well if it is assigned to stressed syllables only. This is compatible with the observation that in such a language, stress will mark syllables of maximal informational value.) Another reason for the correlation between syllable-timing and tone may be the fact that stress-timing languages tend to realize accent phonetically by pitch movement; were the same languages to exploit pitch movement for lexically distinctive purposes, the saliency of this cue would be diminished by functional overload.

The tendency of syllable-timed languages to keep syllables at a constant phonetic duration also has repercussions on the level of inventory traits. Some phonemes are intrinsically shorter than others. In particular, central or devoiced vowel phonemes are of less duration than non-central, voiced phonemes. For this reason, these phonemes should not occur in syllable-timed languages which tend to keep syllable duration phonetically constant.

Another important difference between stress-timing and syllable-timing languages concerns syllable structure. In a language which strives to keep syllable duration (in phonetic or phonological terms) constant, phonemic and phonetic syllables should be of a very restricted type. In particular, as more complex syllable structures imply the existence of simpler ones, and as coda consonants are more relevant for (phonemic) syllable weight and phonemic duration than onset consonants[5], simple syllable structure is to be expected, particularly in the consonantal coda; open syllables should be dominant. As phonological words in a prototypical syllable-timed language are composed of CV syllables only, no intervocalic consonant clusters will occur. As a consequence, no assimilations between consonants will be observed; as

[5]Cf. Auer (1991:11-16)

vowel-to-consonant assimilations are more often regressive than progressive within the syllable, maximizing CV syllables will also minimize contexts for such assimilations. Syllable division is unambiguously CV&CV, etc., and the syllable is easily discernable as a unit. Its simple and repetitive structure is the same in all kinds of syllables, regardless of their position in the word.

In a stress-timed language, the situation is very different. The total reduction (deletion) of non-accented syllables as well as morphological processes will give rise to consonant clusters in the onset and particularly in the coda of accented syllables and/or words. Phonemically, these clusters do not necessarily obey the universal sonority hierarchy (stops < fricatives/affricates < sonorants < glides). On the other hand, it will also be observed that difficulties in articulating these clusters lead to assimilations (lenitions), and that perceptual difficulties lead to dissimilations (fortitions). Thus, complex syllable structures may give rise to "natural" processes of simplification.

Given the potential complexity of the accent syllable in stress-timed languages, syllable division in the phonological word is notoriously difficult. These difficulties are enhanced by the fact that accent syllables tend to attract (some of) the consonants of the neighbouring non-accented syllables in variable ways with increasing rate of speech (tempo). Syllable division therefore is not only ambiguous, for the resulting intervocalic clusters can be syllabified in more than one way, it is also variable. Boundaries between accented and non-accented syllables are also blurred by the fact that single intervocalic consonants (particularly after short accent vowels, where they are ambisyllabic) are weakened and occasionally deleted. Again, there are repercussions to be expected for the phonemic inventory of a language: ambisyllabic single consonants are consistent with the ambiguous syllable division of accent-timed languages, while geminates, implying non-ambiguous syllable division, are consistent with syllable rhythm.

As a means to mark the primary prosodic unit, initial and final consonants of a phonological word ("rhythmic group") may be strengthened in a stress-timed language phonetically by means not available in intervocalic position, e.g. by aspiration, tensing, (pre-) glottalization, etc. There is therefore a marked difference between word-final and word-initial position on the one hand, and word-medial position on the other hand. In a language with syllable-timing, no such difference will be found; resyllabification will occur across word boundaries, sandhi processes (if any) will be identical within and across words. Thus, while syllable division is difficult in stress-timed languages, word division is difficult in syllable-timed languages.

Another feature of syllable-timed languages appears to contradict the account given so far since it is a word-related phenomenon: only prototypical syllable-timed languages have vowel harmony in order to mark word boundaries. However, vowel harmony (which must be distinguished from umlaut) is not a purely phonological phenomenon. The domain of vowel harmony is not the phonological, but the morphological word. (There are usually morphological

exceptions or neutral morphemes.) Moreover, the spreading of vowel features across syllables is at odds with vowel reduction and centralization in non-accented syllables. Vowel harmony is a phonological process relating to the morphological word in syllable-timed languages, whereas vowel reduction is a phonological process relating to the phonological word in stress-timed languages. (Clitics accordingly undergo vowel reduction in the second type of language, but they do not undergo vowel harmony in a syllable-timed language of the prototypical kind.)

A final group of characteristics that differentiate syllable-timing and stress-timing is the nature of accent. In order to give a clear shape to the phonological word (phonologically), and in order to demarcate foot boundaries (phonetically), accent has to be realized phonetically very distinctly in stress-timing languages, i.e., there must be a phonetically strong emphasis. Phonetic correlates are usually pitch movement, duration and loudness. The ictus position within the phonological word is often not stable, but relatively flexible. It may either be governed by phonological conditions (e.g., the distinction between strong and weak syllables), or by morphological rules (due to diachronic obscurations of syllable make-up, which in turn are a consequence of vowel deletions and loss of unaccented syllables), or it may be lexical. In the latter two cases, accent takes on important signalling functions in the grammar or the lexicon of the language. Rules of accent placement are typically very complex. In a prototypical syllable-timed language, on the other hand, accent plays a small role. Phonetically, it is realized only weakly. Its placement in the word is stable; it is often difficult to distinguish from phrasal accent. It does not serve any morphosyntactic function and is useless for lexical storage.

Given this phonological reinterpretation, the six languages mentioned by Abercrombie as examples for stress-timing (English, Arabic, Russian) and syllable-timing (Yoruba, Telugu, French) can now be judged again by their distance from the prototypes of stress-timing and syllable-timing.[6] The results are tabulated in (3):[7]

[6] A methodological problem results from the fact that Abercrombie does not state which variety of Arabic he is referring to. Here, Standard Arabic (Kästner 1981) as well as the dialects of Morocco (Harrell 1962), Egypt (Harrell 1957, Mokhtar 1981) and Srā (Kouloughi 1978) were mainly taken into account.

[7] For a more in-depth analysis of the six languages regarding their phonological characterization see the discussion in section 5. Bracketed information refers to ambivalent cases; '?' means that not enough information is available or that available information is inconclusive or contradictory; '-' means that the question does nott apply.

(Fig. 3): Abercrombie's sample reanalyzed

	Yoruba	Telugu	French	Arabic	Russian	English
1. reduced vowels in non-accented syllables	no	no	marginal	no	yes	yes
2. quantity distin-ctions in all syllables	yes	yes	no	(no)	-	-
3. tone	yes	no	no	no	no	no
4. maximal syllable shell complexity	CV	CVC	CC...CC	CCVCC	CCC... ...CCCC	CCC... ...CCCC
- sonority scale followed in clusters?	-	yes	mostly	no	no	no
- rules to enhance CV-structure	-	-	yes	?	(some)	no
- rules to create closed syllables or consonant clusters	no	yes	yes	yes	yes	yes
5. assimilation	no	some	some	yes	yes	yes
6. syllable division unambiguous?	yes	yes	yes	yes	no	no
7. word accent?	no	yes	no	yes	no	no
- phonologically determined?	-	yes	-	yes	no	in part
- grammatical function	-	no	-	no	yes	yes

The synopsis shows that there is no clear-cut distinction between Yoruba, Telugu and French as candidate syllable-timed languages on the one hand, and English, Russian and Arabic as candidate stress-timed languages on the other hand. Only Yoruba represents the prototype of syllable-timing, and English and Russian that of stress-timing. The other languages are non-prototypical. A more detailed analysis reveals that there is a continuum between these prototypical extremes, from Telugu, which is closer to the syllable-timed prototype, via French (which is syllable-timed with tendencies towards stress-timing), to Arabic, which is a non-prototypical stress-timed language.

Telugu deviates from the prototype in distinguishing between light and heavy syllables and in making accent placement dependent on this distinction; it also has more complex syllables than Yoruba and some rules that create closed syllables. Arabic has medium complex syllable structure with little ambiguity as to syllable division and no vowel reduction due to accent placement; on the other hand, there are frequent assimilations in consonant clusters and

important rules of vowel deletion that create sequences of consonants; these frequently disobey the sonority scale. Arabic also has a phonetically strong accent assigned by phonological rule and disprefers long vowels in non-accented position. This justifies its classification as a non-prototypical stress-timed language.

Most difficult to answer is the question of where French belongs.[8] On the one hand, Modern colloquial French ("français avancé") increasingly tolerates phonetically complex syllables, particularly in the onset and in pre-pausal (phrase-final) position, and particularly in more colloquial varieties, and it has a schwa-vowel which occurs in non-accented syllables only, although the overall degree of phonetic reduction of full vowels in non-accented position is minor. On the other hand, *liaison* and *enchaînement* favour open syllables, syllable division is largely unambiguous as a consequence, and there is no word accent independent of phrasal accent. This justifies its classification as non-prototypically syllable-timed.

As this quick look at Abercrombie's six languages shows, the revision of the stress-timing/syllable-timing distinction in terms of clusters of phonological (and phonetic) features culminating in two prototypes to which languages may correspond more or less closely seems to make sense. It captures Abercrombie's (and others') intuitive feeling for rhythmic differences between languages, although these cannot be pinpointed by durational phonetic measurements as such.

The phonological traits we have associated by deduction with syllable-timed and stress-timed languages are summarized in Fig. (4) for convenience (cf. next page).

2. Prosodic typologies: a review

Before this model for a rhythm-based typology is tested empirically, some other attempts that have been made in order to set up a prosodic typology will be reviewed in this section.

An early attempt at a prosodically based typology was proposed by Sommerfelt (1928). He takes the difference between accented and non-accented syllables as the starting point: some languages (such as Norwegian) show a strong distinction between syllables with "l'émission forte du souffle" and others that are "affaibli et lâchement articulé"; in other languages (such as French), accented and non-accented syllables differ less.[9] While non-accented vowels are reduced in the

[8] In fact, the rhythm type of French has been a matter of dispute for some time; cf. Wenk & Wioland (1982).

[9] It should be added that this distinction was not Sommerfelt's invention but goes back, at least, to Passy (1891: 63)

first type of languages, they are only shortened (and possibly raised) in the second type. Further characteristics derived from this basic parameter are, according to Sommerfelt, the direction of assimilation (in languages with 'strong stress', the accented syllable is active/assimilating, the non-accented syllable passive/assimilated, while the direction of assimilation is ambiguous in languages with 'weak stress'), dissimilation and vowel harmony (which he seems to associate with 'strong stress'). These derived parameters are unclear however, and empirically hardly convincing.

Of the modern prosody based typologes, two directly address matters of linguistic isochrony, one by Donegan & Stampe (1983), another one by Dauer (1987).

(Fig. 4): Syllable-rhythm vs. word-rhythm: first version

syllable-rythm	**word-rhythm**
no accent-dependent reduction	reduction of non accented syllables in quality and/or duration
[±long] in consonants and vowels of all syllables possible	no [±long] distinction in non-accented syllables
tone possible	no tone (or non accented syllables are “neutral”)
simple syllable structure open syllables	complex syllable structure, sonority scale disobeyed
few assimilations	frequent assimilations, dissimilations
syllable division unambiguous	syllable division ambiguous and variable
no word-related phonological processes	word-related phonological processes
external = internal sandhi	external ≠ internal sandhi
vowel harmony possible	no vowel harmony
phonetically weak word accent or none at all	phonetically strong word accent realized by pitch (and other prosodic features)
word accent (if any) fixed, no grammatical functions	word accent assigned by complex rules referring to syllable structure, partly morphologized, or free, may have grammatical functions
geminates possible	no geminates
no central (“reduced”) vowel phonemes	central vowel phonemes possible

2.1. Donegan & Stampe (1983)

Possibly the best-known attempt to devise a prosodic typology which includes the (phonologically revised/reinterpreted) distinction between stress-timing and syllable-timing comes from Donegan & Stampe (1983). (I will use their terms word-rhythm and syllable-rhythm from now on instead of "stress-timing" and "syllable-timing" in order to underline the phonological, multi-parametrical approach, and to distinguish it from a purely durational, phonetic one.) In a short paper, they compare two language families in southeast Asia, Munda and Mon-Khmer; working with one representative of each (Sora and Khmer respectively), they reach the conclusion that the Munda languages have syllable-rhythm, whereas the Khmer languages have word-rhythm. (It is mentioned by the authors in passing - cf. p. 345 - that the other "languages of India", the Uralic languages and early Indo-European also have syllable-rhythm, whereas "other languages of SE Asia, Germanic languages, Portuguese, Old French, etc." have/had word-rhythm, but no evidence is given for this classification.) The two rhythm types are part of a more comprehensive typological system which also includes syntax and morphology.

Donegan and Stampe's typology is based on sychronic and diachronic facts. On the other hand, classification of a language is categorical, i.e., no provision is made for intermediate cases. Both features are noteworthy and will be discussed below.

According to Donegan & Stampe, word-rhythm and syllable-rhythm languages display the phonological/phonetic/prosodic properties summarized in Fig. (5). (Their syntactic and morphological correlates are not included here.)

(Fig. 5) Syllable-rhythm vs. word-rhythm: Donegan & Stampe (1983)

syllable-rhythm	**word-rhythm**
falling phrasal accent	rising phrasal accent
word accent left, enclisis	word accent right, proclisis
iso-syllabic or iso-moraic	iso-accentual
long phonological words	short words
vowel harmony, no reduced vowels	reduced vowels in non-stressed syllables
no diphthongization, no [+lax] vowels	stressed vowels may be [±lax], tend to diphthongize
nasalization of vowels due to NC simplification in rhyme	no nasalization + loss of nasal
no back unrounded or central vowels	back unrounded or central vowels
no unreleased consonants	unreleased consonants as boundary markers of words
(C)V(C)-syllables, liaison	(C)V (unstressed) or (C)(C)V(G)(C) (stressed); no liaison stressed syllables tend to be heavy
no anacrusis possible	deletion of anacrusis syllables, aphaeresis leading to onset clusters
geminates possible	geminates impossible
[±voice] is phonemic in stops	assimilations, dissimilations, particularly aspiration and devoicing in clusters
level tone (if any)	contour tone and/or voice register
alliteration as literary technique	rhyme as literary technique

As the inclusion of isochrony in this list (isomoraic or iso-syllabic for syllable-rhythm, iso-accentual for word-rhythm) shows, the model is closely related to the stress- vs. syllable-timing distinction. However, isochrony is not central to the model. Instead, Donegan & Stampe suggest finding the basic parameter in the location of "phrasal accent", which may be close to the left or to the right margin of the phonological phrase, according to language type. The location of phrasal accent is, in turn, linked to syntax in their model: falling (leftward) phrasal accent is taken to be a reflex of modifier-modified (head-last) serialization in syllable-rhythm languages, whereas rising (rightward) phrasal accent is taken to be a reflex of modified-modifier (head-first) serialization in word-rhythm languages. (The bridge between syntax and prosody/phonology is the given/asserted (new) distinction, with modifiers generally representing asserted/new information, modified elements given information.)

Obviously, there are important differences from the model summarized in Fig. (4). First of all, Donegan & Stampe's basic parameter (left vs. right phrasal accent) does not even play a role in

our 'first version', and there are other cases where Donegan & Stampe make much stronger claims. For instance, the typology of Fig. (4) does not make any predictions as to the placement of word accent (stress), enclisis vs. proclisis, laxness/tenseness of vowels, diphthongization, the phonological feature [±voice], voice register, and the phonological means employed in poetry. In at least one case, there is even a clash between the predictions made by the two models: Donegan & Stampe allow contour tones in word-rhythm, whereas the model of Fig. (4) disallows all kinds of phonemic tone for this language type if tone is assigned to each syllable (not only to accent syllables, or phonological words as wholes).

The problems with Donegan & Stampe's model are both theoretical and empirical. On the theoretical level, the basic parameter "phrasal accent" seems quite problematic. Donegan & Stampe argue that the pragmatically most salient parts of a grammatical phrase should be marked in some way or other by phonetic prominence (p. 340). It can be maintained (although that pragmatic distinction is not without problems either) that most salient information is "new" (as opposed to "given") information. This means that new information should be emphasized by prosodic means. The problem arises as soon as syntax enters. Here, Donegan & Stampe make use of Vennemann's operator/operand (modifier/modified) distinction.[10] The idea is that modifier/modified languages place new information before given information, and therefore have "falling" phrasal accent, whereas modified/modifier place new information after given information, and therefore have "rising" phrasal accent. However, there are problems in the definition of "modifier" ("operator") and "modified" ("operand") in this theory, as has been shown by Keenan (1979) and Hawkins (1983:37ff). According to Vennemann's initial version of his principle of natural serialization (Vennemann 1974:347), operands are defined syntactically as the heads in operator/operand constructions, and at the same time also semantically by the fact of being modified by operators. However, the semantic and syntactic criteria do not always concur, most dramatically in the case of objects and subjects: under a specific, model-semantic point of view, they are arguments of the (verbal) predicate, i.e., they are 'modified' by the verb. On the other hand, the verb is surely the head of the sentence. Thus, whereas the verb would be the operator in semantic terms, it must be classified as the operand in syntactic terms. Because of such difficulties, Vennemann has confined his theory to syntax in later publications (e.g., Vennemann 1976). However, for Donegan & Stampe, the semantic part of the definition is essential, for it is via semantics that the model ties up with the pragmatic distinction between given and new information, and therefore with accent placement. If it is impossible to give such a semantic definition, then the operator/operand distinction also loses pragmatic ground, and consequently cannot be linked to accent placement.

[10] Cf. Vennemann (1973), 1976).

This is easy to see on the sentence level[11], where Donegan and Stampe's approach leads to highly implausible predictions when the order of constituents is included. From Vennemann's equation of SOV with modifier/modified (and SVO/VSO with modified/modifier), and their correlation of modifier/modified with falling sentence stress (and of modified/modifier with rising sentence stress), i.e.

modified/modifier	modifier/modified
SOV	VSO/SVO
falling sentence stress	rising sentence stress
new information first	new information last

it follows that the verb carries new information in SOV or VSO languages, but that it is the subject in SVO languages - a very unlikely claim.

As soon as one drops the parameter "phrasal accent", the parameter "word accent", which is derived from it (words can occur as phrases, therefore the location of accent in the two domains should not be contradictory), loses much of its justification. Not all of it, though, for Donegan & Stampe also point out that prefixation (coupled with VSO/SVO) goes together with final word accent, whereas suffixation (coupled with SOV) goes with initial word accent. The argument is that (given the coincidence of prosodic prominence and pragmatic salience) grammatical morphemes are less "important" than lexemes; for this reason, the latter are stressed. However, the argument is not conclusive. It does not seem correct to assume that languages must have either initial or final word stress: *tertium datur*, as there may be no (or no clearly discernable) word stress, or a highly flexible one depending, e.g., on syllable structure.[12] (See below, section 5.3., for further discussion.)

Other deductive weaknesses in Donegan & Stampe's model concern their hypotheses on segment inventories and phonological features. For instance, their claim that word-rhythm languages have no voicing distinction seems to derive from the assimilative tendencies assumed to occur in consonant clusters in this phonological type (p. 347). But for the phonemic distinction of voicing to disappear entirely because of the assimilative tendencies in clusters, one would have to postulate that obstruents only occur in clusters (and that they are both regressively and progressively assimilated to their neighbouring segments, which should never be obstruents themselves). According to their model, however, consonant clusters are only *frequent* in word-rhythm languages. Yet, as long as CVC (or CV, or VC) syllables are possible, there is no reason why the phonemic voicing distinction should not continue to be used in a language, even

[11]Not *all* phonological phrases are grammatical sentences, of course; however, "sentence stress" sureley is *one* instantiation of Donegan & Stampe's phrasal accent.

[12]Of course, there will be phasal accent on a word uttered as an intonational phrase.

if it is neutralized in cluster positions.

Similar problems emerge in the treatment of tones. Contour tones are said to occur in word-rhythm languages because their heavy (stressed) syllables "have a two-beat duration" (p. 346), whereas level tones are associated with the "one-beat" syllables of syllable-languages (p. 348). If the distinction between one-beat and two-beat duration makes any sense, it must be equated with bi-moraic and mono-moraic syllables, i.e., it must state that contour tones need two morae for association, whereas level tones need one mora only. This would imply that syllable-rhythm is characterized by monomoraic syllables, whereas word-rhythm alternates between bimoraic stressed syllables, and monomoraic non-stressed syllables. Yet, Donegan & Stampe also claim that only syllable-rhythm is compatible with mora-counting. Now mora-counting (in the sense of iso-moraic temporal structuring) is defined by equivalences such as (C)VV ≈ (C)VC and CVCV CVV, i.e. it is only possible to speak of isomoraic rhythm in a language which has long (bimoraic) and short (monomoraic) vowels (such as Japanese) at all - otherwise all syllables would be of equal duration, and isomoraic rhythm could not be distinguished from isosyllabic rhythm. Thus, both mora-counting and contour tones presuppose the distinction between bi- vs. monomoraic syllables, yet one is associated with syllable-rhythm, and the other with word-rhythm by Donegan & Stampe.

On the empirical side, each of the correlations predicted by Donegan & Stampe would need to be tested. However, an initial glimpse at possible problems can already be gained from a look at two languages not investigated by the authors, but also members of the Munda and Mon-Khmer language families, respectively. As mentioned already, most of Donegan & Stampe's examples are from Sora (for the Munda group) and Khmer. If one selects another pair, i.e. Mundari as a representative of the Munda languages and Vietnamese as a representative of the Mon-Khmer group, applying Donegan and Stampe's characteristics results in Fig. (6) (characteristics which run counter to prediction are italicized and underlined):[13]

[13]Sources used for Vietnamese were Thompson (1965), Liem (1970); for Mundari Sinha (1975), Cook (1965).

(Fig. 6): Application of Donegan & Stampe's model to Mundari (syllable-rhythm) and Vietnamese (word-rhythm)

Mundari	**Vietnamese**
pragmatic sentence stress	rising sentence stress
no word stress	*no word stress (only monosyllabics)*
iso-syllabic, long words	*iso-syllabic*, monosyllabic words (but: numerous compounds)
vowel harmony (restricted)	*no reduced vowels*
two diphthongs (/ai, au/)	many more diphthongs
no back unrounded vowels	back unrounded (central) series
unreleased final consonants	unreleased final consonants
(C)V(:)C syllables	*C(w)V(V)(C) syllables*
no onset clusters	*no onset clusters*
no phonemic geminates	no phonemic geminates
[±voice] phonemic in stops	no [+voice] stops
no tone	contour tone + register

It is not difficult to see that there are considerable divergences from the model. Mundari comes close to the prototype of a syllable-rhythm language in many ways. However, both the prediction concerning sentence stress (phrasal accent) and that concerning word stress do not hold. Given the theoretical problems surrounding these claims mentioned above, this is of little surprise. Vietnamese, however, certainly does not meet Donegan & Stampe's requirement for a word-rhythm language. It is true that many of the divergences from the predicted type can be explained historically. At a former stage in its development, Vietnamese had plurisyllabic (prefixed) words with final accent, and reduced vowels in non-accented syllables; these anacrusis syllables were lost entirely. Onset clusters were also lost after complete assimilation, so that the language now has a relatively simple syllable structure (hardly more complicated than that of Mundari). In the phonologies consulted, the rhythm of Vietnamese was explicitly called "syllabic", i.e. each syllable tends to have equal duration.

