Acta Linguistica Hungarica, Vol. 48 (1–3), pp. 155–181 (2001)

DISMANTLING SYLLABLE STRUCTURE*

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Abstract

By listing some empirical evidence and introducing theoretical considerations, this paper argues for the idea that the phonological skeleton is made up of strictly alternating C and V positions. The model advocated here claims that no two consonants and no two vowels are ever adjacent in the phonological representation — if adjacency is defined at the level of the skeleton. This is rather counterintuitive unless one accepts the possibility of empty skeletal positions. If so, the claim acquires a new meaning: whenever adjacent consonants or adjacent vowels (that is to say long vowels or diphthongs, besides the obvious case of hiatus) are encountered their representation will involve an intervening empty vocalic or consonantal position, respectively. Accordingly, the first part of the paper shows that the acceptance of empty skeletal positions is a viable idea and, if looked at from a non-Indo-European vantage point, it is in fact the null hypothesis. The second part aims at demonstrating that the arguments supporting the status of the syllabic constituent coda are rather weak, in fact, the traditional syllable structure, incorporating an onset, a nucleus and a coda, can be dismantled in favour of a simpler model involving only consonantal and vocalic skeletal positions.

1. Empty positions in the skeleton

One of the most important achievements of modern linguistics is the discovery of the use of emptiness. The aim of the discussion that follows is to convince the reader that empty positions in the phonological skeleton are not merely a tricky device to ease the analysis, but rather a logical conclusion of various different lines of thought pursued by theorists of modern phonology.

1.1. The skeleton–melody relationship

A not so recent advancement in phonological theory is the recognition of the necessity of separating the quantitative and the qualitative aspects of segments.

* I am grateful to Miklós Törkenczy for his detailed comments and to the Open Society Support Foundation (Research Support Scheme, grant no. 320/1998).

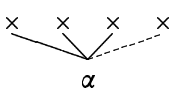
In this line of research, the quantitative aspect is represented by a so-called skeletal tier, the qualitative by the melodic tier. The exact content of these two tiers is one of the most important issues of current research. The skeletal tier primarily encodes the temporal extension of the given stretch of the sound flow, while the melodic tiers contain melodic primes—features, as they are standardly referred to—, which stand for the acoustic signal, on the one hand, and the oral gymnastics, on the other, that are manifest in the period of time represented by the stretch of the skeleton the given primes are associated with. The relationship between the elements of the two tiers is negotiated by association lines.

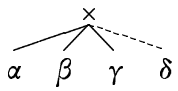
With the advent of the autosegmental model, it becomes necessary to explore the consequences of non-biunique relationships between the skeletal and melodic tiers. Having one batch of melody defining primes associated to two skeletal positions is the best-known and probably least controversial option, standardly employed to represent some acoustic property stretching across multiple timing slots (1a). The realization of this configuration ranges from long vowels ([a:]) and some diphthongs ([ei]), through genuine geminate consonants ([t:]), to partially identical clusters, like adjacent monomorphemic homorganic consonants ([mb]). The complementary configuration—two pieces of melodic material linked to the same skeletal position—is also a common thing, given that sounds are usually thought of as composite entities (1b). (The Greek letters represent melodic primes.)

(1) (a)

(b)

Association of melodic material and skeletal slots includes not only one-to-two, but also one-to-three, one-to-four, etc., associations (2a). What is intriguing is that while such configurations obviously exist—vowel harmony and tone phenomena very often exemplify unbounded spreading of melodic material through longer skeletal strings—, three-long consonants ([t::]) or vowels ([a::]) (allegedly present in, for example, Estonian) are standardly explained away, analysed in such a way that does not involve a structure like the one in (2a) and supposed to be noncontrastive even if phonetically existent. Phonological theory must find a way of rendering such structures impossible, or at least highly marked. (2b) represents a segment consisting of three, four etc. melodic primes, that is, a rather complex sound.