A methodological question must be asked here: may diachronic evidence be used for typological classification? It seems that the answer must be "no", unless we wish to neutralize the distinction between genetic and typological classification. As soon as diachronic arguments are taken into consideration, languages relating to the same proto-language cannot diverge typologically. The procedure rules out any non-genetical cross-classification. (Although there are arguments against

the use of diachronic information for the typological classification of a language, the converse usage of typology in the explanation of language change or "drift" is entirely unproblematic; indeed, one would expect phonological types to indicate the directions in which a language might move, language-external conditions on language change being constant; cf. section 3 below. In this sense, Vietnamese can be said to be in the state of moving/ having moved from word-rhythm towards syllable-rhythm.) If historical and synchronic evidence are kept strictly apart, Donegan & Stampe's model is clearly falsified by Vietnamese.

To sum up, Donegan & Stampe's model makes a number of claims that are either not consistent with one another or not justified deductively within the model for other reasons. In addition, even a preliminary application to a pair of languages closely related to the ones on which their work is based foreshadows serious empirical problems, which suggest that the claims made by the authors are too strong to be verified in a larger sample.

2.2. Dauer (1987)

A less well-known but far more realistic model of syllable and word-rhythm has been proposed by Rebecca Dauer. She concludes from her measurements on a number of languages (Dauer 1983), "that the rhythmic differences we feel to exist between languages such as English and Spanish are more a result of phonological, phonetic, lexical, and syntactic facts about that language than any attempt on the part of the speaker to equalize interstress or intersyllable intervals" (1983:55). In a later, short paper Dauer (1987) gives a set of criteria for identifying stress-timed languages by assigning them a comparative "score". The category of "syllable-timed" languages is given up altogether; principles of rhythmic grouping in a language which has a low stress-timing score may be sought not only in syllable length, but also in other areas of phonology: "It could be patterns of tone, of syllable or vowel length, or even the repetition of certain segmental or grammatical features" (448).
The check-list contains the following features:

1) Phonetic duration of accented syllables vs. non-accented syllables

+ longer	0 slightly longer	- same

2) Complexity of syllable structure

+ variety of types, heavy syllables receive stress		- limited; cluster simplification, epenthesis, liaison

3) Quantity distinctions (if any)

+ only in stressed syllables	0 only some in non-stressed syll.	- everywhere

4) Pitch		
+ realizes phrasal accent		- independent of accent
5) Tone		
+ only on stressed syllables	0 neutralized or subject to sandhi in non-stressed syllables	- on all syllables
6) Vowel system in non-stressed syllables		
+ reduced vowels	0 fewer contrasts but no reduction	- no difference
7) Consonant system in non-stressed syllables		
+ reduction/neutralization		- no difference
8) Word accent		
+ free, lexical/grammatical	0 fixed, mostly initial, grammatical	- no word accent (only stylistical)

In one way or another, all of these criteria have been included in the above model (Fig. 4), which is indeed very much indebted to Dauer's work, although it does not give up the category of syllable-rhythm. The discussion of the individual features is resumed in section 5, where each of them will be tested in sample languages.

In addition to Donegan & Stampe and to Dauer, who explicitly refer to stress-timing/syllable-timing,[14] there are other approaches to prosodic typology which deserve mentioning in the present discussion, although they are grounded in other traditions: Gil's rhythm-based typology (Gil 1986) and Pulgram's distinction between word, nexus, and cursus (Pulgram 1970).

[14]Some other authors have suggested correlations between stress/accent and other traits of a phonological system without giving empirical justification to their claims; thus, Saporta (1963: 68) proposes that "in languages with phonemic stress, the number of phonemic contrasts in stressed syllables will be greater than or equal to the number of phonemic contrasts in unstressed syllables", a hypothesis which seems too weak to be useful for typology.

2.3. Gil (1986)

Gil (1986) distinguishes between iambic and trochaic languages, i.e., his basic parameter is derived from poetic meter (' - vs. - '). (Incidentally, the idea to distinguish phonologies in this way is old and goes back, at least, to Wilhelm Wundt who used it in order to differentiate Romanic and Germanic languages.) As in the case of Donegan & Stampe, Gil includes syntactic and morphological aspects in his model, which are derived from the basic parameter. But contrary to these and all other authors who have worked on phonological/prosodic typology, he tests his predictions against a vast data inventory of 170 languages (using the Stanford Phonology Archive and the UCLA Phonological Segment Inventory Database), which makes his investigation particularly interesting. However, this initial attrativeness quickly disappears at a closer look.

The typological model is based on a theory of metered verse developed for Biblical Hebrew Poetry. Gil observes that in iambic hemistiches syntactic complexity and semantic import as well as more stress and more syllables concentrate 'on the right' (at the end of a line, or in the second of a pair of lines), whereas in trochaic hemistiches they concentrate 'on the left' (at the beginning of a line, or in the first of a pair of lines). He also found that iambic structures in general contain more syllables and less sonorous consonants than trochaic structures.

Gil's approach starts to become problematic as soon as he transfers these findings to ordinary language: "According to the prosodic typology, metered verse is either iambic or trochaic. Now *if* the prosodic typology is extendable to ordinary language, *then* there must be iambic and trochaic languages." (p. 189, emphasis p.a.). The antecedens in this sentence is unfortunately not commented on. By deductions which are somewhat too mysterious to be reproduced here, Gil then arrives at the following typology (p. 197):

(Fig. 7): Gil's prosodic typology

trochaic languages	iambic languages
faster tempo (syll. per unit of time)	slower tempo
stress-timed	syllable-timed
agglutinating	synthetic
simple syllable structure	complex syllable structure
more obstruents (in texts)	more sonorants
more obstruents (in inventory)	more sonorants
level intonation contours	variable intonation contours
no tone	tone
OV	VO

Notice that the predicted correlation between syntax/morphology on the one hand, and phonology - isochrony, syllable structure, tone - is opposite to the one predicted by Donegan & Stampe (1983). (The problems with the OV/VO distinction are of course the same as in their typology.) The model also makes predictions contrary to those of Fig. (4) and to Donegan & Stampe's model with respect to the correlation between isochrony and tone/syllable structure. The results of Gil's empirical study are therefore of some interest. Given the restricted information contained in the two data bases he used, he was only able to test the correlations between syllable structure (measured by the number of segments contained in the syllabic shell), sonority (measured by consonant/vowel ratio in the inventory), tone (+/-) and basic word order (SOV vs. SVO/VSO). Contrary to Gil's own claims (who interprets them as "strong and consistent support for extending the prosodic typology from metered verse to ordinary language - iambic and troachaic languages do exist", p. 211) his own empirical results clearly falsify his theory:[15]

- Tone languages have less complex syllable structures than non-tone languages (averages of 3.85 vs. 4.63 segments per syllable shell structure, statistically significant).
- 23% of his SOV languages and 39% of the SVO languages have tone, but only 17% of his VSO languages; the results disconfirm Gil's attempts to correlate tone and basic word order, which would predict more tone languages than in any other group in verb-initial languages. (As Gil doesn't make a difference between contour and level tone, no conclusions can be drawn with regard to Donegan & Stampe's model.) The behaviour of VSO languages also contradicts Gil's predictions regarding consonant-vowel ratio and average number of segments in the syllabic shell: again, they are more similar to verb-final than verb-middle languages, as Fig. (8) shows:

(Fig. 8): Correlation between V-placement, syllable complexity and consonant-vowel ratio according to Gil

	SOV	SVO	V-initial
average number of segments in syllable shell	4.04	4.93	4.21
average consonant-vowel ratio	4.09	3.52	4.51

The correlations between "average number of segments in syllable shell"/"average consonant-vowel ratio", as well as between "average number of segments in syllable shell/tone" and "average consonant-vowel ratio/tone" were not calculated; therefore, there is no basis for confirming or disconfirming the theory in this respect.

[15] Also cf. the critique of Gil's statistical methods in Schweiger (1990)

All in all, Gil's theory is confusing and, in those parts where it was tested by the author himself, quite obviously empirically inadequate.

2.4. Pulgram (1970)

Pulgram calls his distinction between word languages, nexus languages and cursus languages a suggestion for a typology, not a typology in itself. Nevertheless, it is worth mentioning here, as it will be of some importance for the later parts of the discussion. Contrary to other approaches to prosodic typology it refers to prosodic units only, i.e. not to their timing, or to the distribution of phonetically emphasized/non-emphasized elements.

What Pulgram calls a "word" is a prosodic[16] unit with one main stress, certain distributional (phonotactic) constraints (e.g., in English, no /ps/ in the beginning), and certain terminal allophones and boundary markers (e.g., glottal stop, pause) (1970:25). A "nexus" is a series of morphological words which behave phonologically like one word in the above sense (e.g, it has only one stress, etc.). Nexus formation is not only grammatically, but also "stylistically" determined, e.g., the English phrase *he said to me* may be uttered in one nexus (*he sáid to me*) or in two (he sáid | to mé) (1970:27). Finally, a "cursus" is a "pause group" (i.e., according to Pulgram, a unit flanked by pauses) in which morphological (lexeme) boundaries are obliterated. Again, cursus formation is stylistically determined. Within a cursus, segmental boundary markers of words are obliterated; depending on language type, the suprasegmental features of words (word stress) may also be lost. Thus, whereas in French, the cursus is identical with the phonological word (word boundaries are segmentally and suprasegmentally obliterated), segmental but not suprasegmental word features are lost in the cursus of Sanskrit.

On the basis of these definitions, Pulgram distinguishes the following language types according to their prosodic make-up (1970:38):
word languages: languages "whose pause groups are not cursus, contain no nexus, but are made up entirely of words"
nexus languages: "pause groups are not cursus but they contain nexus side by side with words"
cursus languages: "all pause groups are cursus, some eliminating both segmental and suprasegmental traits of individual words, some only the first and not the second".

While word languages are rare according to Pulgram ("I can cite no example, though one may of course exist", 1970:37), the nexus type, represented by English, Italian and many other languages, is structurally intermediate between word and cursus languages, but nevertheless the

[16] Pulgram himself speaks of a "morphonological" unit.

most frequent one (1970:85). This drawback to Pulgram's theory is overcome, however, if the category of word languages is conflated with that of his nexus languages; such a conflation suggests itself, as Pulgram's word is exactly the same as his nexus anyway. If we define a nexus language as one in which the phonological word does not lose its autonomy within the cursus, his threefold distinction is reduced to a more plausible two-fold one.

With this simplification, Pulgram's theory can be stated as follows: its central parameter is the relationship between subordinated and superordinated prosodic categories. For classifying a language as nexus or cursus it is necessary to see how the prosodic units that are larger than the syllable (smallest unit) but smaller than the pause group (and which may be called phonological words) behave with respect to the latter. The two extremes are that intermediate units retain all their autonomy (nexus languages), or that intermediate units lose all their autonomy (cursus languages of the unequivocal type). Between these extremes, one intermediate position is held by those (cursus) languages which give up all segmental, but no suprasegmental features of the phonological word within the pause group. In the case of an unequivocal nexus language, the prosodic unit "phonological word" has an important status, whereas in an unequivocal cursus language, only the unit "syllable" is necessary below the pause group. Pushing Pulgram's idea to its limits, it would therefore seem that in his nexus languages, the phonological word is the central prosodic unit, whereas in his cursus languages, the syllable is central.

Here, the distinction between nexus and cursus languages can be linked with proposals made by various other Romance linguists to characterize these languages phonologically (and to oppose them to the Germanic languages). Thus, Holm (1987) suggests a typological distinction between "un type comme les langues romanes, où les changements phonétiques n'ont pas été bloqués par les frontières d'unités significatives <...> et, d'un autre côté, un type dont les changements ne peuvent être décrits que dans le cadre du mot". (As examples for the latter type, she gives German or Danish.) However, in contrast to Pulgram, Holm refers to the morphological word as a carrier of semantic content, not to the phonological word.[17] In the first type of language, phonological processes within the word and between words (sandhi) are the same, whereas in the second type, word boundaries define the domain to which phonological processes are restricted. Similar to that of Holm is a distinction suggested by Kuz'menko (1987) with respect to the

[17]Although the basic idea is quite similar, Pulgram and Holm (who does not mention Pulgram's 1970 monograph) come to very different conclusions in empirical detail. For instance, Pulgram classifies Italian as a nexus language (1970: 87 ff) but Holm as a language in which the word plays no role (1987: 233, 234). The well-known phenomenon of *raddoppiamento sintattico* (cf. among others, di Luzio, in prep.) is given as evidence by both authors for their opposite classifications. Pulgram, it seems, is empirically wrong when he states that *raddoppiamento* is evidence for nexus formation as it requires a clitic to precede the geminate. While this holds for the phonologically non-regular *raddoppiamento* after certain particles (a [kk]asa), it does not hold for the more regular case of *raddoppiamento* between two stressed syllables (cittá [vv]ecchia). Although the first case is more widespread in the Italian dialects and may be primary from a diachronic point of view, *raddoppiamento* in modern standard Italian cannot be reduced to this case.

Germanic languages and their historical development; according to Kuzæmenko, a phonological type "depends on the smallest unit of phonological segmentation, which in its turn, is determined by the relationship of the syllable and morpheme boundaries". He calls a language *phonemic* when it resyllabifies across morpheme boundaries (such as Russian), and a language *syllabic* when it doesn't (he cites some Jutland dialects of Danish and Southeast Asian languages such as Vietnamese). Languages such as English or German, which differentiate two types of syllable cut (loose contact after long vowel, narrow contact after short vowel), hold an intermediate position.

In addition to the many empirical problems that lurk behind proposals like the ones by Pulgram, Holm or Kuz'menko, they cannot be called proper typologies: for although certain language types are defined, few or no predictions are made as to which phonological characteristics other than the definitional ones are to co-occur. Nevertheless, there is one common idea in these approaches: that languages should be differentiated by the importance of prosodic categories such as the syllable or the phonological word for their phonologies, and by the relationship of these categories to morphological categories such as the morpheme or the grammatical word.

3. Further illustrations for word-rhythm and syllable-rhythm

Additional evidence for the feasibility of a rhythmic typology based on the distinction between word-rhythm and syllable-rhythm comes from pairs of genetically closely related languages which nevertheless tend towards different types. Historically speaking, such pairs are often due to the fact that one of them is more conservative, whereas the other has undergone phonological change. If the phonological development of the more innovative language involves two or more of the phenomena listed in Fig. (4), then one would expect that phonological change does not affect the language in arbitrary ways. Instead, phonological traits that are correlated according to the model can be expected to change together. The difference within the Mon-Khmer languages between Khmer (word-rhythm) and Vietnamese (on the way to syllable-rhythm) alluded to in the last section is a case in point.

In looking at such language pairs, two things must be kept in mind. First, there are a number of reasons why one can only expect gradual shifts between syllable-rhythm and word-rhythm. The innovations in one language may not be so strong (yet) that the phonological type of the older stage of development is abandoned entirely in favour of the opposite type, i.e., language change may not be complete. Nor is it necessarily the case that the more conservative language represents the older stage in its pure form; it may also have changed, though less than the more innovative language. Finally, the older stage need not have represented a pure type either.

Second, every language change is culturally mediated and subject to social regularities which

may, but need not coincide with "typological adequacy"[18]. Therefore, the language-internal, structural inter-dependencies given by the phonological type may be at odds with language-external, social forces. What can be observed empirically, i.e. factual language change is the outcome of both kinds of influences.

3.1. Italian and Portuguese

A first and famous pair of languages comes from the Romance family. It has often been observed that Portuguese has left the phonological type of the other larger Romance languages - syllable-rhythm - and has moved towards word-rhythm.[19] In contrast, ('standard') Italian is relatively conservative with respect to Latin, the ancestor of both languages.[20] According to phoneticians' judgements, it is syllable-timed (Bertinetto 1977), or at least, does not show the compression effects typical for stress-timed languages (Marotta 1985, Farnetani & Kori 1990, etc.). Comparing the two languages in phonological terms, we note the following differences:[21]

a) *accent-dependent reduction of vowels*

Compared to the system of vocalic phonological oppositions in Latin, i.e.

/i, i:/ /u, u:/
/e, e:/ /o, o:/
/a, a:/

that of Italian, i.e.[22]

/i/ /u/
/e/ /o/
/a/

---

[18]See below, section 4, pp 51.

[19]Many researchers in fact call Portuguese a stressed-timed language without restrictions; cf. Major (1981). I think that this classification can be questioned. Nevertheless, the fact remains that Portuguese is nearer to the word-rhythm type than Italian, Franch or Spanish.

[20]Of course, I do not want to suggest that Standard (Tuscany, or Milano, or Roman) Italian has directly preserved the phonological features of Classical or even Vulgar Latin. Since at least some of the Italian dialects underwent radical changes, it is more adequate to say that the dialects of the Tuscany that were chosen as the basis of modern standard Italian were among the more conservative ones.

[21]Some sources: for Italian: Muljacic (1972), Saltarelli (1970); for Portuguese: Camara (1972), Mateus (1975).

[22]The status of a fourth level of vowel height, /ɛ/,/ɔ/ is a matter of debate, since many speakers and many regional varieties of Standard Italian neutralize the distinction between the tense and lax mid vowels. The distinction only holds for the ictus position and is, where it occurs, an indication of word-rythm.

shows the loss of the [±long] distinction. But as in Latin, this vowel system holds both for stressed and unstressed positions within the phonological word.
The vowel system of (Continental) Portuguese is quite comparable to that of Italian in stressed position, with an added fourth level of vowel height (nasal vowels omitted):[23]

/i/ /u/
/e/ /o/
/ɛ/ /ɔ/
/a/(/ɐ/)

The vocalic system is however considerably reduced in pretonic and in posttonic position. In pretonic position, /e/ was reduced historically to /ə/, and /a/ to /ɐ/; in addition, /o/ merged with /u/ (apart from absolute word-initial position). There is no distinction between mid closed and open vowels. The pretonic vowel system is therefore less "rich" than the tonic system, i.e., it incorporates fewer phonemic oppositions:[24]

/i/ /u/
/ə/
(/ɛ/) (/ɔ/)
(/a/) /ɐ/

In non-final non-stressed syllables the system is even simpler, i.e. a two-level height system with three oppositions only:

/i/ /u/
/ə/

It is only slightly more complex in final unstressed position:

/i/ /u/
/ə/
/ɐ/

The process of accent-dependent vowel reduction remains productive and visible in pairs such as (modern, continental) Port. [mɛl] ~ [m(ə)'ladu], ['l ɔʒɐ] ~ [lu'ʒstɐ] etc.

Thus, the Portuguese vowel system is highly sensitive to accent position, whereas the Italian system is not or only marginally so.

---

[23] /a/ vs. /ɐ/ are only distinctive in position _&N in continental Portuguese.

[24] Vowels in brackets are limited in occurrence; they reflect later borrowings from literary Latin or reflexes of older vowel geminates.

b) word-related processes

Other differences in the phonologies of Italian and Portuguese also point towards a difference in rhythm type, i.e. the treatment of non-stressed syllables has correlates in other parts of the phonolog.y

Phonetically, the reduction of pre-tonic and final /e/ is often carried to its extreme in Portuguese, i.e., this vowel is elided entirely; as a consequence, more complex syllable structures emerge, particularly CC onsets and codas, e.g. ['blisimu] *belíssimo*,[fɔrt'mẽt] *fortemente*, [partʃ] *partes*, ['srɐʒɐ] *cereja*, [ẽtr] *entre*, or even ['pdʒtal] *pedestal*. Some of these complex syllable shells disobey the sonority scale, i.e., less sonorous stops are closer to the syllabic peak (vowel) than more sonorous fricatives or sonorants.

Another typical diachronic and synchronic feature of Portuguese are word-internal lenitions; they are in accordance with the tendency of word-rhythm language to blur syllable boundaries within (but not across) words and therefore harmonize with the historical development towards vowel reduction in non-stressed position. Diachronically, the Latin intervocalic obstruents underwent lenitions in Portuguese to a degree that is unknown in Italian (although the process is not uncommon in this language either). This applies, first of all, to the general loss of the Latin geminates, but also to the voicing of the non-geminate voiceless obstruents and the spirantization and particularly the loss of non-geminate voiced obstruents, the latter having partly resulted in a complete breakdown of syllable structure (diphthongization, contraction); cf.

Latin	Portuguese	Italian
vacca	*vaca*	*vacca*
lupum	*lôbo*[25]	*lupo*
pietatem	*piedade*	*pietá*
pedem	*pé*	*piede*
matrem	*mãe*	*madre*
digitum	*dedo*	*dito.*

Intervocalic nasals and laterals were even more prone to elision:

malam	*má*	*mala*
malum	*mau*	*malo*
lana	*lã*	*lana*
coelum	*céu*	*cielo.*

More than Italian, Portuguese also dropped unstressed syllables entirely in words with antepenultimate stress:

tegula *(> tegla >) telha* *tegola*

These elisions resulted in consonant clusters which were further reduced. Generally, although both languages have a small tolerance for consonant clusters - cf., e.g.,

lectum ([kt])	*leito*	*letto*
miscere ([sk])	*mexer* ([ʃ])	*mescere* ([ʃ]),

Portuguese phonology shows a number of assimilations within consonant clusters that go beyond those of Italian; cf. the case of Latin stop + /l/:

planum	*chão* ([ʃ])	*piano* ([pj])
clamare	*chamar* ([ʃ])	*chiamare* ([kj])

[25]Present-day voiced obstruents are optionally weaked into fricatives [β, γ, δ], i.e., the process of lenition still goes on.

or of Latin [sj]:

passionem *paixão* ([ʃ]) *passione* ([sj]).

Finally, it may be noted that geminate consonants only occur in Portuguese between phonological words (Camara 1972: 57 gives the minimal pair ar roxo ([rr]) 'purple air' - *arrôcho* ([r], despite conservative spelling) 'tourniquet stick', whereas *raddoppiamento sintattico* in Italian makes sure that word internal and word external obstruents are treated alike (geminates occur in both positions; cf. fn. 17).[26]

Of course, there are also a great many similarities between Italian and Portuguese, due to their common ancestor, spoken (vulgar) Latin. Thus, both languages have a strong tendency towards open syllables[27]; both languages re-syllabify over word boundaries; in both languages accent is not entirely predictable on phonological grounds, and partly serves morphological function. Yet, the fact that the most important phonological differences are along the lines suggested by the above model (Fig. 4) lends further plausibility to it.[28]

3.2. Uzbek and Turkish

A slightly more exotic language pair which displays similar differences can be found among the Turkic languages: whereas the Standard Turkish of Turkey[29] is a typical representative of syllable-rhythm, Uzbek[30] (spoken in Uzbekistan, here referring to the "standard" as spoken in the capital Tashkent) shows distinct tendencies towards word-rhythm. The development of Uzbek almost certainly has been *initiated* (though not determined) by extensive language contact with Farsi, Arabic and particularly Russian (while the considerable influence of the first two languages on Standard Turkish has been reduced by the Turkish language reform in the 20ies). Nevertheless, it is of interest for the present discussion, since the transfer of features from those

---

[26]Note, however, that at least some variants of (Northern) standard Italian voice intervocalic /s/ within the phonological word (excluding, clitics and certain prefixes), but not across word boundaries (cf. Nespor & Vogel 1986: 125). Here, word boundaries become important in Italian, too. But also note that the same Italian dialects do not exhibit *raddoppiamento sintattico* and seem to be somewhat nearer to the word-rhythm type in general.

[27]This tendency may even be stronger in Portugese than in Italian, given the nasalization of Latin (C)VN syllables, and the frequent transformation of syllable-final /l/ into a glide. On the other hand, as mentioned above, the elision of non-tonic /e/ r-introduces complex syllable shells, particularly at the boundaries of the phonological word.

[28]Within the Romance language family, a similar argument has been made with respect to the Italian dialects bei Mayerthaler (1982).

[29]See, e.g., Lewis (1967), Lees (1961).

[30]Sources consulted: Sjoberg (1963), Wurm (1953), Sjoberg (1962).

languages has not been a willy-nilly mixture, but has occurred along the phonologically plausible ("internally adequate") lines given by the typological distinction between word-rhythm and syllable-rhythm.
The most striking differences between Turkish and Uzbek are the following:

a) vowel harmony vs. vowel reduction

Turkish vowels in a word (or, according to a weaker hypothesis, in the suffixes of a word plus the final stem-vowel) harmonize according to backness and roundness in a vowel system which is completely symmetric, i.e.

	[-back]		[+back]	
	[-round]	[+round]	[-round]	[+round]
[+high]	/i/	/y/	/ɯ/	/u/
[-high]	/e/	/ø/	/a/	/o/

The phonetic realization of these phonemes is quite stable, i.e. largely independent of their position within the word, of stress, or segmental environment.[31] On the other hand, the six vowel phonemes of Uzbek (i.e., /i, u, e, o, a, ɔ/) are abstractions in a comparatively large space of phonetic variation, which is partly free (idiosyncractic), but to a larger degree dependent on linguistic context, particularly on stress, on the occurrence of back consonants in the immediate or distant neighbourhood, on the types of vowels occurring in neighbouring syllables, and on the position of the syllable within the word. There is little or no vowel harmony left. Unstressed vowels tend to be reduced in length, and to lose their voicing as well as syllabicity (a feature of word-rhythm). Thus, we get pairs like the following (all with word-final accent):

Turkish	*Uzbek*	
[qɯzɯnɯ]	[qïzʒ̊nɜ]	'his/her daughter (acc.)'
[quʃum]	[qu̯ʃɜm]	'my bird'
[ʃunu]	[ʃü̯nɨ]	'that one (acc.)'.

Whereas in the Turkish variants of these (and many other) words, stressed and non-stressed vowels are phonetically very similar and all vowels agree with respect to backness and rounding, the corresponding Uzbek examples show desyllabification of the pre-stress (penultimate) syllable vowel, and vowels in a word do not necessarily agree with respect to backness or rounding (cf. the second example).

b) syllable structure

[31] There is some free variation between /e/ and /ɛ/ in spoken Turkish, and some dialects even treat this distinction as marginally phonemic.

Whereas standard Turkish does not tolerate syllable shells more complex than C...C_1C_2 (for C_1 > C_2 in sonority) and dissolves more complex or different phonological structures in the more common[32] loanwords by epenthesis or prothesis, standard Uzbek is much more tolerant in its massive loan vocabulary[33], even for syllable shells violating the sonority hierarchy (e.g. $C_{ob}C_{son}$&). Note Turkish/Uzbek pairs such as

Turkish	*Uzbek*	
/hysyn/	/husn/	'beauty'
/hykym/	/hukm/	'command, order'
/tijatro/	/teatr/	'theater'
/istasjon/	/stantsija/	'station'

In rapid speech, the complexity of Uzbek syllable shells is further increased by elision of non-stressed vowels, such as in /qʃlɔq/ 'village' (>qi /ʃlɔq/, cf. Turk. /kıʃlak/), /gruntʃ/ 'rice' (>/gurunt ʃ/, cf. Turk. /pirinç/), /ikkta/ 'two (adj.)' (>/ikkita/, cf. Turk. /iki(li)/).

Obviously, complex syllable structure and tempo-dependent loss of unstressed syllabic nuclei is another feature of word-rhythm. Thus, we observe differences from the Turkish pattern in standard Uzbek in three respects: vowel harmony is lost, (some) non-stressed vowels are reduced and syllable structure is more complex. Again, the deviation is easily located in the space constituted by syllable-rhythm and word-rhythm as prototypes.[34]

3.3. Classical Mongolian and Khalkha

A third example, although of a slightly different kind, is the relationship between Classical Mongolian (as used up to the middle of this century for writing in Mongolia[35], unchanged since the Middle Ages) and the modern Mongolian dialect Khalkha[36] (the standard language of the Republic of Mongolia). Here, it is possible to compare directly a nowadays extinct variety with its modern offspring. (Again, it should be noted that Khalkha has been in contact with Chinese and Russian, and that the development from Classical Mongolian to Khalkha most probably has

---

[32]There are some exceptions in very learned vocabulary, cf. loans such as *stratej* 'strategy' ([strateʒ])

[33]This is not to say that there is no cluster dissolution at all in Uzbek; in fact we observe epenthesis both in Turkish and in Uzbek in words such as Uzbek /sinif/ ~ Turkish /sɯnɯf/ 'class'. There also seems to be variation between /stantsa/ (more formal) and /istansa/ (more colloquial).

[34]As in the case of Italian/Portuguese, it goes without saying that Turkish and Uzbek also share a number of phonological traits, being as closely related genetically as they are. In particular, the placement and status of word accent seems to be very similiar (it is basically word-final - despite Wurm's claims of word-initial accent, cf. Wurm 1953), and although phonetically weak and overridden by phrasal accent (also right-bounded), it serves a number of grammatical functions (cf., for Turkish, Lewis 1969: 21ff, for Uzbek, Sjoberg 1963:23ff).

[35]Examples are taken from Grønbech & Krueger (1955).

[36]Sources: Poppe (1970), Street (1963).

not been independent of this contact, although its precise impact, particularly on phonological change, is hard to assess.)

As in the other pairs of languages considered in this section, the historical development is such as to affect a number of phonological characteristics of the older system (which clearly had syllable-rhythm) and to replace them with features of a word-rhythm language; Khalkha today is of an intermediate type.

a) syllable structure

Classical Mongolian had maximally CVC syllables (with the coda consonant usually a sonorant or sibilant). In Khalkha, syllables are less uniform, as long vowels are possible as well as diphthongs, i.e., syllable structure is (C)V(V/G)(C) or (C)(G)V(C) (where G = glide). In addition, the elision of /ə/ is very common in more casual styles, resulting in rather complex syllable shells, cf. (elided schwas in brackets):[37]

/ɯns(ə)ne:s/	'from cinders'
/alt(ə)na:s/	'from gold'
/xuls(ə)na:s/ '	from reeds'
/ors(ə)no:s/	'from having entered'

(b) vowel harmony and vowel reduction

Classical Mongolian had a clear front/back vowel harmony in a symmetrical system of seven vowels, with neutral /i/ (the merger of common Altaic /i/ and /ɯ/), i.e. /e, i, ø, y/ (front) vs. /a, i, o, u/ (back). In modern Khalkha, an additional neutral vowel phoneme /ə/ was introduced, and /e/ is also neutral under specific conditions. This means that vowel harmony has become less effective. On the other hand, as indicated by the new schwa phoneme, the vowel system of Khalkha is strongly centralized and highly variable, depending (in addition to the front/back distinction governed by vowel harmony) on syllable position in the word, length, adjacent and non-adjacent vocalic and consonantal environment, and accent. This means that, just like in Uzbek, the tendential loss or the reduction of vowel harmony has gone hand in hand with an increase in vowel centralization and vowel allophony in general.

(c) word accent

[37]Examples from Poppe (p. 51). Grønbech & Krueger (1955): 74) give examples for final CC-clusters as a consequence of vowel-elision of medial and final (short) vowels in Classical Mongolian. It seems that in their view, at least some of the schwas considered phonemic by Poppe are treated as phonetically weak or epenthetic surface forms.

For Classical Mongolian, the linguistic relevance of word level phonetic prominence seems to have been nil[38]. Phonetic emphasis, if any, was always on the initial syllable. Khalkha, on the other hand, has a phonetically strong accent realized by stress and length, as well as optionally/occasionally by lengthening of the following consonant (and compensatory shortening of the following non-accented vowel; cf. Street's example /'modə/ 'tree' →['mɔd°]). It interacts with syllable structure, for accent falls on the last but one[39] long syllable (long vowel or diphthong), or the first short syllable otherwise; in its phonetic realization and because it is unstable and assigned by phonological rules, accent assignment in Khalkha definitely departs from the syllable-rhythm of Classical Mongolian.

(d) word structure

Finally, one of the most important changes in the transition from Classical Mongolian to Khalkha is the contraction of plurisyllabic words by elision of intervocalic /g (γ), b/ and sometimes /m/, yet another characteristic feature of word-rhythm, cf.:[40]

Classical Mongolian	Khalkha	
/aγula/	/u:la/	'mountain'
/qaγalγan/	/xa:lga/	'gate'
/debel/	/de:l/	'coat'
/degy/	/dy:/	'younger brother'

Present-day Khalkha continues to weaken intervocalic /b, g/ into [β, γ].
Thus, the decreasing importance of vowel harmony, the newly acquired phonological status of accent, the opening of the vowel system for allophonic variation, particularly centralization, the weakening and elision of intervocalic voiced stops, and the elision of schwa with the concomitant increase in syllable structure all point to a transition from syllable-rhythm to word-rhythm.

[38]"As a stress accent is not an integral part of the phonetic makeup of a word, the position of the accent may shift between syllables, and ist phonologically irrelevant" (Grønbech & Krueger 1955: 18)

[39]This description follows Poppe, while Street (pp 62ff) speaks of the first long syllable.

[40]Examples from Grønbech & Krueger (1955: 74)

3.4. RP/General American English and the West Indian Creoles

In the pairs of languages considered so far, the historical trend was one towards word-rhythm. At least in the cases of Khalkha and of Uzbek, language contact may have initiated the change and its direction. Yet, the opposite case is also observed, due to language contact of a word-rhythm language with one of the syllable-rhythm type. The development of the English Creoles in West Africa and in the West Indies is an example. Through pidginization and creolization, English has lost some of the characteristics of a word-rhythm language in favour of syllable-rhythm; the change was most probably initiated (though not determined) by contact with West African languages of the latter type.
The most important differences between British or General American English on the one hand, and the West Indian English-based creoles on the other hand are the following (cf. Wells 1982, III:560ff, Hall 1966):

(a) Cluster reduction

Word-initial and -final consonant clusters are simplified in the creoles. In particular, final clusters of an obstruent + t or any consonant + d lose their second element, e.g (Wells 1982:566f):

RP/Gen.Am.		West Indian creoles
/lɛft, nɛst, ækt/	~	/lɛf, nɛs, æk/

(cf. the morphological boundary: /fa:st+er/ ~ /fa:sa/)

/sɛnd, bɪld/	~	/sɛn, bɪl/

The final clusters /sk/ and /sp/ may also be simplified word-finally

/mask/	~	/ma:s/

as well as, in the broadest creole, word-initially:

/start, skrætʃ/	~	/ta:t, kratʃ/.

(b) De-centralization of the vocalic system

Unreduced (or less reduced) vowels are used instead of the reduced ones in non-ictus position. This applies, for instance, to word-final /er/ which is realized as [a] in the creoles instead of [əɹ] or another mid-central vowel in RP (example: /mata/ 'matter'), but also to unstressed /e/ which is realized as a full vowel instead of RP and Gen.Am. mid-schwa (cf. *governm[ɛ]nt, happin[ɛ]ss,*

purp[ʌ]se, wom[a]n, want[ɛ]d, [a]go; from Wells 1982:571).

(c) Monophthongization/lack of diphthongization

British and American tendencies to diphthongize long vowels in words like *see* or *two* are not found in the West Indian creoles. On the other hand, the RP/Gen.Am. diphthongs /ei/, /ou/ are realized as long monophthongs (/fe:s/, /go:t/ ~ *face*, *goat*). Although diphthongization is not a parameter considered in the model of Fig. (4), it is one of the characteristics of word-rhythm according to Donegan & Stampe (cf. Fig. 5).

(d) Accent

At least some West Indian creoles have a musical accent, i.e. contrastive pitch patterns (comparable to those of, e.g., Japanese). For instance, minimal pairs such as *father* (HL) (parent)/*father* (LH) (clergyman), *tailor* (HL) (profession)/*Taylor* (LH) (name) are reported for Barbados and Guyana. In other English pidgins and creoles (such as Krio/Sierra Leone; cf. Hall 1966:34f), stable word-initial accent instead of the non-stable RP accent is observed. Both musical accent and stable accent are characteristic of syllable-rhythm.

The newly acquired features of the West Indian creoles are all consistent with a tendency towards syllable-rhythm. Of course, many of them (but not, e.g., musical accent!) can be said to be direct transfers from the West African contact languages (substrata). But again, it seems that this transfer is too systematic to be explained by an ad hoc addition of features selected by chance.

All in all, comparison of genetically related languages such as Portuguese and Italian, Uzbek and Turkish, Classical Mongolian and Khalkha, English and West Indian Creoles (we may add: Vietnamese and Khmer) seems to support the kind of typology proposed in section 2. In order to test this typology more thoroughly, however, more languages have to be taken into account. For this reason, a larger empirical study was carried out.

4. Preliminaries on Methodology and Data

The approach to (phonological) typology chosen here may be summarized as follows:

a) It is *holistic instead of atomistic*. In its classic formulation, the distinction between stress-timed and syllable-timed languages was restricted to one durational parameter that characterizes the respective language: syllable length and foot duration. The distinction between

word-rhythm and syllable-rhythm, on the other hand, is intended to capture a constellation of features that cover many aspects of a given language.

If one chooses to adopt a naturalist framework (cf. Dressler (ed.) 1987) phonological types can be seen to operate as filters on natural processes. A language cannot apply all natural phonological processes at the same time, even if there are no social contingencies that impede it from doing so. Natural phonological processes may contradict each other and compete for application. In particular, perceptive and articulatory needs may be in conflict. As an example, consider the two most important possibilities of making consonant clusters more pronounceable: vowel epenthesis, and partial or complete assimilation. The first possibility preserves phonemic contrasts but increases the number of syllables; it may be at odds with the (also natural) process of reducing or deleting unstressed syllables; the second possibility, while compatible with the reduction or deletion of unstressed syllables, reduces phonemic contrasts and thereby the perceptual clarity of the language.

The conception of a linguistic type as a filter has been stated most clearly by Dressler (1985: 54) with respect to morphological typology, but it is easily transferred to phonological typology: "Since a language cannot 'choose' the most natural options or thresholds from all (conflicting!) parameters, a particular language type is constituted by the particular choice of highly natural (or unmarked) options from some parameters and of rather unnatural (marked) options from other parameters of naturalness. Or, speaking metaphorically, each language type sacrifices some parameters for the sake of other parameters." Under this view, word-rhythm and syllable-rhythm are optimized solutions to the problem of selecting compatible processes (and inventories) from the available ones. Typological adequacy in the realm of phonology may be then defined as compliance with such a solution.

b) It is *deductive instead of inductive*. In the preliminary version of the typology presented in section 1 (Fig. 4), the characteristics ascribed to word-rhythm and syllable-rhythm were derived from the overall "teleologies" (in the sense of Natural Phonology) of keeping the phonological word/foot, or the syllable, constant, where this constancy may refer to the phonological and/or the phonetic make-up of the language. The approach is therefore deductive.

c) It is *phonological and phonetic* instead of purely phonetic. In the classic formulation of the distinction between stress-timed and syllable-timed languages, only duration as a measurable phonetic surface parameter of a language was taken into account. The phonemic system of a language as well as the phonological and morphonological rules were not considered.[41] In contradistinction, the approach chosen here does not make a clear-cut distinction between

[41]This applies to Abercrombie, at least,whereas e.g. Pike (1945) includes the feature 'reduced vowels' which may bei interpreted phonologically and phonetically.

phonology and phonetics. Features from both domains may be involved in word-rhythm and syllable-rhythm.

d) It is *neither process-oriented nor inventory-oriented*. Traditional approaches to phonological typology as well as some modern ones have focussed on the inventories of sounds or phonemes (cf. Trubetzkoy 3./1958, Maddieson 1984, 1991, etc.). Alternatively, languages may be classified according to the phonological rules or processes that apply (cf. most of the contributions in Greenberg 1978, also Dressler 1979[42]). The present model includes both domains.[43]

e) It is *prototypical instead of categorical*. It is not claimed that each and every language can be classified as having either word-rhythm or syllable-rhythm. This would be an empirically untenable position, as the analysis of Abercrombie's six sample languages in section 2 has shown. A much more promising methodology seems to consist of defining word-rhythm and syllable-rhythm as prototypes which may be realized in individual languages to varying degrees. This procedere takes into account that due to historical developments, areal influence and language-internal factors, a language hardly ever represents a perfect type. Just as prototypical head/modifier (VOS) and modifier/head (SOV) languages are much rarer than one would think if internal type consistency was the only teleology languages aim at in syntax, the distinction between word-rhythm and syllable-rhythm languages will not permit a clear-cut classification in each case. Languages of intermediate status do not do any harm to the contention that there is a prototype, as long as deviation from the prototype can be explained by some other principle, or by reference to the diachronic development of the language. (I.e., it may be on the way from one prototype to the other.)

The prototype approach owes much to Skalička's concept of a *typologisches Konstrukt* in syntax, which he characterizes as follows (Skalička 1966:157):

> Von den verschiedenen sprachtypologischen Konzeptionen wollen wir hier jene aufgreifen, die von selten oder nie realisierten Extremen ausgeht. Eine solche Typologie arbeitet nicht nur mit wirklichen Sprachen, sondern auch mit nicht realisierten, mit wahrscheinlichen, unwahrscheinlichen und unmöglichen Sprachen. So nähern wir uns einer deduktiven Typologie, die für die richtige Auffassung der Sprachen unentbehrlich ist.
> Ein weiterer Stützpunkt unserer Theorie ist die Existenz eines Typus als eines Bündels von aufeinander abgestimmten Erscheinungen. <...> Es ist die Aufgabe des vorliegenden Aufsatzes, die

[42]"Languages can be classified by the universal processes that they retain as P[honological] R[ules]"; he cites further literature. Note that usually process oriented phonological work focusses on one process or rule and does not state interdependencies between such processes. They are therefore of relatively little typological interest.

[43]Dressler (1979) argues that generalizations about phoneme inventories can be translated into generalizations about (prelexical) rules, but not vice versa. This, however, is only possible if the framework of Natural Phonology is accepted, according to which phonemic oppositions are the result of language-specific prelexical rules.

Thesen unserer Typologie an "typologischen Konstrukten" zu prüfen, d.h. an Modellen mit konsequent durchgeführten Eigenschaften.

In a deductive theory of typology, the types do not necessarily represent natural languages. They are, first of all, idealizations (ideal types). Thus, even if no language satisfied the pure type of word-rhythm or syllable-rhythm, the model would not suffer.
In the next section, 34 languages will be tested against the model in Fig. (4) with the above-mentioned premisses in mind. Fig. (9) tabulates the languages in the sample. After each language name, an abbreviation is given which will be used in the following text.

(Fig. 9): List of languages with typological classification (according to Ruhlen 1976), area and primary sources

Khoisan			
- central	1. Nama (Hottentot)	S Africa	Meinhof 1909, Beach 1938
- ?	2. !xóõ (=Southern Bushmann (!X)	SW Botswana, Namibia	Traill 1985
Niger-Kordofanian			
- Niger-Kongo	3. Yoruba (YO)	W Nigeria	Rowlands 1060, Bamgbohe 1966
- Benue Kongo	4. Amo (AMO)	N Nigeria	Di Luzio 1967
Afro-Asiatic			
- Chadic	5. Hausa (HAU)	Nigeria, W Afrika	Abraham 1959 a,b Gouffé 1981, Dunstan 1969, Greenberg 1941
- Semitic	6. Arabic, standard (ARA)		Kästner 1981
	- Moroccan	Morocco	Harrell 1962
	- Egyptian	Egypt	Harrell 1957
	- Sṛāwi (Maghreb)	Algeria	Kouloughi 1978
Caucasian			
- (North-)West	7. West-Circassian (CIR)	Turkey	Smeets 1984
Indo-Hittite			
- Italic	8. French (FR)	France, Canada	various
- Germanic	9. English (ENG)	UK., U.S.A., etc	various
- Balto-Slavic	10. Russian (R)	Russia	Gabka (ed.) 1987

- Celtic	11. Gaelic (GAE)	Ireland	Ó Siadhail 1989
Altaic			
- Turkic	12. Turkish (T) 13. Uzbek (UZ)	Turkey etc. Uzbekistan etc.	Lewis 1967, Lees 1967 Sjoberg 1963, 1962
- Mongolian	14. Khalkha (KH)	Mongolian Rep.	Street 1963, Poppe 1970
- Korean	15. Korean (KO)	Korea	Lee 1989, Kim-Renaud 1978, Cho 1967
- Japanese-Ryukyuan	16. Japanese (JA)	Japan	Vance 1987, Shibatani 1990
Eskimo-Aleut	17 .West- Greenlandic (Eskimo) (ESK	W Greenland	Rischel 1974, Fortescue 1984
Elamo-Dravidian			
- central	18. Telugu (TE)	India, Andhra-Pradesh	Kostiç et al. 1977 Krishnamurti & Gwynn 1985
- ?	19. Toda (TO)	S India	Emeneau 1984
Sino-Tibetan			
- Sinitic	20. Mandarin (MAN)	China	Cheng 1973, Chao 1968
- Tibeto-Burman	21. Tamang (TA)	Nepal	Mazoudon 1973
Austric			
- Austroasiatic			
- Munda	22. Mundari (MUN)	India, South Bihar	Cook 1965, Sinha 1975
- Mon-Khmer	23. Vietnamese (V)	Vietnam	Thompson 1965
- Austronesian			
- Western Malayo-Polinesian	24. Toba-Batak (TOB)	Indonesia	Nababan 1981
- Eastern Malayo-Polinesian (Central Pacific)	25. Fijian (Bauan) (FIJ) Bau (Fiji)		Schütz & Komaitai 1971
Indo-Pacific			
- Trans-New Guinea	26. Nimboran (NIM)	West New Guinea	Anceaux 1965
- Papuan (Asmat-Kamoro)	27. Asmat (AS)	Indonesia (Irian, Jaya, Southeast)	Vooorhoeve 1980

Australian	28. Yidiɲ (Y)	North Queensland	Dixon 1977
Amerind			
- Penutian			
- Plateau	29. Klamath (KLA)	Oregon	Barker 1964, Clements & Keyser 1983
- Mayan	30. Tzeltal (TZ)	Mexico	Kaufmann 1971, Uribe 1962
- Hokan	31. Diegueño (D)	Mexico/California	Langdon 1970
- Andean	32. Quechua (Q)	Peru	Quesada 1976, Parker 1969
Na-Dene			
- Athabaskan	33. Navaho (NAV)	Arizona etc.	Sapir & Hoijer 1967, Young & Morgan 1980
Isolates	34. Basque (B)	Spain/France	Saltarelli 1988, Hurch 1988a

The usual disclaimers regarding typology apply:

a) First of all, a sample of 34 languages is, of course, admittedly small. For this reason, the presentation of results will stay close to the linguistic data and will try not to hide the individual languages behind quantifications and statistics which would be hardly convincing in such a small sample anyway.

b) It is trivial that no typology can be better than the grammars on which it is based. The problem is aggravated in the present case as grammars and phonologies are particularly unreliable and deficient in information on accent placement, rhythm and casual speech phenomena, all of which are of prime importance for prosodic typology.

c) The present analysis shares with all typological investigations the general problems of comparability of grammars which results from the lack of congruence of theoretical terms between researchers and research traditions. (In phonology, the problem is particularly evident in the case of what counts as a phonemic representation.) An additional problem for the present study was the comparability of the information contained in the phonological studies consulted with regard to phonetic detail. The phonetic depth of phonological descriptions varies considerably. Some phonologies include information on "late" (very shallow) phonetic processes which are more or less universal, in the description of a particular language. Other phonologies do not mention these processes. There are cases where it is difficult to judge whether, e.g., an

allophonic rule of vowel colouring from neighbouring consonants, or of vowel-to-vowel assimilation across consonants, is more than the reflection of a quasi-universal "late" phonetic process. Conversely, the absence of such a rule in another phonology leaves the typologist unsure if the process itself is absent, or if it has just been neglected in the language-specific description because it is as phonetically minor and relegatable to the realm of quasi-universal "late" processes.

d) A final methodological problem concerns the variety or register considered. Some of the languages in the sample clearly distinguish a Low and a High variety, some even more than two varieties. The higher varieties tend to be used for ceremonial purposes and are often influenced by other languages which owe their prestige to the role they play in (religious) ritual. Thus, the "educated" variant of Telugu shows phonological traits absent from the popular language, due to the influence of Sanskrit. In other cases, the language may be a minority language and in contact with a dominant language, most of the speakers being bilingual. In all of these cases, an attempt was made to base the analysis on that variant of the language that shows the least external influence, i.e., the spoken, non-educated language of the least bilingual part of the group of its speakers[44].

5. Results

5.1. Syllable structure, vowel harmony and tone

The first parameters to be correlated are syllable structure, vowel harmony and tone. The model predicts that languages with vowel harmony and/or tone will have a simple syllable structure, while complex syllable structure will be found in languages that have neither vowel harmony nor tone. In order to test the prediction empirically, "syllable structure complexity", "tone" and "vowel harmony" must be defined more precisely.

Complexity of syllable structure will be judged according to the following criteria:

a) The maximal *number of phonemes in the syllabic shell*. Following Vennemann (1988), the shell of a syllable is defined as the union of the syllable's head and coda. The number of phonemes in the syllabic shell therefore equals that of the phonemes in the syllable as a whole, with the nucleus phonemes subtracted. (The complexity of the nucleus - i.e. whether a language allows diphthongs or long vowels which may count as two phonemic elements - will be

[44] The loan phonology of a language is of course of particular interest and has been used as evidence for structural - phonotactic - constraints of the language itself.

considered as part of the phoneme inventory traits in section 5.6.) If a language permits syllable shells of a given complexity, it will also allow syllable shells of less complexity (cf. Greenberg 1967). Therefore, a high maximal number of shell phonemes as such is an indicator of word-rhythm, for the variance in shell type complexity that follows from it means that the phonemic duration of syllable tokens is variable.

Two problems arise with this operationalization. The first results from the decision to measure shell complexity on the phonemic level, not on a more superficial (phonetic) one. The problem becomes immediately obvious in the case of vowel epenthesis. Epenthetic vowels are by definition not phonemic; a language which resolves consonant clusters in the syllabic shell by inserting epenthetical vowels therefore will have a relatively high value for shell complexity, although superficially, such syllabic shells may not be realized at all. An extreme case for this in the sample is the Dravidian language Toda which tolerates up to seven phonemic coda consonants according to Emenau (1984:18ff):

/öʃtjʃpj/	'you said'
/moːɳkjm/	'ruby'
/poʈoɳmnm/	'and Potonm (=proper name), acc.'
/kofɖkj/	'guestmaster of Badaga village'

Most of the consonants in the codas of these words are fully released, however, which is only possible, when a short epenthetic vowel intervenes. Thus, phonetically speaking, Toda words such as the examples given here may in fact consist of of a sequence of one full and up to seven "secondary" syllables.

Note that epenthesis is a feature of syllable-rhythm, consonant clusters one of word-rhythm; complex shells co-occurring with phonetic epenthesis therefore diminish a language's affiliation with the syllable-rhythm prototype. The opposite is also observed: a language that has a relatively simple phonemic syllable structure (such as French) may increase shell complexity on the surface by rules of (often tempo-dependent) vowel elision (cf. *ch<u>e</u>min* [ʃmɛ], *r<u>e</u>garde* [ʀgaʀd], *p<u>e</u>tit* [pti]). Here, phonemic shell complexity positions the language close to the syllable-rhythm type, while phonetic rules of vowel elision leading to more complex phonetic surfaces relativize this classification.

In the present investigation, shell complexity will be analyzed on the phonemic level; the rules/processes which may or must apply in order to transform these phonemic into phonetic forms (such as epenthesis or deletion) constitute a different parameter for establishing a language's type and will be treated separately (see next subsection).

A second problem with measuring shell complexity resides in the separation of nucleus and shell. In the case of diphthongs vs. glides, i.e. in a syllable body of the type CGV, or in a syllable rhyme of the type VGC, it is not a priori clear if GV/VG should be considered falling or rising diphthongs, or sequences of a consonant and vowel or vice versa. In the first case, G would be considered part of the syllable nucleus, in the second case, part of the shell. The question cannot be answered without a detailed investigation of the phonological system of a language as a whole. Where such an investigation was impossible, the consulted author's terminology was followed.

b) *Coda complexity*. For the calculation of phonemic syllable weight or phonemic syllable duration the syllable head is often neglected: in most theories, a CCV syllable has the same weight/length as a V syllable.[45] This matches the prediction made by our model that syllable-rhythm maximizes onsets and favours open syllables. Consequently, coda complexity must be valued higher as an indicator of word-rhythm than head complexity. To give an example: Diegueño and Japanese both have a shell complexity of "3", but the Diegueño pattern (C)V(:)(C)(C) is nearer to the word-rhythm prototype than the Japanese pattern (C)(C)V(:)(C), since the two consonantal slots are in the coda in the first case, but in the onset in the second case.

c) *Sonority relations* in the syllable shell. Shell complexity is not merely a matter of the number of consonantal phonemes. A "good" syllable obeys the laws of sonority, i.e., its sonority increases through the head and decreases through the coda. The sonority scale used here[46] orders non-vocalic phoneme classes as follows:

glides > sonorants > fricatives > stops

Coda or head clusters that disobey this scale - such as stop clusters in Russian (as in *KTO*, etc.) or Arabic (as in /bad?/ 'beginning', /katabt/) - are typical for word-rhythm. The least problematic deviation from the optimal CV syllable seems to be a CCV-syllable of the type CGV, i.e. a maximally sonorant glide next to the nucleus; the least problematic deviation towards syllable closure seems to be CVN or CVG, i.e. a highly sonorant syllable coda. For instance, the maximal CC...C-shell of Japanese is CG...N. Among the violations of the sonority scale, the sequence sibilant + stop .... or .... stop + sibilant seems to be less problematic than other combinations with stops (e.g., stop + stop, or ... stop + sonorant/sonorant + stop ...).

---

[45] Cf. Hyman (1985), Hayes (1989), Auer (1991).

[46] Cf. Auer (1990):38), Kiparsky (1981). Of course other - richer - sonority scales have been proposed which would lead to different results. For instance, some authors make a distinction between more sonourous voiced stops and less sonorous voiceless counterparts.

Finally, in judging shell complexity, the *marginality* of some shell structures has to be considered. For instance, Telugu basically has syllable shells of a maximal complexity of "2" (C...C); however, there are some C_1C_2...C shells (with C_2 = /w,y,r,l/) in its loan vocabulary (as in /swaa&ryi&tam/ 'self-earned property'). Surely it would be inadequate to treat this language on a par with Arabic or Tzeltal which have very frequent CC-codas and -heads throughout their vocabulary. This means that the frequency of the established maximal shells must be taken into account.

Vowel harmony is defined in rather strict terms here as progressive long-distance assimilation involving at least one distinctive feature, the domain of which is statable in morphological terms; vowel harmony therefore involves neutralization of vocalic features, and a morphological boundary marker. This definition excludes cases of "vowel attraction" below the threshold of distinctive features, and it also excludes *umlaut* (metaphony). A case of metaphony would be regressive long-distance attraction as it is sporadically observed in Amo (Di Luzio 1967), cf.

/`n-malù-yiru/ → [mmálìyiru] I have taken'
/àkùtaba-nìkùtocìn/ → [akutábánuktɔcìn] 'seventy'
/ma ù-mon ´n-dă ba/ → [mûmɔńdabá] 'no one has come'

which does not qualify as a VH language for this reason. An example for vowel attraction below the threshold of distinctive features would be the phonetic centralization and/or laxing of vowels before low vowels in the following syllable as observed in Telugu (Kosticò et al. 1977:7), cf.

[gi:ru] 'to scratch' vs. [gɪ:ra] 'a scratch'
[ko:ti] 'monkey' vs. [kɔ:ta] 'harvest'
[kʌmpa] 'bush' vs. [kampu] 'stink'.

Vowel harmony is independent of the ictus position, i.e., it is not necessarily the accented syllable (if the language has lexical stress at all) that acts as the assimilator. However, a language which is in a state of transition from syllable to word-rhythm may restrict vowel harmony to non-accented vowels (as is reported for East-Cheremis, see Rédel 1976).

Vowel harmony may be a central or marginal phenomenon. As an example for an almost 'maximal' (fully exploited) system of vowel harmony, Turkish has already been mentioned (see above, p. 37). The system is 'maximal' in the sense of applying to all vowel phonemes (i.e., there are no neutral vowels), and it is almost 'maximal' in the sense of involving a vast majority of suffixes and additionally, a good number of the stems. As an extremely marginal system of vowel harmony, we may consider Yidiɲ (Dixon 1977: 60), where there is a statistical correlation between the second and third vowel in trisyllabic roots (e.g., in 62% of the so-called reducing

stems, they are identical). Although the basic criteria for vowel harmony (neutralization, progressiveness of assimilation) are fulfilled, the assimilation is restricted to one morphological-lexical environment (it applies neither to the first/second vowel in a stem, nor to suffixes, for example), and it is statistical instead of categorical. Obivously, it would be nonsensical to treat such a language on a par with Turkish.

It should be noted that word-internal phonotactic harmonization may also affect consonants, either because certain features harmonize across vowels and consonants (which is marginally the case in Turkish), or because consonants harmonize independently of vowels. An example of the latter type is Hausa which only permits one type of glottalization per lexeme. Consonant harmony has not been considered in the present investigation, however.

A *tone language* in the sense of the present study is one in which contrastive pitch patterns are used for distinctive purposes within the word. This includes languages that have "pitch accent" (or "musical accent") such as Japanese. However, regarding the distinction between word-rhythm and syllable-rhythm, "restricted" and "non-restricted" tone languages have to be distinguished, the latter being closer to the prototype of syllable-rhythm than the first. Following van der Hulst & Smith (1988), an unrestricted tone language is one in which contrastive tone is assigned to (almost) every syllable in the lexicon. Of the languages in our sample, this applies to Yoruba. A tone language is the more restricted the fewer syllables are assigned distinctive (lexical) tone. Thus, Mandarin is a somewhat restricted tone language as it permits neutral (toneless) syllables. Even more restricted are tone languages in which lexical tone is only assigned to stressed syllables, such as Norwegian or Croatian. Another important instance of restricted tone languages are those languages that do not have lexical stress but distinctive tone patterns on maximally one syllable of the word ("musical accent").

Applying the above-mentioned criteria, Fig. (10) orders the languages of the corpus according to increasing shell complexity and correlates syllable complexity with vowel harmony and tone.

(*Fig. 10*): *Vowel harmony, tone, and syllable complexity (0= obstruent, P=plosive, S=sonorant, G=glide, N=nasal, L=liquid); information in ( ) is unreliable)*

	max. shell structure	**sonority**[47]	**tone**	**vowel harmony**
YO	C...	ø	yes: unrestricted	no
FIJ	C...	ø	no	no

[47] 'ø' means that the language has no consonant clusters; '-' that the sonority scale is not always followed, '+' that it does.

AMO	C... marginally P*r*..., ...(L)C	+	yes: but toneless syllables	no
MAN	C...N	ø	yes: but toneless syllables	no
JA	CG...N/C[48]	+	musical accent	no
TE	V…S/G/*s*	ø	no	no
HAU	C...C	ø	yes: unrestricted (marginal)[49]	no
TOB	C...C	ø	no	no
ESK	C...C	ø	no	no
NAV	C...C	ø	yes: but toneless prefixes	no
AS	C...C, C…CC dialectal	ø/?	(marginal)[50]	no
Q	C...C, CC…, ..CCC marginal	ø	no	no
MUN	C...C, C*r*...C marginalCG...C	+	no	(restricted)[51]
VIE	CG...C[52]	+	yes: unrestricted	no
TA	CG/L...C	+	yes: unrestricted[53]	(very restricted)
KH	CG..C, C…GC	+	no	restricted

[48]Syllable-final consonant may be a nasal or the "first part" of an intervocalic geminate.

[49]Cf. Abraham (1959)b: 165). His other examples for "vowel harmony" (cf. 1959b: 127f and passim) are "vowel attraction" in the sense of the present study.

[50]Voorhoeve (1980: 22) found "no evidence for phonemic pitch except for a few puzzling cases in which monosylllabic homonyms when contrasted in isolation seemed to carry different tones" in one dialect; he adds that unpublished word on other dialects has come to different results.

[51]There is a partly optional system of [±high] harmony with a neutral vowel /a/ (i.e., across morpheme boundaries). The available phonological restrictions leave some doubt if the definitional criteria for vowel harmony are always met, since regressive and progressive harmony both seem to be possible.

[52]The system of final consonants only has unreleased stops/nasals or glides, while the initial consonant system also has preglottalized implosives and fricatives.

[53]Tone is only distinctive on the first syllable of a phonological word.

NAM	CC...N[54] only stem-initial, otherwise C...C	-[55]	yes: unrestricted[56]	restricted[57]
!X	CC...N only stem-initial otherwise C...C	-	yes: unrestricted	very restricted[58]
Y	CC...C oder D...CC[59]	?	no	marginal
NIM	CCr...C[60]	-	no	no
T	C...CC	+	no	almost unrestricted
U	C...CC	- (rare)	no	no
D	C...CC	+	no	no
KO	CG...CC[61]	- (PS&)	no	marginal[62]

[54]In Nama and !xóõ, stem-initial CC-clusters may consist of an initial click and a subsequent "joiner". The analysis follows Vedder (1938) and Traill (1985) respectively, while other authors (e.g., Beach 1938) have suggested a monosegmental treatment of such stem-initial configurations.

[55]If clicks are treated as stops, and since "joiners" may be stops as well, sequences of two stops occur stem-initially. The same applies to !xóõ.

[56]Both in Nama and !xóõ, tones are projected on stems or suffixes, but two-syllabic stems receive one tonal pattern only.

[57]Meinhof (1909: 115) and Beach (1938: 41f) agree that the second vowel of two-syllable stems harmonizes with the first with respect to height (*e/o* and *i/u* forming natural classes), while /a/, the fifth vowel of the language, is neutral. this "vowel harmony" does not extend to affixes, however, and it seems to be more statistical than categorical. It is non-prototypical due to the fact that it is not productive, and is more of generalization over stem vowel sequences in the lexicon than a phonological rule filling up unspecified suffix vowels (as in the case of a non-restricted VH language).

[58]According to Traill (1985), the second vowel in a two-syllable stem has to be [+back] if the first vowel is also [+back], i.e. /a,u,o/.

[59]According to Dixon (1977), medial CCC-sequences can be syllabified both ways; only the second obeys the sonority scale, however (cf. his examples /guyŋgan/ 'spirit of a woman ' or dulnbilay/ 'white cedar', p 37). Initially and finally, only single C occur; the possible word-final consonants are subject to further restrictions.

[60]Both the initial consonant in head clusters and the coda consonant are subject to restrictions; in the first case, only /h,s/ or nasals may occur, in the second only /p,b/ or nasals.

[61]Note that the formula, taken from Kim-Renaud (1978), refers to underlying (phonemic) syllables;. On the phonetic surface, all syllables are CG...P/S, and the only possible stops in final position are unreleased [b̚], [d̚], [g̚].

[62]According to Lee (1988: 286), some traces of VH can still be found, such as the variation between /a/ und /ʌ/ in some suffixes, depending on whether the preceding syllable's vowel is /a, o/ or not.

B	CS...S/*s* C	+	(marginal[63])	(marginal[64])
TZ	CC...CC	-	no	no
ARA	CC...CC	-	no	no
FR	CC...CC, CCC... marginal	+[65]	no	no
GAE	*s*CC...CC	- (&*s*P)	no	no
CIR	(CCC...CC)[66]	(-)	no	no
R	CCC...CCCC	-	no	no
KL	CC...CCCC[67]	-	no	no
ENG	CCC...CCCC	- (&*s*P, P*s*&)	no	no
TOD	CG...CCCCCCC[68]	-	no	no

The predicted positive correlation between syllable shell complexity and the absence of tone and vowel harmony seems to be born out by these data. However, the correlation is stronger for tone than it is for vowel harmony. No tone language (not even a restricted one) has a syllable structure exceeding CC...C with strong restrictions on the syllable-final and/or the second syllable-initial consonant (see dotted line). The inverse relation does not hold: some languages (such as FIJ, TE, TOB, ESK) do not have tone, although their syllable structure is extremely simple. Vowel harmony (if marginal cases are excluded) is quite rare in our sample; conclusions must be very tentative for this reason. It seems that a VH language can have a somewhat more complex syllable structure than a tone language (see T); still, no language with a shell structure exceeding C...CC has vowel harmony (cf. solid line). Again, the inverse does not hold.

---

[63]Saltarelli (1988: 286), mentions a case of grammatical marking by pitch (musical accent?) in the plural vs. singular ergative forms of the western Bask dialects.

[64]Saltarelli (1988: 281) gives examples for [±high] and [±round] harmony in some dialects; the direction of the assimilation does not seem to be fixed.

[65]There are marginal exceptions in CCC-onsets, mostly in loan vocabulary; cf. *stradivari, squatter, sprint*, but also *strict*.

[66]Smeets (1984: 138) cites the example [psk'e] 'jump!' for CCC-heads, but does not give a description of syllable structure himself. The above formula is reconstructed from his examples and from his notes on word structure.

[67]This syllable template follows the phonemic description in Clements & Keyser (1983: 117ff).

[68]Clusters occur word-finally only.

5.2. Syllable-related processes

In section 5.1., only phonemic syllable structure was considered. On the way to phonetic surface, these structures may undergo transformations of various kinds. The phonological processes or rules involved are expected to be different depending on the rhythm of a language. In syllable-rhythm, syllable-related processes will enhance the optimal CV pattern, i.e. they will create simpler syllable shells ("syllable-structure enhancing"); in word-rhythm, they will create more complex patterns instead. In the following, the most frequent processes of both kinds will be discussed, with examples from the languages in the sample. Obviously, a language that already has optimal CV structure can do nothing to enhance it. Of particular interest are therefore languages with intermediately or very complex underlying syllable structures.

Processes typical for syllable-rhythm

Vowel epenthesis

Underlying consonant clusters are resolved by vowel epenthesis. This is observed in GAE, KL, U (type / sinf+da/ → /sinifta/ 'in the class' or type / burn#/ → /burun/), T (same type), TO, D, and in MUN (to resolve ...VC&CV... structures). For example, Gaelic resolves most SC sequences after short stressed vowels by an epenthetic mid-schwa (cf. Ó Siadhail 1989:20f):

/ger^{j} m/ (gairm) 'call' → [ger^{j} →əm^{j}]
/gorm/ (gorm) 'blue' → [gorəm]
/dorx&ə/ (dorcha) 'dark' → [dorəxə]

The Munster dialect investigated by Ó Siadhail makes use of vowel epenthesis in other contexts as well, such that even CVC syllables are optimized into CVCV (Ó Siadhail 1989:22f):

/ku:p&lə/ (cúpla) 'couple' → [ku:pələ]
/mna:/ (mná) 'woman' → [məna:].

D (Langdon 1970:63) uses epenthetic schwa in order to resolve impossible consonant clusters that would otherwise arise through affixation, cf.

/ɬ-t-k^{w}i.s/ → [ɬətə k^{w}i.s] 'to wring out'
/p-c-ta.x/ → [p əc əta.x] 'to clap hands'
/ny-c-way-p/ → [n^{y} əc əwayp] 'to live'.

Epenthesis also occurs in the loan vocabulary of those languages that have a simpler syllable structure than the donor language, i.e. in FIJ, J, in some cases in NIM (/s#/ → /se/), in U, KH,

TOB, KO[69], and NAM. As an example, consider the resolution of CC heads in Russian loans in Uzbek by epenthesis in more relaxed registers (note that Uzbek does not allow initial clusters in its native/core phonology):

/traktir/ → /tiraktir/ 'tractor'
/stakan/ → /istakan/ 'glass'
/stan&tsa/ → /istansa/ 'station'

External sandhi = internal sandhi

Word boundaries do not inhibit phonological processes in syllable-rhythm. In general, the phonological adjustments that occur across morphological word boundaries (external sandhi) are those that are observed word-internally as well. Typical for syllable-rhythm are therefore assimilatory processes across word boundaries which treat these contexts just like any word-internal junctures or juncture-less sequences of segments. This can be observed in Toba-Batak (cf. the detailed discussion in Nababan 1981:58ff), in Basque (nasal assimilation, etc.; cf. Saltarelli 1988: 3.4.1.3) and in Toda (Emeneau 1976:34f).

Particularly relevant for syllable structure is the fact that word final consonants may be resyllabified as the heads of following syllables in the appropriate surroundings. Resyllabification of this type is reported for R (across word boundaries, for simple intervocalic consonants, cf. пе&ре&д о&кном, го&ро&д у&фа; Gabka (ed.) 1987:76), for KO (Kim-Renaud 1978:87), for ESK (Fortescue 1984), and of course for FR (*enchaînement and liaison*). Most likely, resyllabification also occurs in some other languages with simple syllable structure without being explicitly mentioned in the grammars consulted.

Allomorphs depending on syllable structure

A particular type of allomorphic alternation predicted for syllable-rhythm languages depends on syllable structure: the morpheme loses its vocalic component when attached to a morpheme ending in a vowel, but keeps it when affixed to one ending in a consonant; or, it loses its consonantal component when attached to a morpheme ending in a consonant, but keeps it when affixed to one ending in a vowel. This holds for Q (enclitics and other morphemes), NAV (in prefixes of the type C*i*/CVC*i* : *i* → ø/__V), U, T, AMO. Cf. the examples from Turkish:

/baba+Im/ → [babam] 'my father'
vs. /ev+Im/ → [evim] 'my house'

[69]Korean seems to use two alternative strategies, however, in order to incorporate more complex syllable structures in its vocabulary, i.e.: simplification of consonant clusters and epenthesis; cf. the various adaptions of engl. *picnic* : [$p^hik^h\text{ɨ}nik^h\text{ɨ}$], [$p^hik^h\text{ɨ}nik^{\neg}$], [$p^hi\ \text{ŋ}nik^{\neg}$] (Kim-Renaud 1978:95]

/oda+In/ → [odan] 'your room'
vs. /kitab+In/ → [kitabɯn] 'your book'
/su+nIn/ → [sunun] 'water (GEN.)'
vs. /adam+nIn/ → [adamɯn]

It is obvious that morphophonemic alternations such as these enhance the CV pattern typical for syllable-rhythm. Closely related are processes of consonant epenthesis in order to avoid hiatus (sequences of vowels with intervening morphological boundary); inserting a consonant supports the syllable by providing it with an onset and avoids the natural tendency of vowel sequences to coalesce into a diphthong. An example is the "ligature /h/" of Navaho which is sometimes inserted between an open stem vowel and an enclitic (Young & Morgan 1980:xxiv):

/tó+ígíí/ → /tóhígíí/ 'the water'
/tó+éé/ → /tóhéé/ 'the aforementioned water'.

Further processes of this kind are discussed in section 5.5.

Processes typical for word-rhythm

Deletion of vowels

When unstressed vowels are deleted, more complex syllable structures may arise. This is true for mid-schwa deletion in Circassian (Smeets 1984: 122):

/səwəmət̪ ew/ → [sʊwu:mt̪oʊ̯] '(you) not giving me (to somebody)'
/nat̪əfədeɣʷer/ → [natəfdeɣʷœr] 'the good maize'

or for the various morphonological and sandhi rules of Telugu which produce closed syllables, particularly through vowel deletion, as in the following examples (from Kostic et al. 1977):

/win+a+nu/ → /winnu/ 'I won't listen'
/mana+to/ → /manto:/ 'with us'
/guḍi+lu/ → /guḍḷu/ 'temples', etc.

It also applies to elision of the instable (unstressed) vowels in the Arabic dialects; cf. the following examples from Egyptian Arabic which result in intervocalic clusters (from Mokhtar 1981:9f):

/ya:ḥud/ 'he takes' ~ /yaḥdu/ 'they take'
/ana + ʃiribt/ → /anaʃribt/ 'I drank'

The same processes of elision can also result in final or initial clusters in Arabic, as in the following examples from Sr̥āwi (from Kouloughi 1978):

/ma#xedem+et#húm+ʃ/ → [mäxedmethúmʃ]
'she hasn't done them'

/ne+sä:mett+u/ → [nsä:mttu] 'we forgive'

Similar phenomena are reported for KLA, GAE, D (all of which combine vowel epenthesis and vowel deletion, however), KH (Street 1963:70), ESK, E, and marginally for HAU (Abraham 1959b: 128).

The process tends to be tempo-dependent. An increase of syllable structure as a consequence of the deletion of unstressed vowels in more rapid speech is reported for NIM, for U (see above), KH (see above), some Arabic dialects (Sr5añ̃ wi), D, KO, T, ENG, FR and NAM. Cf. the following allegro forms from Nimboran (Anceaux 1965):

/prí&be&ne&ŋgá&tu/ → /príbn&ŋgá&tu/ 'I throw repeatedly below to above'

/príp&kre&be&dú/ → /príp&kreb&d/ 'the two will throw up from here'

Of course, vowel deletion also occurs without creating more complex syllable shells; it may even support the ideal CV structure. This is the case when VV sequences are simplified, which occurs both in potential word-rhythm languages (such as CIR) and in potential syllable-rhythm languages (such as YO).

Consonant-consonant assimilation

Complex syllable shells may be simplified articulatorily by assimilation. Assimilation with respect to the feature [±voice] is most frequent, and observed in U, CIR, ARA, R, FR ([aʧté] < a *jeté*, [bukl̥] < *boucle*[70]), ENG. Assimilation with respect to the features [±glottalized], [±labialized] and/or [±velarized] is reported for CIR and ARA, for palatality in R, for retroflexion in TOD.

Processes of ambiguous status

Consonant cluster simplification

Consonant clusters which have arisen through morphological or morphosyntactic operations may be simplified by total assimilation/coalescence or deletion. This happens in ENG (type *let me*, *let him* > [lɛmɨ], [lɛᵖm̩l]), in U (type /waqt+ga/ → /waqqa/ 'at the time'), sporadically in NIM (/#hr/ → [r]), in R (cf. праздник, марксистский, здравствуйте → [práz'n'ιk] [mʌrks'ísk'ιi], [zdrástvuɨt'ι]), TOD (numerous; cf., e.g., /wɯdn/ → [wɯn] 'one', /uʧtʧ/ → [uʃtʃ] 'that (the stars)

[70]M. Kilani-Schoch, pers. comm.

have risen', /kaʈtjʃk/ → [kaʈʃk] 'he sent'; Emeneau 1976:41ff) and KO (of the type /nəks+əps+ta/ → [nəgəpt'a], cf. Kim-Renaud 1978: 95). Coalescence is observed in CIR (Smeets 1984: 117ff). Apart from syllable-internal consonant clusters, clusters may also simplify across syllable boundaries by coalescence or deletion, resulting in simpler intervocalic ...VCV... structures. Processes of this kind are reported for B, KL, Q and ESK. Cf. the following examples from West Greenlandic/Eskimo (Fortescue 1984: 351):

nirisassaq+kit+pput → nirisassakipput 'they have little food'
inuk+piluk → inupiluk 'bad man'
qimmiq+mik → qimmimik 'dog (INSTR.)'

Tempo-dependent deletion of this type is reported for U (type /oqituwtʃi/ → /oqituʃi/ 'teacher'). Note, however, that total assimilation in ...VC_i&$C_{ii}V$... structures does not necessarily imply any kind of change in syllable structure in syllable-rhythm languages. In fact, while it may produce open syllables (in potential syllable-rhythm languages) or ambisyllabicity (in potential word-rhythm languages), total assimilation also frequently results in geminates (...VC_i&C_iV...), which leave syllable structure intact. Such a solution to heterosyllabic cluster simiplification is chosen, e.g., by Hausa (Abraham 1959: 153ff), where processes such as the following are frequent:

/fikfikè/ →> /fiffikè/ 'wing'
/wakwakìltá/ → /wawwakìlt/ 'kept on appointing persons as one's representatives'
/rakràká/ → /rarràká/ 'escorted'.

The same type of geminate formation occurs in ESK (cf. *Nuuk+piaq* → *Nuuppiaq* 'the real Nuuk', etc.).

The available information on processes and rules typical for word-rhythm or syllable-rhythm is summarized and compared to information on syllable shell structure in Fig. (11).

(Fig. 11): Phonemic syllable shell complexity (marginal or dialectal shells in ( )) and syllable-related processes (Ep = Vowel Epenthesis, (Ep) = Epenthesis in loan words, San = sandhi/resyllabification, Allo = syllable-structure related allophones, Del = vowel deletion, (Del) = vowel deletion marginal or only in allegro forms, (Ass) = Consonant cluster assimilation of voicing only, Ass = other consonant cluster assimilations, Simpl = Simplification of consonant clusters by deletion or total assimilation.
Ep, (Ep), San, Allo = predicted for syllable-rhythm
Del, (Del), (Ass), Ass = predicted for word-rhythm.)

	max. schell structure	**syllable-related processes**					
YO	C...	(Ep)					
↑FIJ	C...	(Ep)					
↑AMO	C...,(P*r*…,…(L)C)			Allo			
MAN	C...N						
↑JA	CG...N/C	(Ep)					
↓TE	C...S/G/*s*				Del		
(↓)HAU	C...C				(Del)		
↑TOB	C...C	(Ep)	San				
ESK	C...C		San		Del		Simpl
↑NAV	C...C			Allo			
AS	C…C, (C…CC)						
↑Q	C…C, CC…, (..CCC)			Allo			
↑MUN	C...C, (C*r*…C)	Ep					
VIE	CG...C						
TA	CGG/L...C						
KH	CG...C, C...GC	(Ep)			Del		
NAM	CC...N, C...C	(Ep)			(Del)		
!X	CC...N, C...C						
Y	CC…C, C…CC						
NIM	CC*r*...C	(Ep)			(Del)		
T	C…CC	Ep		Allo	(Del)		
U	C…CC	Ep		Allo	(Del)	Ass	Simpl
D	C…CC	Ep	San		Del		
KO	CG…CC	(Ep)			(Del)		Simpl
B	CS…S/*s*C		San				Simpl
TZ	CC…CC						
↓ARA	CC…CC				Del	Ass	
FR	CC...CC, (CCC...)		San		(Del)	(Ass)	
GAE	*s*CC…CC	Ep			Del		
↓CIR	(CCC…CC)				Del	Ass	Simpl
R	CCC…CCCC		San			Ass	Simpl

KL	CC...CCCC	Ep		Del	Ass	Simpl
↓ENG	CCC...CCCC			Del	Ass	Simpl
TOD	CG...CCCCCCC	Ep	San		Ass	Simpl

Blanks in this figure do not necessarily imply that the process is absent from the language. For instance, in order to integrate loan vocabulary vowel epenthesis is likely to occur in Amo and Eskimo just as in Fijian and Japanese. However, no information on the issue was found in the grammars available to me.

The data reveal first of all that there is a clear correlation between cluster simplification and consonant-to-consonant assimilation on the one hand, and maximal shell complexity on the other. Since the possibility for these processes to occur increases naturally with syllable complexity, this result should not be too surprising. They are, in a way, derived phenomena. This applies in particular to assimilation, which is a feature of word-rhythm languages following from their potentially highly complex syllables. Simplification of consonant clusters is of some interest where it occurs in languages with medium or low syllable complexity, such as ESK/Q, and U, KO, B. But in these languages, some simplifications (particularly deletion in CC clusters across syllable boundaries as in ESK, Q and B) may be interpreted as an indicator of syllable rhythm as well, as it enhances CVCV structure.

The remaining syllable-related processes are linked to syllable-rhythm (Epenthesis, Sandhi, Allophones) or word-rhythm (Deletion). However, quite a few languages combine processes of both types (e.g., vowel deletion with vowel epenthesis) and are, in this sense, ambiguous. Only in 12 languages does one type of process clearly dominate (marked in Fig. (11) by arrows: ↑= towards syllable-rhythm, ↓= towards word rhythm). For these languages, it seems to be true that syllable-optimizing processes occur in languages which already have a syllable shell structure of C...C or simpler, while typical word-rhythm phenomena are observed in languages of CC...CC patterns or more. In a few cases, however, taking into account syllable-related processes corrects the ranking of the language with respect to phonemic syllable structure as given in section 5.1.: Telugu and (to a lesser degree) Hausa move somewhat towards the word-rhythm pole.

5.3. Stress and accent

Before this parameter (one of the most difficult) can be investigated, a number of terminological and theoretical problems have to be settled. It is intuitively obvious that the importance of stress at the level of the phonological word (vs. the intonational phrase) for a language varies enormously. It is not so easy, however, to decompose this notion of intuitive "importance" into well-defined features.

"Accent" is defined here as word accent, i.e. a functionally determined position in the (phonological) word realized on one of its syllables. In accordance with a long tradition of research[71], the typical function of accent is seen as "culminative" ("gipfelbildend", Trubetzkoy), i.e. it is one of marking the word as a prosodic unit. Thus, (a) there is one and only one accent per word, and (b) the function of accent is (primarily) a syntagmatic one, although it may have an (additional) distinctive (paradigmatic) function. (The latter criterion delimits accent from tone.)

Consequently, languages are said to have no (word) accent, if one of the following holds:

- All syllables receive approximately even stress. (Of course, there may be a phrasal accent of some kind.) This is reported for YO, ESK, VIE and FR. In some languages, most words have lexical accent; yet there is a group of unaccented words as well. This applies to MAN (toneless syllables are unaccented) and to JA.

- There may be more than one accent per word. This applies to FIJ, where all long vowels, the second to last vowel if the last one is not long, and the first syllable in four-syllabic words, are equally emphasized by loudness. (The rules do not exhaust all possibilities, i.e., there is - most probably idiosyncratic and also lexical - variation; cf. Schütz 1971.) It also applies to MUN and to YI. (In YI, every second syllable receives phonetic prominence in the word, long vowels and word-initial syllables attract prominences; Dixon 1977.)

Word accent is independent from phrasal or sentence accent. Words uttered in isolation are spoken as intonational phrases; their accentuation therefore is irrelevant for (word) accent. In order to classify a language as an accent language, word-level accent needs to be investigated in intonational phrases containing more than one (phonological) word.

Accent itself has to be distinguished from its phonetic realization. It may vary from language to language. In particular, a distinction has been made between dynamic (stress) accent and musical (pitch) accent. While fo-prominences are used as phonetic markers for both types of accent, dynamic accent is additionally realized by the phonetic parameter loudness.

Accent may be predictable or non-predictable. Predictable accent may be stable, e.g. on the first, or last syllable of a word. Or there may be phonological rules which specify accent placement unambiguously (e.g., last heavy syllable, otherwise first light syllable). Non-predictable accent is less suited for fulfilling the culminative function than predictable accent.

---

[71] Cf. e.g., Trubetzkoy (3./1958), Garde (1968), Hyman (1977), Beckman (1986).

The combined culminative (primary) and distinctive (secondary) functions of accent can be exemplified in Turkish with its dominant word-final stress; although this pattern holds for the large majority of words, there are numerous exceptions (cf. Lees 1961: 41ff, Marchand 1960:26f, Kaisse 1985). Thus, certain suffixes attract accent, while others do not; the plural, case and possessive suffixes are of the first type, while the existential, question suffix or appreciative are of the second:

/adám/ 'the man' ~ /adamɯ′n/ 'of the man (GEN.)'
~ /adamlár/ 'the men' ~ /adamlarɯ′n/ 'of the men' ~
/adamɯ′/ 'her man' ~ /adamlarɯ/ 'her men' ~
/adamlarɯ nɯ′/ 'of her men'

/adám/ 'the man' ~ /adámmɯ/ 'the man?' ~ /adámdɯ r/
'it is the man' ~ /adámca/ 'beloved man'

From yet another type of suffix, such as the present marker ó or the negative potentiality marker *á*, accent cannot be shifted away:

/yap-acaq-sɯ nɯ′ z/ 'you will do (PL.)', but
/yap-yór-sɯ nɯ z/ 'you do (PL.)'
/yap-á-mɯ-yacaq/ 'he will not be able to do it'

In addition to these purely grammatical functions, accent may also indicate grammatical category in Turkish (e.g., adverbs tend not to have final accent, cf. /yálnɯ z/ 'only' vs. /yalnɯ′ z/ 'alone'), and it may serve purely lexical functions, particularly in proper names (which are generally excepted from the rule of final stress, cf. *Ánkara, Istánbul*, etc.).

Given this theoretical background, the intuitive notion of the "importance" of (word) accent for a language may now be defined more precisely. The following parameters are considered:

a) *Phonetic realization*

Given the fact that increased intensity is perceptually less distinctive than duration or fundamental frequency changes (cf. Lehiste 1970: 125-132), languages which realize accent phonetically only by intensity should be ranked lower than those which use fundamental frequency or duration (in addition). The same probably holds for duration alone. However, information about the phonetic realization of accent was often scarce and occasionally lacking completely in the phonologies consulted.

b) *Phonological predictability*

The clearer and the less ambiguous the phonological rules are that assign accent, the better it can serve its definitional culminative function. On the other hand, where it is difficult to find out about the regularities of accent placement (usually not only for the linguist, but also for lay persons acting as informants), the culminative function is ill-served and the importance of accent for the language is small. As a rule-of-thumb, phonological accent rules depending on syllable weight, segment length etc. are less suited to fulful the culminative function of accent than those operating on the basis of syllable position in the word.

c) *Grammatical/lexical function*

If accent takes on grammatical functions, its importance for the language is judged to be high, although its culminative function decreases. The same is true if accent takes on lexical functions in the word (i.e., when accent becomes a distinctive lexical feature). Usually, languages with grammatical accent also have some cases of lexical accent in their vocabulary (cf. Hyman 1977:40f).

Fig. (12) summarizes the information on accent in the sample. The first column relates to the question if a (word) accent exists at all, and if so, if it is a dynamic or musical accent; the second column relates to the phonetic realization of accent; the third column relates to the phonological rules which assign accent - is accent free or fixed, which phonological rules apply, is stress assignment unambiguous?; the final column refers to grammatical and lexical (distinctive) functions of accent in addition to the culminative function.

(Fig. 12): Word accent and its importance

	type of accent	**phonetic realization**	**phonology of accent**	**distinctive functions**
YO	none	-	-	-
AMO	none[72]	-	-	-
FIJ	none	-	-	-
ESK	none	-	-	-
MUN	none	-	-	-
VIE	none	-	-	-

[72]Di Luzio, pers.comm. (deviating from the description in Di Luzio 1967).

TA	none[73]	-	-	-
YI	none	-	-	-
FR	none	-	-	-
NAM	none[74](?)	-	-	-
JA	musical (toneless words)	pitch	-[75]	lexical
TE	dynamic	?	vague, phonological (weight)[76]	
T	dynamic	pitch/loudness	final (exceptions!)/ vague[77]	grammatical/ lexical (rare)
UZ	dynamic	?	final (exceptions!) vague;	grammatical/ lexical (rare)
CIR	dynamic		ultimate or penultimate (dominant) vague, not predictable	
KH	dynamic	duration and loudness	penultimate heavy syllable, otherwise initial	

[73]I follow Mazaudon (1973:88f) who argues for 4 tones in Tamang, instead of a system of two tones and accent, by pointing to the inadequacies of such a description. (In particular, the mixed tone/accent system would predict a six-fold prosodic pattern on three-syllabic words, while only four are observed.) Note that Tamang is a restricted tone language with one tone assigned to each word (not syllable). The culminative function ist therefore served by tone, not by accent.

[74]According to Beach (1938:120ff) what could be called accent is identical with high tone. As there may be more than one high tone in a word, the culminative criterion is not met. It should be noted, however, that Meinhof (1909:20) suggests a strong stem-initial stress-accent.

[75]There is a statistical tendency for the pitch to change on the antepenultimate mora.

[76]According to a recent publication (Lisker & Krishnamurti 1991) there is little agreement on accent placement even among native speakers; the same holds for linguists. Hyman's classification of TE as having initial accent is clearly wrong (Hyman 1977). The only thing which seems to be sure is that accent assignment is sensitive to the distinction between light and heavy syllables. According to Lisker & Krishnamurti (1991), the second syllable seems to be preferred in three-syllabics, the last long vowel otherwise.

[77]Native speakers have considerable difficulties to assign or identify stresses; cf. Dauer (1983, fn. p 52).

KO	(dynamic)[78]	pitch	predictable, first heavy syllable; first but second elsewere	
KL	dynamic	pitch, loudness	depending on [±long] and syllable closure	
ARA/Sʿāwi and Egyptian	dynamic	loudness, pitch	penultimate dominant, but depending on weight	
GAE	dynamic	?	initial (dominant), [±long] important	
ENG	dynamic	pitch, loudness, duration	depending on weight	grammatical/ lexical
D	dynamic	loudness/ pitch	final, penultimate if final short vowel	
B	dynamic	pitch or/and loudness	penultimate (dominant)	lexical
Q	dynamic	?	penultimate (mostly)	
TOD	dynamic	loudness	inital	
TZ	dynamic	?	final[79]	?
TOB	dynamic	loudness, duration	penultimate syllable (dominant);	grammatical
MAN	dynamic	pitch[80], duration	last tone syllable	

[78]The analysis follows Cho (1967: 121). Lee (1989:23 et passim) denies the existence of a word accent and speaks of the stress group (foot) instead. Lee's reason for denying the existence of word accent is that "stress is not phonologically distinctive in Korean": this suggests that his notion of accent/stress is different from the one used here and restricted to "free" accent According to his rules for stress assignment in the stress group, only one accent per word should be possible; therefore, stress has culminative function.

[79]Kaufmann (1971) does not give explicit rules for accent placement; Hyman (1977) and Uribe (1962) both classify Tzeltal as having dominant final accent.

[80]In a tone language such as Mandarin, stress by pitch means that the overall pitch movement in the realization of tone is enlarged on this syllable.

NIM	dynamic (exceptions)[81]	pitch and loudness		lexical
R	dynamic	pitch, loudness, duration	-	grammatical/ lexical

For HAU, NAV, AS, !X available information was not sufficient to warrant analysis.

Languages are ordered according to (a) whether there is a culminative accent at all (languages of the first group have no word accent in this sense), (b) whether the rules that assign accent are salient and clear or vague (the latter holds for the second group), (c) whether rules that assign accent depend on phonological criteria such as syllable weight (this holds for the third group) and (d) whether accent is stable (fourth group). Russian and Nimboran, the last languages in the list, assign accent on the basis of grammatical and lexical criteria only, i.e. never on phonological grounds.

Comparison with syllable structure results in Fig. (13), which repeats the ordering of languages according to the 'importance' of accent as in Fig. (12), with shorthand information on accent rules, and additional information on syllable structure and syllable-related processes:

[81] According to Anceaux (1965:38f), Nimboran has a limited number of words with two stressed syllables; Hyman (1977:38) concludes from this observation that Nimboran has no word accent at all, as the culminativity criterion is not met. However, the examples given by Anceaux show that - with the exception of one word, probably a hidden duplication - the two accents are never equal; either one of them has to be secondary (any of them may), or, in the case of some proper names, one of them (but not all of them!) may be dropped. It has to be concluded (following Anceaux himself) that stress does have culminative function in Nimboran.

(Fig. 13): Word accent and syllable structure

	accent rules	**shell structure**	**sonority**	**syllable rules**[82]
YO	-	C...	ø	
AMO		C..., (P*r*…/…(L)C)	+	↑
FIJ	-	C...	ø	↑
ESK	-	C...C	ø	
MUN	-	C...C, (C*r*...C)	+	↑
VIE	-	CG...C (restr.)	+	
TA	-	CG/L...C	+	
Y	-	CC…C, C…CC	?	
FR	-	CC...CC, (CCC...)	+	
NAM	- (?)	CC...N (restr.)	(-)	
JA	lexical	CG...N/C (restr.)	+	↑
TE	vague, phonological (weight)	C…S/G/*s*	ø	(↓)
T	final (exceptions!) /grammatical; vague	C…CC	+	
UZ	final (exceptions!) /grammatical; vague	C…CC	(-)	
CIR	ultimate or penultimate (vague)	(CCC…CC)	(-)	↓
KH	penultimate heavy syllable, otherwise initial	CG…C, C…GC	+	
KO	predictable, first or second syllable; depending on syllable weight	CG…CC	-	
KL	depending on [±long] and syllable closure	CC…CCCC	-	
ARA/Sṛāwi and Egypt	penultimate dominant, but depending on weight	CC…CC		↓

[82]Only unambiguous cases are given.

GAE	initial (dominant), [±long] important	*s*CC…CC	-	
ENG	depending on weight, partly grammatical/lexical	CCC…CCCC	-	↓
D	final, penultimate if final short vowel	C…CC	+	
B	penultimate (dominant), partly lexical	CSA…C/*s*C	+	
Q	penultimate (mostly)	C…C, (CC…, ...CCC)	ø	↑
TOD	initial	CG…CCCCCCC	-	
TZ	final	CC…CC	-	
TOB	penultimate syllab (dominant); grammatical	C...C	ø	↑
MAN	last tone syllable	C...N	ø	
NIM	lexical	CC*r*...C (restr.)	-	
R	grammatical/lexical	CCC…CCCC	-	

The results of this comparison are disappointing. The only regularity that can be stated with reasonable certainty is that languages of the first group (no accent) will not have particularly complex syllable shells (i.e., exceeding CC...CC). However, some languages with very simple syllable structure such as MAN, TOB, Q, as well as many with medium complex syllable structure (CC...CC) are also found in the other groups with clearly defined, phonologically and/or grammatically assigned accent.

The picture that emerges from a comparison of accent and tone/ vowel harmony is more in line with the predictions of our model, as can be seen from Fig. (14):

(Fig. 14): Accent and tone/vowel harmony

	vowel harmony/ tone	**phonetic realization of accent**	**accent rules**	**accent function**
YO	tone	-	-	-
AMO	tone	-	-	-
FIJ	-	-	-	-
ESK	-	-	-	-
MUN	(restricted VH)	-	-	-
VIE	tone	-	-	-
TA	restrictid tone	-	-	-
Y	marginal VH	-	-	-
FR	-	-	-	-
NAM	restr. VH and tone	-	-	-
JA	musical accent	pitch	-	lexical
TE	-	?	vague, phono-logical (weight)	
T	VH	pitch/loudness	final (exceptions!) vague	grammatical/ lexical (rare)
U	-	?	final (exceptions!) vague	grammatical/ lexical (rare)
CIR	-	?	ultimate or pen-ultimate (vague)	
KH	restricted VH	duration and loudness	penultimate heavy syllable, otherwise initial	
KO	marginal VH	pitch	predictable, first heavy syllable; first but second elsewhere	
KL	-	pitch, loudness	depending on [±long] and syllable closure	

ARA /Sṛāwi and Egypt	-	loudness, pitch	penultimate domi-nant, but depen-ding on weight	
GAE	-	?	initial (dominant), [±long] important	
ENG	-	pitch, loudness, duration	depending on weight	grammatical/ lexical
D	-	loudness / pitch	final, penultimate if final short vowel	
B	(marginal tone/VH)	pitch or/and loudness	penultimate (dominant)	lexical
Q	-	?	penultimate (mostly)	
TOD	-	loudness	initial	
TZ	-	?	final	?
TOB	-	loudness, duration	penultimate syllabe (dominant);	grammatical
MAN	tone (restr.)	pitch, duration	last tone syllable	culminative
NIM	-	pitch and loudness		lexical
R	-	pitch, loudness, duration	-	grammatical/ lexical

Vowel harmony or tone (in full form and often in restricted form) as well as musical accent occur in languages which either have no word accent at all (cf. the first group in Fig. (14), up to the solid line), or in languages such as Turkish or Japanese which have word accent but only of a vaguely defined type (i.e. with underspecifying accent rules, variation according to speakers and phrasal context and little metalinguistic awareness among speakers for correct accent placement; second group). Among the other languages, in which accent plays a more central role, some cases of marginal or restricted vowel harmony are observed. Only Mandarin is clearly out of line, as it has a stable final accent but also tone.

5.4. Treatment of non-accented syllables

The model makes the prediction that in syllable-rhythm languages, accented and non-accented syllables should be treated alike while word-rhythm languages strongly differentiate syllables depending on accent. (Only languages that have a word accent are considered in this part of the

investigation.) Again, the prediction must be broken down in a number of more precisely defined sub-problems.

a) *Syllable shell structure*. We expect a syllable-rhythm language to allow the same shell complexity that occurs in accented syllables to occur in non-accented syllables as well. In a word-rhythm language, accented syllables should be more complex than non-accented syllables. The maximal shell structures tabulated in Fig. (10) refer to accent syllables. The question could be asked if the number of elements in the shell of non-accented syllables is identical to these maximal shell structures or not. However, the question almost answers itself: since maximal shell structure is measured in monosyllabic words, identity of shell structures across syllable types (accented or unaccented) would imply that polysyllabic words should double these maximal structures. With sufficiently complex monosyllabic shell structures, this becomes quickly impossible; thus, the shell structure for Russian monosyllabics is CCC...CCCC, identity of shell structures in polysyllabics would therefore imply words of the type CCC...CCCC&CCC...CCCC. However, intervocalic clusters of seven consonants are hardly to be expected in any language.

It would be more interesting to investigate syllable division within polysyllabic words: does the accent position attract consonants? Unfortunately, phonologies usually have very little to say on this issue, which therefore has to remain outside this discussion.

b) *Occurrence of reduced vowels.* A more testable prediction is that in word-rhythm languages, vowels may be reduced in non-accented position. For the present investigation, "reduced vowels" are defined as centralized and/or devoiced. Such vowels occur of course in a great number of languages, but not always as a correlate of accent. Thus, centralized/back unrounded or devoiced vowels may be part of the phonemic inventory of both ictus and non-ictus syllables (cf. below, section 5.6.). For instance, Vietnamese has, according to Thompson (1965), four centralized/back unrounded vowels:

i	ɯ	u
e	ɤ	o
ɛ	ɐ	
	ʌ	
	a	

Vowel reduction is also frequently conditioned by segmental environment. Thus, Moroccan Arabic "instable" /e/ is centralized and backed to [ʌ] adjacent to velarized/pharyngalized consonants and the uvular consonants /q,x,ɣ/; in Klamath, /a/ in closed syllable becomes [ə]; in Tamang, /a/ in closed syllable becomes [ə] or [ʌ]; in Hausa, /u, i/ are reduced to [u] before palatalized velar plosives, etc.

For the distinction between word rhythm and syllable rhythm, the interesting case is that of the reduction of full vowels in secondary- or non-accented position, or of reduced vowels that can only occur in non-accented syllables. (How to choose between these two alternatives is sometimes a matter of phonological taste or theory.)

c) *Occurrence of different sets of phonemes in accented/non-accented position.* Apart from reduced vowels, the occurrence of other sounds may be restricted to accented or unaccented syllables. Of particular relevance here are long segments and diphthongs. If a language has geminates, long vowels or diphthongs, these may occur in all syllables or in accented syllables only. The latter would be predicted for word-rhythm, the former for syllable-rhythm.[83]

In the sample, the following languages have phonemic geminates (long consonants): Toba Batak, Turkish (marginal), Japanese, Telugu, Eskimo, Arabic, Hausa, Klamath, Toba-Batak, Khalka (only /l/ ~ /ll/), Uzbek. The status of geminate consonants in Asmat is unclear.

The following languages have phonemic long vowels: Turkish (marginal), Japanese, Mundari, Telugu, Nama, Yoruba, French (marginal), Toda, Diegueño, Arabic, Eskimo, Korean (status unclear, possibly marginal), Hausa, Klamath, Tamang, Navaho, Khalka, Gaelic, Fijian.

The following languages have phonemic diphthongs: Turkish and Uzbek (only /Vy/), Mundari, Telugu, Yoruba, French, Mandarin, Korean, Vietnamese, Toda, Diegueño, Russian, Arabic (Moroccan, with colloquial tendencies towards monophthongization), English, Hausa, Tamang, Khalka, Gaelic; phonemic diphthongs occur marginally in Amo and Japanese (as an optional simplifcation of VV sequences as in ike ba 'if (I) go' → [ikjaa]); possibly also in Nama, Basque, Navaho[84] and Yidiɲ, where available information was inconclusive. Marginal and unsure cases were omitted from the analysis.

Fig. (15) contrasts maximal (=accent) syllable shell complexity and syllable related processes with information on non-accented syllables. As mentioned before, languages with no word accent are omitted.[85] Languages are ordered in increasing (accent syllable) shell complexity.

---

[83] In languages that assign stress according to syllable weight, this usually implies an interdependency of accent position and the occurrence of long segments. Such a language would only be said to distribute phonemes differentially to accented and non-accented syllables if long segments/heavy syllables always attract accent, i.e., if there is only one heavy syllable in a phonological word.

[84] Sapor & Hoijer (1967:11) speak of vowel clusters, which "have a phonetic effect much like the English diphthongs of open syllables".

[85] Vowel reduction may occur as a consequence of phrasal accent, however. An example would be French, which has a mid-schwa occurring only in syllables that cannot be the carrier of phrasal accent.

(Fig. 15): Accented and non-accented syllables contrasted ('-' = doesn't apply)

	max. shell structure	**vowel reduction in nonaccented**	**long sements syllables**
AMO	C..., (P*r*...,...(L)C); ↑	no	-
MAN	C...N	no/yes[86]	-
JA	CG...N/C;↑	no/yes[87]	yes
TE	C...S/G/*s*; (↓)	no	yes
HAU	C...C; (↓)	(peripheral[88])	yes
TOB	C...C, ↑	no	yes
Q	C...C, (CC.., ...CCC) ↑	no, but only [+lax] accented vowels	-
KH	CG...C, C...GC	no	yes
!X	CC...N only stem-initial, otherwise C...C; son. -	no	-
NIM	*CCr*...C, son. -;[89]	yes	-
T	C...CC;	no	yes
U	C...CC, son. - (rare)	yes	yes
D	C...CC	yes	no[90]
KO	CG...CC, son. -	peripheral[91]	(no)
B	CS...C/*s* C	no	-
TZ	CC...CC, son. -	yes	-

[86]Only toneless non-accented syllables can be reduced.

[87]/i/ and /u/ devoice when unstressed in the environment of devoiced segments; cf. Shibatani (1990:161).

[88]According to Abraham (1959:128), the vowel /a/ is centralized to [ʌ] in short unstressed syllables but is [a] otherwise.

[89]"son.-" = sonorita scale disobeyed

[90]D. does not allow long vowels in non-accented position and diphthongs in postictus position

[91]On the realization of the peripheral diphthong /ɨi/ as [ɛ] in the unstressed particle 'of', cf. Lee (1989:20).

ARA	CC...CC, son. -;↓	no	(no[92])
GAE	*s*CC...CC, son. -	yes[93]	?
CIR	(CCC...CC), (son.-); ↓	yes	-
R	CCC...CCCC, son. -	yes	-
KL	CC...CCCC, son. -;	no	yes
ENG	CCC...CCCC, son. -; ↓↓	yes	-
TOD	CG...CCCCCCC, son. -	no	no long V

The results at first sight seem to disconfirm the predicted correlation, since Japanese and Mandarin, both of which have simple syllable structure, do show vowel reduction. However, the nature of this reduction is quite different from that found in languages with a syllable complexity as in Nimboran, or more. Whereas in the latter case centralization affects the whole system of vowels, it is restricted in Japanese to only two vowels, which furthermore are not devoiced generally in non-accented syllables but only under certain conditions; in Mandarin, vowel reduction is restricted to toneless syllables. Since Japanese and Mandarin are somewhat apart from the other languages with overall reduction of the vocalic system in non-accented syllables, there is indeed a certain positive correlation between syllable complexity and the differential treatment of accented/non-accented syllables: such a differential treatment will not occur in languages with simple syllable structure (cf. dotted line). The opposite, however, does not seem to hold: even languages with complex (phonemic) syllables do not necessarily reduce their non-ictus vowel system, as shown by Klamath and Arabic. (Toda does not have general accent-dependent centralization, but length reduction instead.)

Tone/vowel harmony and accent-dependent reduction of the vocalic system are compared in Fig. (16).

[92]There is some variation between Arab dialects with respect to this question. Thus, Sṛāwi does not allow long vowels to occur in open syllable unless they are stressed (but long vowels do occur in closed syllables; cf. Kouloughi 1978). A general rule which holds for most Semitic lanuages is that word-final unaccented long vowels and vowels in post-ictic open (partly also in closed) syllables are shortended. This is clearly a cue to word-rhythm.

[93]In addition to accent dependent reduction of vowels and the use of non-accented epenthesis vowels, Gaelic seems to restrict the lenis/fortis distinction to heavily stressed words: weakly stressed words tend to be lenis throughout (ó Siadhail 1989:134).

(Fig. 16): Differences between accented and non-accented syllables, and tone/vowel harmony

	tone / vowel harmony	**vowel reduction in nonaccented**	**long segments syllables?**
AMO	tone (but toneless syllables)	no	-
MAN	tone (but toneless syllables)	no/yes	-
HAU	tone, marginal VH	(peripheral)	yes
!X	restricted tone, very restricted VH	no	-
JA	musical accent	no/yes	yes
T	vowel harmony	no	yes
KH	restricted VH	no	yes
KO	marginal VH	peripheral	(no)
B	marginal VH/tone	no	-
TE	Ø	no	yes
TOB	Ø	no	yes
KL	Ø	no	yes
ARA	Ø	no	(no)
QUE	Ø	no, but only [+lax) accented vowels	-
TOD	Ø	no	no long V
NIM	Ø	yes	-
U	Ø	yes	yes
D	Ø	yes	no
TZ	Ø	yes	-
GAE	Ø	yes	?
CIR	Ø	yes	-
R	Ø	yes	-
ENG	Ø	yes	-

The results clearly support the model: no language with an overall reduction of the vocalic system in non-accented syllables (i.e., as before, excluding Japanese and Mandarin) has even a marginal system of vowel harmony or tone. No language with even a marginal system of tone or vowel harmony shows more than peripheral accent-dependent reduction. (But, of course, there is a group of languages that have neither tone/vowel harmony nor vowel reduction.)
Finally, Fig. (17) compares the results for accent assignment and accent-dependent reduction (as before, languages with no culminative word accent have been omitted):

(Fig. 17): Accent and accent-dependent reduction

	accent rules	**vowel reduction in nonaccented**	**long segments syllables?**
JA	lexical; but toneless words	no/yes	yes
TE	vague, phonological (weiht)	no	yes
T	final (exceptions!) / grammatical; vague	no	yes
U	final (exceptions!) / grammatical; vague	yes	yes
CIR	ultimate or penultimate (vague)	yes	-
KH	penultimate heavy syllable, otherwise initial	no	yes
KO	predictable, first heavy syllable; first but second elsewhere	peripheral	(no)
KL	depending on [±long] and syllable closure	no	yes
ARA/Sṛāwi and Egypt	penultimate dominant, but depending on weight	no	(no)
GAE	initial (dominant) [±long] important	yes	?
ENG	depending on weight, partly grammatical /lexical	yes	-
D	final, penultimate if final short vowel	yes	no
B	penultimate (dominant), partly lexical	no	-
Q	penultimate (mostly)	no, but only [+lax] accented vowels	-
TOD	initial	no	no long V

TZ	final	no	yes
TOB	penultimate syllable (dominant); grammatical	no	yes
MAN	last tone syllable	no/yes	-
NIM	purely lexical	yes	-
R	grammatical/lexical	yes	-

The correlation is weak at best; the nature of accent is of little use in predicting the treatment of non-accented syllables. Languages with weak or underspecified accent rules usually do not have accent-dependent overall reduction of the vocalic system, but Uzbek and Circassian are counterexamples. Languages with phonologically determined but unstable accent either have accent-dependent reduction (GAE, ENG, D) or they do not (KH, KO, KL, ARA). The same applies to the group of languages with stable accent. The two languages with purely grammatically or lexically determined accent assignment (R, NIM) both have reduced vowel systems in non-ictus position.

5.5. Other word-related phonological processes

Accent-dependent reductions or differences in the system of phonemic contrasts help identify the ictus position and therefore support the culminative function of accent. They are therefore typical for word-rhythm. However, there are numerous other possibilities to highlight phonetically and/or phonologically the prosodic unit "phonological word". Such word-related processes may either function as boundary markers which mark in some way or other the beginning and/or end of this prosodic unit; or they may affect the word-internal (medial) positions while leaving intact the margins. On the contrary, a syllable-rhythm language will treat all syllables equally; syllable-related processes will occur with and across words in the same fashion.

The following word-related processes are observed in the sample:

Allophonic alternations in word-final position

Full vowels may be reduced in word-final position. Thus, Nimboran has a rule that reduces /ɛ/ to [ə] in the context y__# and also, when unstressed, in the contexts ú, í__ #; unstressed /o/ is likewise reduced to [ɤ] in the context __# and /ó/ to [ʌ] in the environment ___C#. Uzbek lowers and centralizes /i/ to [ɜ] in word-final syllable. Quechua variably devoices and centralizes vowels after unvoiced consonants, and slightly lowers and centralizes /i/ and /u/ in general, before word

juncture.[94] Yidiɲ slightly lowers word-final long vowels, and nasals (particularly /ŋ/) tend to be elided in this position. In Moroccan Arabic (and most other Arabic dialects), (stable) word final long vowels are shortened.

Consonants may be weakened or devoiced in word-final position as well. In some cases, this leads to the neutralization of phonemic contrasts. Nimboran in this position variably reduces /p/ to [ɸ] and devoices /b/, which is also unreleased or nasally released (b̚], [bⁿ]). Circassian also tends to devoice word-final obstruents/lenes, but since voiceless obstruents are phonetically aspirated, the phonemic contrast is not lost but taken over by the feature [±aspirated]. In Uzbek and Turkish, as well as in Russian, final obstruents are devoiced. In Khalkha, final /b/ is fricativized (in monosyllabics) or devoiced (in polysyllabics), and /g/ is devoiced in both cases[95]. In Asmat and in Eskimo, stops are unreleased in word-final position. Quechua in the same environment neutralizes the phonemic distinctions /k/ ~ /q/ and /r/ ~ /ɾ/[96] and backs /n/ to [N].[97] There may also be non-weakening phonological rules which are sensitive to the word-final context and thus signal juncture. For instance, both in Uzbek and in Turkish, pre-consonantal /l/ is velarized after a back vowel; the same process also applies before word juncture. Mundari has a rule /r/ → [R]/V__#, and voiced stops are preglottalized preconsonantally and word-finally. In Klamath, all obstruents are affricated/aspirated at the end of a word. In Tzeltal, final consonants may be geminated and followed by an echo (voiceless epenthetic) vowel.[98]

Allophonic alternations in word-initial position

Gaelic "denasalizes" (rhotacizes) word-initial /n/ after any consonant except /s/ (thus: /knuk/ → /kruk/ 'hill'). Asmat labializes initial /p/ and variably fricativizes /k/; nasals are variably strengthened, resulting in the corresponding prenasalized stops or simple voiced stops (/m/ → [b], [ᵐb]; /n/ → [d], [ⁿd]). Khalkha devoices word-initial /b/ and /g/. Often, aspiration is used for signalling word-boundaries. Thus, Klamath only strongly aspirates fortes in first position in the word (before vowels or voiced sonorants).[99] Glottal stop insertion is also a frequent technique used to mark the beginning of a phonological word beginning with a phonemic vowel; Quechua

[94]Parker (1969:19).

[95]Poppe (1970)

[96]Quesada (1976:44)

[97]Parker (1969:19)

[98]According to Urib (1962:34), no emination is involved in this kind of echo vowel formation in the Tzeltal dialect of Bachajon. In his analysis, the process has a (discourse-) semantic function, i.e. that of lending emphasis to the word in question. The issue clearly needs further investigation.

[99]Cf. Barker (1964)

and Eskimo are examples of languages which do this.

Allomorphic/morphophonemic alternations at word boundaries

A typical case here are the well-known Celtic initial mutations (as in Gaelic, which incidentally has some final mutations as well).

Word-related phonotactic restrictions

Examples abound. Circassian and Tzeltal do not permit vowels in word-initial position. In Telugu, only the consonants /m,w,y/ occur word-finally[100], while syllable-finally other nasals and /r,s/ are also possible.[101] In Tamang, the feature [±long] is only distinctive in the first syllable of a word; aspirated stops, fricatives, affricates and retroflexes do not occur word-finally. In Mundari, only the voiced stops /b,d,g/ can appear in word-final position and of the nasals, /ŋ/ only occurs in this position; [±long] in vowels is neutralized word-finally. In Khalkha, full single vowels (apart from /i/) occur only in the first syllable of a word.[102]

Particularly impressive is the case of !xóõ and Nama, both of which have radical phonotactic restrictions on vowels and consonants in non-initial position in the phonological word (which, in this case, is identical to the stem, i.e., excludes suffixes). For instance, a !xóo stem has maximally four segmental positions (consonant - vowel - consonant - vowel/nasal); in the first consonantal position, approximately 119 phonemic contrasts are possible (including a large number of "accompanied" clicks); in the first vocalic position, 44 phonemic contrasts are observed (five plain vowels plus their nasalized, breathy, pharyngalized, glottalized counterparts); yet, in the second consonantal position, only /b, dy, l/ and the nasal consonants occur, and in the second vocalic position only plain and nasal vowels. First and second syllables in the stem are clearly treated in a very different fashion.

Another very efficient way to mark the boundaries of the phonological word is the number of consonantal slots permitted word-finally and word-initially. In many languages, the consonantal shell of a monosyllabic word includes more slots than the shells of syllables which are part of a polysyllabic word. In these languages then, the "shells" of the phonological words follow different phonotactic restrictions than those of the syllables (provided the two do not coincide). Consonant clusters exceeding a certain number of slots therefore mark word boundaries. For

[100]According to Krishnamurti & Gwynn (1985), words end in nasals or vowels, which contradicts Kostic et al.'s statement. However, word-final restrictions are operative according to both descriptions.

[101]Kostic et al. (1977).

[102]Street (1963:65)

instance, many Arabic dialects allow clusters of two consonants word-finally and word-initially, but word-medial clusters cannot exceed two (rarely three) slots, which are divided between the right and the left syllable equally. The same applies to TOD, R, D[103], ENG, N, !X, UZ, T, GAE and possibly CIR. Thus, while in word-rhythm, languages will tend to treat word margins different from syllable margins (shells), languages that observe syllable-rhythm will display the same phonotactics for each syllable in the word, regardless of its position. (Note that this distinction is independent of accent and therefore different from the problem discussed in section 5.3. above.)

Word-internal vowel alternations

A particular interesting technique to mark word boundaries is exemplified by Circassian (Smeets 1984:215). The language has a morphonological rule that changes most cases of stem-penultimate /e/ to /a/, which helps to identify the stem-boundary, the essential morphological pivot of the word; cf. (/m/ is the Rel.-Suffix, i.e. the stem-boundary precedes it):

/pse̲se̲+m/ 'the girl, REL.' → /pse̲se̲m/
/pse̲se̲+ce+m/ 'the young girl, REL.' → /pse̲se̲acem/
/pse̲se̲+dexe+m/ 'the beautiful girl, REL:' → /pse̲se̲daxem/

Word-medial weakening

Another word-related phonological process is the weakening of medial single consonants (e.g. spirantization or deletion). For instance, in Gaelic, intervocalic /h/ and /j/ are deleted under certain conditions (as in /bo:hər/ → /bo:ər/ → /bo:r/ 'road', /e:dəjə/ → /e:di:/ 'clothes').[104] Uzbek (but not Turkish!) variably fricativizes medial /p/, /q/ and /b/ (cf. /ittiɸɔq ~ ittipɔq/ 'union', /kabɔb ~ kawɔb/ 'shashlik').[105] Asmat variably weakens single intervocalic /p/ to [b], [ß] or [ɸ] and /k/ to [χ]. Eskimo turns intervocalic /q/ into [χ] or [ʁ]. Tamang variably weakens non-aspirated medial stops as in

/ˈkha+pa/ 'to come' / → [khaba], [khaßa].

Korean optionally deletes nasals, obligatorily voices and weakens lenes and rhotacizes /l/

[103]Here, the distinction coincides with that between non-accented / accented vowels (the latter having a more complex shell than the former).

[104]Cf. Ó Siadhail (1989:68 et passim).

[105]Cf. Sjoberg (1963:19).

medially.[106] Japanese also has an optional (casual speech) rule of weakening or deleting intervocalic consonants. American English "flaps" intervocalic alveolar stops. The optional medial weakening of Basque /b,d,g/ → [ß], [ð], [ɣ] is probably a rule borrowed from Spanish.

Word-internal simplification of geminates as discussed in section 5.2. also belongs to this group of processes.

Syllable-related processes and restrictions

Typical for a language that highlights the syllable instead of the phonological word is reduplication (usually of stem-forming monosyllabics, with a regular morphological function in the grammatical core of the language, not just in special varieties such as motherese) as occurs in Quechua, Mundari, Tamang, Mandarin, Hausa, Yoruba, Amo, Diegueño, Vietnamese, Fijian, and occasionally in Eskimo and Arab.[107]

Similarly suited for marking syllable boundaries are allophonic alternations dependent on syllable position (i.e. syllable-related phonological rules). For instance, Quechua realizes /q/ syllable-intially as [q] but syllable-finally as [x].[108] Navaho turns most syllable-initial instances of /k/ into a velar affricate [kɣ]; syllable-initial vowels are preceded by a glottal stop. In the same language, intervocalic (medial) consonants tend to be doubled, a process of phonetic gemination which supports syllable division in syllable-rhythm and therefore is the phonological counterpart of medial weakening in word-rhythm:

/dékwi/ → /dék&kwi/ 'I vomited'
/biziiz/ → /biz&ziiz/ 'his belt'
/yidloh/ → /yid&dloh/ 'he's laughing' (Young/Morgan 1980:xxvii)

Mundari has /g/ → [ʔ] / __C or # (i.e. syllable-finally) and preglottalizes voiced stops in the same environment.

Typical languages which center phonological processes around syllable positions and not around word positions are also Korean (Kim-Renaud 1978) and Vietnamese (Thompson 1965). Thus, Korean weakens syllable codas, where the otherwise (i.e., syllable-initially) distinctive series of lenes, fortes and aspirate stops as well as affricates and /h/, are neutralized into unreleased lenes

---

[106] Kim-Renaud (1978:92).

[107] I am here referring to the reduplicative verb patterns found in some Arab dialects, e.g. in Syrian Arabic (Cowell 1964:110).

[108] Quesada (1976)

stops. Vietnamese also weakens the syllable coda by only allowing unreleased stops and nasals as well as glides (which do not occur syllable-initially) in this position. On the other hand, syllable onsets are maximized by inserting a glottal stop when no lexical onset consonant is available.

Many languages have syllable-related phonotactic restrictions; in these languages, the phonotactics of words can be derived entirely from those of the syllables. Of this type are NIM, TOB, QUE, NAV, MAN, JA, and with some exceptions also HAU[109], AMO[110] and YI.[111] (Since they have only CV syllables, there are no phonotactic restrictions in FIJ and YO.)

In the following Fig. (18), word-related processes other than vowel reduction and syllable-related processes other than the ones discussed in section 5.2. (where syllable structure was the issue) are summarized, including phonotactic restrictions (++ = strong, + = weak, (+) = very weak). The occurrence of such processes is compared to the maximal structure of the syllabic shell:

(Fig. 18): Word-related processes and maximal shell structure

	max. shell structure	**word-related processes/**	**syllable-related phonotactics**
YO	C...		++
FIJ	C..., ↑		+
AMO	C..., (P*r*...,... (L)C); ↑		++
MAN	C...N		++
JA	CG...N/C; ↑	(+)	++
TE	C...S/G/*s*; (↓)	+	
HAU	C...C; (↓)		++
TOB	C...C; ↑		++
ESK	C...C	+	++
NAV	C...C, ↑	(+)	++

[109]Cf. Gouffé (1981:418); while /f,b,t,k,ʃ,s,m,n,y,w,l,r,/ are allowed word-finally /f,c,s,z,m,n,y,w,l,r,ɾ/ occur syllable-finally.

[110]/kp,gb/ do not occur word-initially, but only syllable-initially (di Luzio 1967:9)

[111]/ŋ/ occurs word-finally, but not syllable/root-finally (cf. Dixon 177:47, 103ff).

AS	C...C, (C...CC)	++	
Q	C...C, (CC...,...CCC), ↑	[++	++]
MUN	C...C, (C*r*...C), ↑	+	++
VIE	CG...C		++
TA	CG/L...C	++	
KH	CG...C, C...GC	++	
NAM	CC...N only stem-initial, otherwise C...C	++	
!X	CC...N only stem-initial, otherwise C...C; son.-	++	
Y	CC...C or C...CC	[+	+]
NIM	*Ccr*...C, son. -	[++	++]
T	C...CC	0	
U	C...CC, son. - (rare)	+	
D	C...CC	++	+
KO	CG...CC, son. -	+	++
B	CS—S/*s* C	(+)	
TZ	CC...CC, son. -	++	
ARA	CC...CC, son. - ; ↓	+	(+)
FR	CC...CC, (CCC...)		
GAE	*s*CC...CC, son. -	++	
CIR	(CCC...CC), (son.-); ↓	++	
R	CCC—CCCC. son. -	++	
KL	CC...CCCC, son. -;	+	
ENG	CCC...CCCC, son.-;↓	++	
TOD	CG...CCCCCCC, son.-	+	

Some languages (NIM, Y, Q) have equally strong tendencies towards word- and syllable-related rules and regularities and are therefore "neutral".

Inspection of Fig. (18) shows a clear correlation between syllable- vs word-related processes on the one hand, and syllable shell complexity on the other, although there are some

exceptions. (In particular, Korean has strong syllable-related processes but a medium complex syllabic shell (in phonemic terms!), Telugu has simple syllables but word-related phonological processes; in the latter case, the existence of phonetic processes that create more complex syllables somehow weakens the misfit).

Since there is an overlapping area, it can be expected that those languages that optimize phonemic syllable structure by structure-enhancing rules (as discussed in section 5.2.) also have other syllable-related rules, and that those languages that have rules producing more complex syllables have word-related rules. In the small group of only 12 languages which have a clear preference for structure-destroying or structure-enhancing rules, there are indeed some indications for a positive correlation: ARA, CIR, ENG, TE have both word-related rules and syllable structure destroying processes, only HAU has weak syllable-structure enhancing rules but clearly a preference for syllable-related rules otherwise; A, TOB, NAV, MUN, AMO have both syllable-related rules and syllable structure enhancing processes. However, given the small number of languages in the sample for which this question can be reasonably asked, the results remain tentative.

While the overall correlation between syllable complexity and word-related rules seems undebatable, the relationship between tone/vowel harmony and word- vs. syllalble-related processes/phonotactics (as summarized in Fig. (19)) is somewhat more difficult to interpret at first sight.

(Fig. 19): Vowel harmony and tone, and word- vs. syllable- related processes

	tone	**vowel harmony**	**word-related processes**	**syllable-related**
YO	unrestricted	no		++
VIE	unrestricted	no		++
HAU	unrestricted	(marginal)		++
AMO	toneless syllables	no		++
NAV	toneless prefixes	no	(+)	++
MAN	toneless syllables	no		++
TA	restricted	(very restricted)	0	
NAM	restricted	restricted	++	
!X	restricted	very restricted	++	
AS	(marginal)	no	0	

B	(marginal)	(marginal)	(+)	
JA	musical accent	no	(+)	++
Y	no	marginal	[+	+]
T	no	almost unrestricted	+	
KH	no	restricted	++	
MUN	no	(restricted)	+	++
KO	no	marginal	+	++
NIM	no	no	[++	++]
TE	no	no	+	
FIJ	no	no		+
Q	no	no	[++	++]
TOB	no	no		
ESK	no	no	+	++
U	no	no	+	
D	no	no	++	+
TZ	no	no	++	
ARA	no	no	+	(+)
FR	no	no		
GAE	no	no	++	
CIR	no	no	++	
R	no	no	++	
KL	no	no	+	
ENG	no	no	++	
TOD	no	no		

It is, first of all, clear that nothing follows from the absence of tone and vowel harmony; languages of this group may have word-related processes or not. Tone languages, however, seem to have syllable-related processes and no word-related ones. There are three cases that contradict this pattern: the "restricted" tone languages Tamang, !xóo and Nama. It may be useful at this point to remember how restricted tone languages were defined in section 5.1 above: they do not assign tone to syllables but to phonological words (corresponding to the morphologically simple (non-compound) word in Tamang and to the stem in Nama and

!xóõ). It follows that with respect to tone assignment, we have to distinguish languages that refer to the syllable as the relevant unit and those that refer to the word, exactly as has been done with respect to segmental processes. It seems quite natural that tone languages will have syllable-related processes only if they assign lexical tone to syllables, but word-related processes if they assign tone to phonological words.

Word-related/syllable-related processes are now compared with accent and accent assignment in Fig. (20).

(Fig. 20). Accent and word- vs. syllable-related processes

	accent rules	**word-related processes**	**syllable-related**
YO	-		++
AMO	-		++
FIJ	-		+
ESK	-	+	++
MUN	-	+	++
VIE	-		++
TA	-	++	
Y	-	[+	+]
FR	-		
NAM	- (?)	++	
JA	lexical, toneless words	(+)	++
TE	vague, phonological (weight)	+	
TZ	final	++	
T	final (exceptions!)/ grammatical; vague	+	
U	final (exceptions!)/ grammatical; vague	+	
CIR	ultimate or penultimate (vague)	++	
KH	penultimate heavy syllale, otherwise initial	++	

KO	predictable, first heavy syllable; first but second elsewhere	+	++
KL	depending on [±long] and syllable closure	+	
ARA	penultimate dominant, but depending on weight (Sṛāwi and Egypt)	+	(+)
GAE	initial (dominant), [±long] important	++	
ENG	depending on weight, partly grammatical/ lexical	++	
D	final, penultimate if final short vowel	++	+
B	prenultimate (dominant), partly lexical	(+)	
Q	penultimate (mostly)	[++	++]
TOD	initial	+	
TOB	penultimate syllable (dominant); grammatical		
MAN	last tone syllable		++
NIM	lexical	[++	++]
R	grammatical/lexical	++	

There does not seem to be any kind of reliable interdependence; a slight dominance of syllable-related rules in languages with no accent system will have to be checked in a larger sample.

Finally, Fig. (21) shows the relationship between word-related/syllable-related processes on the one hand and the vowel system in non-accent position:

(Fig. 21): Differences between accented/non-accented syllables and word-related/syllable-related rules

	vowel reduction in nonaccented	**long segments syllables?**	**word-related**	**syllable-processes**
TE	no	yes	+	
TOB	no	yes		++
KL	no	yes	+	
KH	no	yes	++	
!X	no	-	++	
T	no	yes	+	
B	no	-	(+)	
ARA	no	(no)	+	
TOD	no	no long V	+	
MAN	no/yes	-		++
JA	no/yes	yes	(+)	++
HAU	(peripheral)	yes		++
Q	no, but only [+lax] accented vowels	-	[++	++]
KO	peripheral	(no)	+	++
NIM	yes	-	[++	++]
U	yes	yes	+	
TZ	yes	-	++	
GAE	yes	?	++	
CIR	yes	-	++	
R	yes	-	++	
ENG	yes	-	++	
D	yes	no	++	+

There is indeed a strong tendency for languages which reduce vowels in non-ictus position to have other word-related processes as well (last group). Usually (i.e., with the exception of NIM, where word- and syllable-related processes and regularities are balanced, and D, which has dominantly, but not exclusively word-related processes/regularities) these languages will not have syllable-related processes. On the other hand, languages without reduction of the whole vowel system (first group) or with partial reduction (middle group) may have

word-related processes or not, i.e. nothing can be followed from the lack of vowel reduction.

5.6. Segmental parameters (inventory traits)

The model tested here (Fig. (4), section 1) as well as that of Donegan & Stampe (1983) associates phonemic geminates with syllable-rhythm and back unrounded/central/devoiced vowel phonemes with word-rhythm. In addition, Hurch (1988b) has claimed that aspiration is typical for word-rhythm. The co-occurrence of phonemic aspirates, geminates and centralized/back unrounded vowel phonemes (in accented position) with the above-mentioned parameters was therefore investigated in the sample as well. Fig. (22) gives a summary of the occurrence of these phonemes.

(Fig. 22): Phonemic geminates, central/back unrounded vowels and aspirated obstruents in the languages of the sample

	geminates	central/back unrounded vowels	aspirates
Toba Batak	+	_[112]	-
Turkish	marginal	/ɯ/	-
Japanese	+	-	-
Telugu	+	-	_[113]
Eskimo	+	-	-
Arabic	+	-	-
Hausa	+	-	-
Klamath	+	_[114]	-
Uzbek	+	-	-
Khalkha	only/ll/	/ɯ, ɵ, ə/	-
Asmat	?	/ə/	-

[112] /ə/ is observed in some loans from Bahasa Indonesia.

[113] Aspiration is phonemic in loan vocabulary.

[114] According to Clements & Keyser (1982), midschwa is predictable and therefore not phonemic. In a more superficial phonemization, Barker (1981) also treats midschwa as an allophone of the other vowel phonemes.

Mandarin	-	/ɨ, ɤ/[115]	-
Toda	-	/ɵ, ɯ/	-
English	-	/ʌ/	-
Nimboran	-	/ɨ, ɯ/[116]	-
Ciracassian	-	/ə/	-
Gaelic	-	/ɯ, ə/	-
Diegueño	-	/ə/	-
Russian	-	/ɨ/	-
Amo	-	/ö/[117]	-
!xóõ	-	/ɵ/	+
Nama	-	/ə/[118]	(+[119])
Korean	-	/ʌ, ɯ/	+
Vietnamese	-	/ɯ, ɤ, ʌ, ɐ/	+ (only /t^h/)
Navaho	-	-	+
Tamang	-	-	+
Yidiɲ	-	-	-
Basque	-	-	-
Tzeltal	-	-	-
Yoruba	-	-	-
Mundari	-	-	-
Quechua	-	-	-
French	-	-	-
Fijian	-	-	-

[115]According to Cheng (1973). Other phonemizations have been proposed, but the existence of back unrounded vowels is undisputed.

[116]Anceaux (1965) uses the symbols /y, u/ but the dominant phonetic realization is that of unrounded vowels.

[117]According to Di Luzio (1967:5), the contrast /ö/ ~ /o/ is phonemic.

[118]According to Beach (1938). Meinhof (1909) does not give a phonemic mid-schwa element; for him, all centralization (and devoicing) of the vowel system is phonetic.

[119][±aspirate] is only relevant in clicks.

There are some indications that these inventory traits are not independent. While the existence of phonemic aspiration is rare (but weakly correlated with the existence of phonemic back unrounded or central vowels), the existence of phonemic geminates seems to be clearly negatively correlated with that of phonemic back unrounded/central vowels: in only two languages do both occur (Khalkha, Turkish), and in these languages, gemination seems to play a rather minor role in the lexicon. (Obviously, the inverse does not hold: languages without geminates may or may not have central/back unrounded vowels.) Equally, phonemic geminates and aspirates seem to be negatively correlated.

The interesting question to ask is whether these inventory traits correlate with any of the characteristics for word or syllable-rhythm. For the few languages with aspiration as a phonemic feature, no such correlations can be found. In order to answer the question for the other inventory traits, the group of languages with phonemic geminates and that with phonemic central or back unrounded vowels have been analyzed with respect to the parameters syllable shell complexity, differences between accented and non-accented syllables, nature of accent, vowel harmony/tone, and word- vs syllable-related rules. The following tables summarize the results:

(Fig. 23): Shell complexity and inventory traits

	low	high
	shell complexity	
central/back unrounded phonemes	**3 (AMO, MAN, AS)**	13
no such phonemes	10	8
geminate phonemes	5	5
no such phonemes	7	16
(low complexity = C...C or less, i.e. incl. MUN in Fig. (11))		

(Fig. 24): Full or restricted vowel harmony or tone (incl. musical accent) and inventory traits

	VH/tone	none
central/back unrounded phonemes	9	11
no such phonemes	5	9
geminate phonemes	5	5
no such phonemes	9	15

(Fig. 25): Accent and inventory traits

	no or vague accent	clear accent
central/back un-	**5 (AMO, CIR, NAM,**	9
rounded phonemes	**VIE, T)**	
no such phonemes	10	6
geminate phonemes	5	4
no such phonemes	11	10

(Fig. 26): Differences between accented and non-accented syllables and inventory traits (unclear/ambiguous cases omitted)

	reduction in non-accented syllables	no reduction
central/back unrounded phonemes	5	6
no such phonemes	3	7
geminate phonemes	**1 (UZ)**	7
no such phonemes	7	6

(Fig. 27): Word- vs. syllable-related processes and inventory traits (equivocal cases omitted)

	word-related dominant	syllable-related dominant
central/back unrounded phonemes	10	5
no such phonemes	7	6
geminate phonemes	5	4
no such phonemes	12	7

Central or back unrounded vowel phonemes seem to be quite rare in languages with a simple syllabic shell (C...C or less) and in languages with no or vaguely defined accent systems. (As shown above, these two parameters are also positively correlated.) Phonemic geminates seem to be very rare in languages with a reduced vowel system in non-accented position. These correlations are consistent with the suggested model.

6. Summary and interpretation: a revised model

The results of testing the predicted correlations between phonological and phonetic parameters of the model in Fig. (4) in a sample of 34 languages has yielded the following results:

1) Tone and (tentatively) vowel harmony negatively correlate with syllable shell complexity. No tone language (not even a restricted one) in the sample has a syllable structure exceeding CC...C with strong restrictions on the syllable-final and/or the syllable-initial consonant; and no language with a shell structure exceeding C...CC has vowel harmony.

2) (Tentatively:) Syllable structure enhancing processes occur in languages which already have a syllable shell structure of C...C or simpler, while processes that destroy syllable structure are observed in languages of a shell complexity of CC...CC or more.

3) Languages without word accent will not have syllable shells exceeding a complexity of CC...CC.

4) Vowel harmony or tone (in full and often in restricted form, incl. musical accent) mainly occur in languages with no or only vague word accent.

5) (Weak:) Languages with low shell complexity (below the threshold of C...C or slightly above) will not have overall reduction of the non-accented vowel system.

6) No language with an overall reduction of the vocalic system in non-accented syllables has even a marginal system of vowel harmony or tone. No language with even a marginal system of tone or vowel harmony shows more than peripheral accent-dependent reduction.

7) (Weak, tentative:) Languages with weak or underspecified accent rules usually do not have accent-dependent overall reduction of the vocalic system.

8) Shell complexity positively correlates with word-related processes/phonotactics, but negatively with syllable-related processes/ phonotactics.

9) Non-restricted tone languages do not have word-related processes or phonotactics.

10) There is a strong tendency in the group of languages with accent-dependent overall reduction of the vocalic system to have other word-related processes (or word-related phonotactic restrictions) as well, but to have no syllable-related processes/ phonotactics.

11) Central or back unrounded vowel phonemes tend not to occur in languages with a simple syllabic shell (C...C or less) and in languages with no or only vaguely defined accent systems.

12) Phonemic geminates seem to be very rare in languages with a reduced vowel system in non-accented position.

All in all, these results provide positive evidence for the model proposed in section 1 (Fig. 4). However, it must be asked if the model can be further revised and reshaped in order to improve its fit with the empirical findings. This seems necessary for a number of reasons:

- For the model, the existence and type of word accent is the central parameter. It is from this parameter that many of the others are derived. Since accent defines the foot (and, in many theories, the phonological word as well), it is almost a definitional feature of word- rhythm. Most of the other features such as vowel reduction, shell complexity or syllable-enhancing/destroying processes follow from it. This central status of word accent is not supported by the data, however. When compared to the parameters "word- vs. syllable-related processes/phonotactics", "tone" and "shell complexity", "word accent" permits fewer and/or weaker predictions. Its correlation with vowel reduction is only tentative, and it is only the absence or vagueness of word accent from which any predictions can be made at all. This is in conflict with the model, which rests on the assumption of correlation between the positive existence of a strong word accent with the other parameters. It has to be concluded that the empirical results do not support the central status given to word accent.

- The relevance of phonetic or phonological duration is another, even more basic assumption for the above model, due to its source in the phonetic conception of stress- and syllable-timing à la Pike. However, nowhere does duration directly enter into the analysis. True enough, shell complexity, vowel reduction and a number of other phonological processes such as those that enhance or destroy syllable structure, relate directly to durational matters; yet, for other parameters such as tone/vowel harmony or word- vs syllable-related processes the link is only a much more indirect one. It should be asked if the model cannot be reshaped such that reference to duration is avoided altogether. In such a case, the notion of rhythm, which is intrinsically linked to duration (and, in a wide-spread usage of the term, to accent as well), would have to be abandoned as well.

- More empirically, the skepticism with regard to the central role of accent is supported by the group of three languages in the sample which represent tone-languages that assign tone to phonological words, not to syllables. These languages (Tamang, Nama and !xóo) have no word accent and no vowel reduction. However, all three of them clearly have word-related phonological rules and/or phonotactics. There is then, in these languages, a close correspondence between the domain of tone assignment, the domain in which the phonotactics of these languages have to be stated and the domain in which most of their phonological rules apply. However, since the model in its present version associates word-related phonological rules and phonotactics with word-rhythm, but tone (regardless of the domain of lexical tone assignment) with syllable-rhythm, this correspondence is interpreted as a deviation from either prototype.

An alternative model which takes into account this point of criticism is one that focuses on prosodic domains (categories) instead of duration (rhythm). Such a model (which obviously owes much to Pulgram's "suggestions" for prosodic typology discussed above, section 2.4.), starts from the assumption made popular by Prosodic Phonology (cf. Nespor & Vogel 1986) that in any language there is a hierarchy of prosodic categories to which phonological and phonetic rules and regularities refer. Contrary to Prosodic Phonology, I further assume that two such prosodic hierarchies are necessary, one phonetic and one phonological. While the phonological prosodic hierarchy may make reference to grammatical (morphological or syntactic) information in order to build its categories, the phonetic prosodic hierarchy only refers to phonological information (i.e., to the phonological hierarchy). The difference is most striking on the level of the phonological word (phonological prosodic category) and the foot (phonetic prosodic category). While the first can only be defined by recurring to morphological information, the latter can be described on the basis of phonetic surface information alone, together with some phonological knowledge about accent assignment alone. (Similar differences between phonological and phonetic prosodic categories can be found on higher levels, such as the prosodic and intonational phrase[120].)

For prosodic typology, the phonological hierarchy is of foremost importance; tentatively, we may suppose this hierarchy to include the following levels:

Mora
Syllable
Phonological Stem
Phonological Word
Clitic Group
Phonological Phrase
Prosodic Phrase
Intonational Phrase

The exact number of levels may vary from language to language. In some languages, phonological prosodic categories beyond the Intonational Phrase may be necessary as well as an intervening category between the syllable and the phonological word, etc. In other languages, categories such as the mora will be absent. Also, the number of phonological regularities that relate to any of these hierarchical categories will vary from language to language. Thus, one language may center its phonological regularities around the mora but have some additional rules that refer to the syllable. Prosodic categories may be weighted by the number of regularities that refer to them as their domain; their importance for the phonological make-up of a language increases or decreases according to this weighting.

[120]For a further discussion regarding the latter, see Couper-Kuhlen (1992). The issue of the "two prosodic hierarchies" can only be hinted at here and needs further elaboration.

It seems that for many languages there is one prosodic category that receives by far the highest value in such a process of weighting. It is this category that can be called its central or basic category. Empirically, it seems that this basic category is most often either the syllable or some higher prosodic category which refers to morphological, but not to syntactic information. For convenience, this category (the exact definition of which can only be given for a specific language) may be called the phonological word.

Within this framework, the central parameter for the revised model of prosodic typology can now be defined. Languages will either treat the syllable as their basic category, or the phonological word. Accordingly, they may be called syllable languages or word languages. A syllable language is one which dominantly refers to the syllable, a word language is one which dominantly refers to the phonological word in its phonological make-up; in the first case, a maximum number of phonological regularities or processes have as their domain the syllable, in the second case, a maximum number has as their domain the phonological word[121].

This central parameter is identical to one of the six parameters investigated in the previous sections, and it corresponds closely to another one, i.e. the dominance of syllable structure destroying or enhancing rules. The parameter "tone" has to be redefined. The important question to ask now is: if there is tone, is the domain of tone assignment the syllable (which supports classification as a syllable language) or is it the phonological word (which supports classification as a word language)? (As in the old model, the absence of tone is not taken to predict anything.) The parameter "accent" and the parameter "differential treatment of accent and non-accent syllables", which is derived from it, take on a slightly different role. Word accent is now treated as one word-related process among others; some word languages may choose this option, while others may use other resources (such as tone or "musical accent") in order to highlight the prosodic category of the word. (The same applies to accent-dependent reduction and other processes or phonotactic restrictions on non-accented syllables.) Therefore, the absence of word accent is not predictive; the only prediction made by the revised model is that syllable languages will not have a strong and unambiguous word accent, while word languages may choose among various options.

The only parameter that seems to be difficult to derive from the notion of word language and syllable language at first sight is syllable shell complexity. However, recall that maximal shell

[121]These structurally defined basic categories should also be central for language processes (production and perception). In fact, the scarce evidence that is available on the subjekt supports such a view. In particular, Berg (1991) has shown that speech errors in German (a word language) and Spanish (a syllable language) differ in their domain: he found that “word onsets are less often involved than syllable onsets in Spanish as opposed to German error data” (291).

complexity is found at the margins of words or in monosyllabics, i.e., word-internal syllable shells are never more, but often less complex than those of monosyllabic words or syllables at the left/right word margin. With increasing shell complexity, a language will therefore be increasingly likely to have different cluster phonotactics in word-internal and word-marginal syllable shells (left onset of initial syllable and right coda of final syllable). For instance, in a language with a maximal shell complexity of CV, word-internal syllables and word-marginal syllable shells are quite likely to be identical, i.e. we may find words of the type CV&CV; a language with a maximal shell complexity of CVC may have words of the type CVC&CVC, but it may also have restrictions on word-internal clusters, restricting them to single consonants, i.e. the pattern CV&CV(C). In a language of a maximal shell complexity of CCCVCCC, however, it is extremely unlikely that word patterns such as CCCVCCC&CCCVCCC will occur; in all likelihood, word-internal clusters will be less complex (for instance, up to CCCVCCCVCCC), as will be non-marginal syllable shells. This imbalance between word-internal and word-marginal syllable shells, in turn, is a characteristic feature of word languages, while the identity of syllable phonotactics in all environments in the word is typical for syllable languages. The parameter "syllable shell complexity" therefore fits in the revised model very well.

In the following table (Fig. 28), the results of the previous figures correlating shell complexity, syllable structure destroying/enhancing processes, tone, accent, vowel reduction and other differences between accented and non-accented syllables, and word- vs. syllable-related processes/phonotactics are summarized in reduced detail with the revised model in mind. Languages are ordered between the two prototypes: a clear word language (bottom) and a typical syllable language (top).

(*Fig. 28):* *Summary and revised model*

Legend (italics see discussion in text)

word- vs syllable-related processes and/or phonotactics:

W	=	word-related processes dominant
S	=	syllable-related processes dominant
S/W	=	both
blank	=	does not apply or insufficient information (see previous chapters for details)

syllable-destroying/-enhancing processes:

W(ord)	=	syllable-destroying
S(yllable)	=	syllable-enhancing
S/W	=	both or none of them
blanks	=	does not apply or insufficient information (see previous chapters for details)

reduced vowel system:	+	=	overall reduction
	(+)	=	marginal or restricted domain of reduction, or only [±long] neutralized
	blank	=	no reduction or does not apply (see previous chapters)
accent:	+	=	word accent exists
	(+)	=	vague accent system
	blank	=	no accent or insufficient information (see previous chapters)
tone:	S	=	assigned to lexical syllables
	W	=	assigned lexically to phonological words
	( )	=	restricted tone language (see previous chapters)
	blanks	=	no or marginal tone
shell complexity:	H(igh)	=	CC...CC or more (unless marginal or dialectal)
	L(ow)	=	C(G)...C or less
	M(id)	=	inbetween (incl. CG...CC)

	processes/ phonotactics	syllable structure	vowel reduction rules	accent	tone	shell complexity
prototype	S	S			S	L
Yoruba	S				S	L
Amo	S	S			S	L
Navaho	S	S			S	L
Eskimo	S					L
Mundari	S	S				L
Vietnamese	S				S	L
Fijian		S				L
Basque	S/W	S/W		(+)		M
Japanese	S	S	(+)		(W)	L
Hausa	S	(W)	(+)		S	L
Toba-Batak	S	S		+		L
Mandarin	S		(+)	+	(S)	L
Quechua	S	S	(+)	+		L
Korean	S	S/W	(+)	+		M
Yidiê	S/W					M
Nimboran	S/W	S/W	+	+		M
French	S/W	S/W	(+)			H
Turkish	W	S/W		(+)		M
Telugu	W	W		(+)		L
Khalkha	W	S/W		+		L
Asmat	W					L
Uzbek	W	S/W	+	(+)		M
Tamang	W				W	L
Nama	W	S/W			W	M
!xóõ	W				W	M
Toda	W	S/W	(+)	+		H
Diegueño	W	S/W	+	+		M
Tzeltal	W	W		+		H
Klamath	W	S/W		+		H
Gaelic	W	S/W	+	+		H
Russian	W	S/W	+	+		H
Circassian	W	W	+	(+)		H
Arabic	W	W	(+)	+		H
English	W	W	+	+		H
prototype	W	W	+	+	or W	H

A group of unambiguous syllable languages (comprising Yoruba, Amo, Navaho, Mundari, Vietnamese, Eskimo and Fijian) and one of rather unambiguous word languages (comprising Tzeltal, Klamath, Gaelic, Russian, Circassian, Arabic, English, Toda, possibly also Diegueño, despite its mid-complex shell structure[122]) emerge.

Non-prototypical syllable languages are Basque, Japanese, Hausa, Toba-Batak, Mandarin and Quechua. Most of them deviate from the prototype in having word accent and/or some kind of reduction in non-accented syllables (but no overall vowel reduction); Basque also because of its mid-complex syllable shells; Hausa because of its weakly syllable-deteriorating rules; and Japanese because of its word-related assignment of musical accent (if only to a part of the lexicon).

Non-prototypical word languages are Uzbek as well as the group of languages that assign tone in the domain of the phonological word (i.e. Tamang, Nama and !xóõ). Uzbek only has medium complex syllable shells; the same applies to Nama and !xóõ while Tamang only has very simple syllables, a characteristic feature of syllable languages. Tamang, Nama and !xóõ also have no vowel reduction in non-accented syllables and no clear accent. Their classification as non-prototypical word languages rests on the strong correlation between word-related processes/phonotactics and word-related tone assignment.

Finally, there is a group of eight languages that stand between word and syllable languages: both the syllable and the phonological word are important for their phonological make-up. From the syllable pole towards the word pole, these are Korean, Nimboran, Yidiɲ, French, Turkish, Asmat, Telugu and Khalkha.

To conclude: This preliminary study based on a restricted, but geographically and genetically diversified sample of 34 languages has been able to support the assumption that a prosodic typology is possible. Important phonological characteristics of human languages have been shown to correlate in a way that can be explained by a prosodically based, prototype-oriented model. However, the basis for such a typology most probably should not be rhythm, but rather the selection of a prosodic category which is central for the make-up of a language's phonology.

[122]Only English conforms with the word-language prototype without any restriction.

References

Abercrombie 1967, Elements of General Phonetics

Abraham, R.C., 1959a, The Language of the Hausa People. London.

Abraham, R.C., 1959b, Hausa Literature. London.

Anceaux, J.C., 1965, The Nimboran Language. Verhandelingen van het koninklijk Instituut voor Taal-, Land- en Volkenkunde. Deel 44. 's-Gravenhage: Marinus Nijhoff.

Auer, Peter, 1990, Phonologie der Alltagssprache. Berlin: de Gruyter.

Auer, Peter, 1991, Zur More in der Phonologie. Zeitschr. f. Sprachwiss. 10, 1, 3-36.

Auer. Peter & Uhmann, Susanne, 1988, Silben- und akzentzõhlende Sprachen: Literatur³berblick und Diskussion. Zeitschr. f. Sprachwiss. 7, 2, 214-259.

Bamgbohe, A., 1966, A Grammar of Yoruba. Cambridge: CUP.

Barker, M.A.R., 1964, Klamath Grammar. Berkeley.

Beach, D.M., 1938, The Phonetics of the Hottentot Language. Cambridge: Heffer.

Beckman, Mary E., 1986, Stress and Non-Stress Accent. Dordrecht: Foris.

Berg, Thomas, 1991, Phonological processing ina syllable-timed language with pre-final stress: evidence from Spansih speech error data. Language and Cognitive Processes 6,4,265-301.

Bertinetto, P.M., 1977, Syllabic blood, ovvero l'italiano come lingua ad isocronismo sillabico. In: Studi di Grammatica Italiana VI, Florenz: Academica della Crusca, pp 69-96.

Bertinetto 1988, Reflections on the dichotomy 'stress' vs 'syllable-timing'. Quaderni del laboratorio di linguistica. Scuola Normale Superiore, Pisa, 2, 59-84.

Camara, J. Mattoso, Jr., 1972, The Portuguese Language. Chicago: University of Chicago Press.

Chao, Yuen Ren, 1968, A Grammar of Spoken Chinese. Berkeley: U of California Press.

Cheng, Chin-Chuan, 1973, A Synchronic Phonology of Mandarin Chinese. Paris/The Hague 1973.

Cho, Seung Bog, 1967, A Phonological Study of Korean. Uppsala.

Clements, N. & Keyser, S.J., 1983, CV Phonology. Cambridge, Mass.

Cook, W., 1965, A descriptive analysis of Mundari. Ph.D. Thesis, Georgetown University.

Cowell, Mark W., 1964, A Reference Grammar of Syrian Arabic. Washington D.C.: Georgetown University Press.

Couper-Kuhlen, Elizabeth, 1992, Metrical hierarchies and the rhythm of conversational English. KontRI Working Papers, University of Constance, Fachgruppe Sprachwissenschaft, No. 16.

Dauer, Rebecca, 1983, Stress-timing and syllable-timing reanalyzed. J. Phonetics 11, 51-62.

Dauer, Rebecca, 1987, Phonetic and phonological components of language rhythm. Proc. XIth Intern. Congr. Phonet. Sc., Vol. 5, 447-450, Talinn.

den Os, E.A. 1983, Stress-timed and syllable-timed languages. PRIPU 8.2., 12-23.

di Luzio, Aldo, 1967, Preliminary description of the Amo language. Afrika und Übersee LVI, 1/2

di Luzio, in prep., Ancora su le geminate in italiano. KontRI Working Paper, Univ. of Constance, Fachgruppe Sprachwissenschaft, No. 17.

Dixon, R.M.N., 1977, A Grammar of Yidiã. Cambridge: CUP.

Donegan, Patricia & Stampe, David, 1983, Rhythm and the holistic organization of language structure. In: CLS 19, Parasession on the interplay of phonology, morphology & syntax (ed. F. Richardson), pp 337-353.

Dow, F.D.M., 1972, An Outline of Mandarin Phonetics. Canberra.

Dressler, W.U., 1979, Reflections on phonological typology. Acta linguistica Academiae Scientiarum Hungaricae, Tomus 29, 3-4, 259-273.

Dressler, W.U., 1985, Typological aspects of natural morphology. Acata Linguistica Academiae Scientiarum Hungaricae, 35, 1-2, 51-70.

Dressler, W.U. (ed.), 1987, Leitmotifs in Natural Morphology. Amsterdam: Benjamins.

Dunston, Elizabeth, 1969, Twelve Nigerian Languages. London.

Emeneau, Murray B., 1984, Toda Grammar and Texts. Philadelphia.

Farnetani, Edda & Kori, Shiro, 1990, Rhythmic structure in Italian noun phrases: A study on vowel durations. Phonetica 47, 50-65-

Fortescue, Michael, 1984, West Greenlandic. London: Croom Helm.

Gabka, K., (ed.) 5./1987, Einführung in das Studium der russischen Sprache. Bd. 1, Phonetik und Phonologie (E. Wiede u.a.). Leipzig: VEB Verlag Enzyklopädie.

Garde, Paul, 1968, L'accent. Paris: Presses universitaires de France.

Gil, D., 1986, A prosodic typology of language. FoL 20, 165-231.

Gouffé, Claude, 1981, La langue Haoussa. In: J. Perrot (ed), les langues dans le monde ancien et moderne. Paris.

Greenberg, Joseph, 1941, Some problems in Hausa phonology. Language 17.

Greenberg, Joseph, 1965, Some generalizations concerning initial and final consonant sequences. Linguistics 18, 5-34.

Greenberg, Joseph, 1966, Some universals of grammar with particular reference to the order of meaningful elements. In: Greenberg (ed.), Universals of Language. Cambridge: MIT Press, pp 73-113.

Greenberg, Joseph (ed.), 1978, Universals of Human Language. Stanford: Stanford University Press.

Grønbech, Kare & Krueger, John R., 1955, An Introduction to Classical (Literary) Mongolian. Wiesbaden: Harrassowitz.

Hall, Robert A., 1966, Pidgin and Creole Languages. Ithaca: Cornell University Press.

Harrell, R.S., 1957, ThePhonology of Colloquial Egyptian Arabic. New York: American Council of Learned Societies.

Harrell, R.S., 1962, A Short Reference Grammar of Maroccan Arabic. Washington: Georgetown University Press.

Hawkins, John A., 1983, Word Order Universals. N.Y.: Academic Press.

Hayes, Bruce, 1989, Compensatory lengthening in moraic phonology. Linguistic Inquiry 20, 253-306.

Holm, Catherine, 1987, Le cadre des changements phonétiques dans les langues romanes. Mot et 'syntagme phonétique'. In: H. Andersen & K. Koerner (eds.), Historical Linguistics. Amsterdam: Benjamins, pp 231-243.

Hurch, B. 1988a, Is Basque a syllable-timed language? Anuario del seminario de filologia vasca "Julio de Urquijo" XXII-3, 813-825.

Hurch, B., 1988b, Über Aspiration. Tübingen: Narr.

Hyman, Larry M., 1977, On the nature of linguistic stress. In: Idem, ed., Studies in Stress and Accent = Southern Califomia Occasional Papers in Linguistics No. 4. Los Angeles, Department of Linguistics/ University of Southern California, pp 37-82.

Hyman, Larry, 1985, A Theory of Phonological Weight. Dordrecht: Foris.

Kaden, Klaus, 1979, Kurzer Abriß der segmentalen Phonologie des heutigen Chinesisch. ZPhSK 32, 525-535.

Kaisse, Ellen M., 1985, Some theoretical consequences of stress rules in Turkish. CLS 21, I.

Kästner, H., 1981, Phonetik und Phonologie des modernen Hocharabischen. Leipzig.

Kaufmann, Terence, 1971, Tzeltal Phonology and Morphology. Berkeley: University of California Press

Keenan, Edward, 1979, On surface forma nd logical form. In: Studies inthe Linguistic Sciences, Special Issue, Vol, 8,2, 1-41.

Kim-Renaud, Young-Key, 1978, The syllable in Korean phonology. In: Kim, Chin-Woo, ed., Papers in Korean Linguistics. Columbia.

Kiparsky, Paul, 1981, Remarks on the metrical structure of the syllable. In: W. Dressler (ed.), Phonologica 1981, pp 245-256.

Kostic, Djordje, et al., 1977, A Short Outline of Telugue Phonetics. Calcutta: Indian Statistical Institute.

Kouloughi, Djamel-Eddine, 1978, Contribution á la phonologie générative de l'Arabe: le système verbal du parler Arabe du Sra (Nord Constantinois, Algerie). Thèse de Doctorat de 3ème Cycle, Paris VII.

Krishnamurti, Bh. & Gwynn, J.P.L., 1985, A Grammar of Modern Telugu. Delhi: Oxford University Press.

Kuz'menko, Y., 1987, The change of the phonological type of a language. In: Proc. XIth Intern. Congr. Phon. Sc. Vol. V, Talinn, pp 429-432.

Langdon, Margaret, 1970, A Grammar of Diegue±o. The Mesa Grande Dialect. Berkeley etc.: University of California Press.

Lee, Hansol Hyun Bok, 1989, Korean Grammar. Oxford University Press.

Lees, R.B., 1961, The Phonology of Modern Standard Turkish. The Hague: Mouton.

Lehiste, Ilse, 1970, Suprasegmentals. Cambridge, Mass.: MIT Press.

Lehiste, Ilse, 1977, Isochrony reconsidered. J. Phonetics 5, 253-63.

Lehmann, W.P, 1973, A structural principle of language and its implications. Lg 49, 1, 47-66.
Levin, Juliette, 1984, Conditions on syllable structure and categories in Klamath phonology. In: Proceedings WCCFL, Stanford, 158-169.
Lewis, G.L., 1967, Turkish Grammar. Oxford: Clarendon Press.
Liem, Nguyen Dang, 1970, Vietnamese Pronunciation. Honolulu, University of Hawai Press.
Lisker, L. & Krishnamurti, Bh., 1991, Lexical stress in a 'stressless' language. Judgments by Telugu- and English-speaking linguists. In: Proc. XIIth Intern. Congr. Phon.Sc., Vol. 2, Aix-en-Provence, p. 90ff.
Maddieson, Ian, 1984, Patterns of Sounds. Cambridge: CUP.
Maddieson, Ian, 1991, Investigating Linguistic Universals. UCLA Working Papers in Linguistics No. 78, pp 26-37.
Major, R.C., 1981, Stress-timing in Brazilian Portuguese. J. Phonetics 9, 343-351.
Marchand, Hans, 1960, On the phonological system of the Turkish vowels. Acta Linguistica VIII,1,21-31.
Marotta, Giovanna, 1985, Modelli e misure ritmiche: la durata vocalica in italiano. Bologna: Zanichelli.
Mateus, Maria Helena Mira, 1975, Aspectos da fonologica portuguesa. Lisboa: Publicações do centro de estudos filológicos, 19.
Mayerthaler, Eva, 1982, Unbetonter Vokalismus und Silbenstruktur im Romanischen. Tübingen: Niemeyer.
Mazaudon, Marine, 1973, Phonologie Tamang. Paris: SELAF.
Meinhof, Karl, 1909, Lehrbuch der Nama-Sprache. Berlin: Reimer.
Mokhtar, A., 1981, Lehrbuch des Ägyptisch-Arabischen. Wiesbaden: Harrassowitz.
Muljačič, Zarko, 1972, Fonologia della lingua italiana. Bologna: Mulino.
Nababan, P.W.J., 1981, Grammar of Toba-Batak. Canberra. (=Pacific Linguistics Series)
Nespor, Marina & Vogel, Irene, 1986, Prosodic Phonology. Dordrecht: Foris.
Ó Siadhal, Michaél, 1989, Modern Irish. Cambridge, CUP 1989.
Parker, Gary J., 1969, Ayacucho Quechua Grammar and Dictionary. The Hague: Mouton.
Passy, Paul, 1891, Etude sur les changements phonétiques et leurs caractères généraux. Frimin-Didot.
Pike, Kenneth, 1945, The Intonation of American English. Ann Arbor: University of Michigan Press.
Poppe, N., 1970, Mongolian Language Handbook. Washington: Center for Applied Linguistics.
Pulgram, Ernst, 1970, Syllable, Word, Nexus, Cursus. The Hague: Mouton.
Quesada, Felix C., 1976, Gramßtica quechua: Cajamarca - Cañaris. Lima: Ministerio de Educación.
Rédel, Károly, 1976, Einige Typen der Vokalharmonie. In: W.U. Dressler (ed.), Phonologica 1976. Innsbruck, pp 167-175.
Rischel, Jørgen, 1974, Topics in West Greenlandic Phonology. Copenhagen: Akademisk

Forlag.
Roach, Peter, 1982, On the distinction betweeen stress-timed and syllable-timed languages. In: D. Crystal (ed.), Linguistic Controversies. London: E. Arnold.
Rowlands, E.C., 1969, Teach Yourself Yoruba. London: English Universities Press.
Ruhlen, Merritt, 1976, A Guide to the Languages of the World. Stanford.
Saltarelli, Mario, 1970, A phonology of Italian in a generative grammar. The Hague.
Saltarelli, Mario, 1988, Basque. London: Croom Helm.
Sapir, E. & Hoijer, H., 1967, The Phonology and Morphology of the Navaho Language. Berkeley & Los Angeles: U of California Press.
Saporta, Sol, 1963, Phoneme distribution and language universals. In: J. Greenberg (ed.), Universals of Language, pp 61-72.
Schütz, Albert J. & Komaitai, Rusiate T., 1971, Spoken Fijian. Honolulu: University of Hawaii.
Schweiger, F., 1990, How to persuade with statistics. The weak ground of prosodic typology. FL XXIV, 1-2, 123-126.
Shibatani, Masayoshi, 1990, The languages of Japan. Cambridge: Cambridge University Press.
Sinha, N.K., 1975, Mundari Grammar. Mysore: Central Institute of Indian Languages.
Sjoberg, Andrée F., 1962, The phonology of Standard Uzbek. In: N.N. Poppe (Ed), American Studies in Altaic Lingusitics. Bloomington, Ind. Univ. Publ. Uralic and Altaic Series, Vol. 13, pp 237-261.
Sjoberg, Andrée F., 1963, Uzbek Structural Grammar. Bloomington: Indiana University Press.
Skalička, V., 1966, Ein 'typologisches Konstrukt'. Travaux Linguistiques de Prague Vol II, 157-165.
Smeets, Rieks, 1984, Studies in West Circassian Phonology and Morphology. Leiden.
Sommerfelt, Alf, 1928, Sur le caractère psychologique des changements phonétiques. Journal de Psychologie XXV [reprinted in: Sommerfeld, Diachronic and synchronic aspects of language, The Hague: Mouton 1962, 214-233].
Street, John C., 1963, Khalkha Structure. Indiana University Press.
Traill, Anthony, 1985, Phonetic and Phonological Studies of !xóõ Hamburg: Buske.
Thompson, L.C., 1965, A Vietnamese Grammar. Seattle & London: University of Washington Press.
Trubetzkoy, Nikolaus Fürst, 3./1958, Grundzüge der Phonologie. Göttingen.
Uribe, Carlos Robles, 1962, Manual del Tzeltal (Gramatica Tzeltal de Bachajon). Mexico (City?): Universidad Iberoamericana.
van der Hulst, Harry & Smith, Norval, 1988, The variety of pitch accent systems: Introduction. In: iidem, eds., Autosegmental Studies on Pitch Accent. Dordrecht: Foris, pp ix-xxiv.
Vance, Timothy, 1987, An Introduction to Japanese Phonology. Albany: State University of

New York Press.

Vedder, H., 1938, Lautfolge in den weitaus meisten Wortstämmen der Namasprache. Appendix to Beach 1938, pp 313-315.

Vennemann, Theo, 1974, Topics, subjects and word order: From SXV to SVX via TVS. In: J.M. Anderson & C. Jones (eds.), Historical Linguistics. Amsterdam: North Holland Publishing Company.

Vennemann, Theo, 1976, Categorical grammar and the order of meaningful elements. In: A. Juillard (ed.), Linguistic Studies Offered to Joseph Greenberg on the Occasion of His Sixtieth Birthday. Saratoga: Anma Libri.

Vennemann, Theo, 1988, Preference Laws for Syllable Structure. Berlin: Mouton-de Gruyter.

Voorhoeve, C.L., 1980, The Asmat Languages of Irian Jaya. Canberra.

Wells, J.C., 1982, Accents of English. Cambridge: CUP.

Wenk, B. & Wioland, F., 1982, Is French really syllable-timed? J. Phonetics 10, 193-216.

Wurm, S., 1953, Über Akzent- und Tonverhältnisse im Özbekischen. Ural-Altaische Jahrbücher XXV, 1-2, 220-242.

Young, R.W. & Morgan, W., 1980, The Navajo Language and Colloquial Dictionary. Albuquerque.