(2) (a) 

(b) 

Two further options that deviate from the simple one-to-one relationship are available in an autosegmental model. One is melodic material without an associated skeletal slot. Such floating segments are very useful in handling alternations where in what looks like the base form of a word there is nothing to indicate the presence of melodic material surfacing in some other, oblique form. This option is used, for example, by Kenstowicz–Rubach (1987) in their analysis of yers in Slovakian. The phonetic identity of a realized yer is usually predictable in Slavic languages, but in Slovakian the decisive factor, the palatalization of surrounding consonants, is lost, rendering the quality of the surfacing yer unpredictable. Another alternation of this type is liaison, which is especially intriguing when there exist other words with phonologically similar base forms which fail to manifest the same alternation. Such is the case in, for example, the textbook RP[1] *grammar is* [græmə r ɪz] vs. *gamma is* [gæmə ɪz], where the base forms are [græmə] and [gæmə], respectively. The presence of the [r] in the first but not in the second case can be explained by assuming that [græmə] is lexically furnished with an [r] that lacks (or is unassociated to) a skeletal slot, while [gæmə] has no [r] of any kind, as shown in (3).

(3) (a)

×	×	×	×	×			×	×	×
g	r	æ	m	ə	r			ɪ	z

(b)

×	×	×	×		×	×	×
g	æ	m	ə			ɪ	z

Such an account avoids the use of brute force deletion, i.e., maintains monotonicity (cf. Kálmán 1989), to explain the failure of the [r] to surface in case no vowel-initial string follows (e.g., *grammar book* [græmə bʊk]). It also presupposes that phonetic interpretation proceeds on the skeleton, realizing those and only those portions of the melody that are associated with the skeleton.

[1] This dialect is sometimes claimed to be nonexistent outside prescriptively biased books on English pronunciation (Harris 1994, 293, note 5), though Jones, for example, claims he is a speaker of this dialect (1967, xxvii). Whatever its reality, it illustrates the case in point.

If the mere presence of melodic material in the representation were enough for its being phonetically interpreted the option of unpronounced floating melody would not be viable.

The complementary situation is obviously a skeletal slot without any melodic content associated to it. This configuration comes handy again in dealing with liaison phenomena: for the floating liaison consonant to be interpreted it must be linked to a skeletal position. Since such consonants are typically pronounced only if a vowel-initial word (or suffix) follows, all that need be hypothesized is that such words carry a skeletal slot at their beginning which is not associated to any melodic material lexically, like at the beginning of *is* [IZ] in (3). The floating melody thus has a chance to associate and hence get interpreted.

Though this account appears elegant at first sight, there is some theoretical difficulty with it. If the phonetic interpreter takes consecutive skeletal positions as its input and realizes whatever melody is linked to each, one may wonder what should happen when it encounters a position to which no melody is associated. There are two obvious possibilities, depending on the theoretical status of skeletal slots, i.e., whether they represent a segment of the speech flow or a more abstract entity which if empty is interpreted as silence. If we make the assumption that skeletal slots are segments of the speech flow each slot must be interpreted, including empty ones. Without any explicit melodic material the phonetic interpretation of a position is not trivial. It is only in a framework applying exclusively unary features that this task is worth attempting: if features are binary or scalar phonetic interpretation may only begin once all feature values are present — some lexically given, others supplied during the phonological derivation. As opposed to this, unary features model privative oppositions, where a contrast is produced by one of the parties lacking some property the other possesses. That is some segments are made up of less features than others, a property that also reflects the relative unmarkedness of the former type as compared to the latter. The bottom extremity of markedness is a segment containing no features at all, i.e., an empty skeletal position.

As we are going to see, it also makes sense to assume that the phonetic interpretation of an empty position is a function of other factors of the representation, that is, the same skeletal slot devoid of any melodic content may under certain circumstances be interpreted as a very unmarked segment, while in other cases remain silent. The advantage this assumption buys us is that segment–zero alternations will not have to involve the insertion or deletion of any phonological material, the former option being arbitrary, the latter non-monotonous, instead they will follow from the interpretative conventions.

1.2. Empty skeletal positions and the null hypothesis

One way of classifying current phonological theories is by the criterion whether they allow skeletal positions to be empty or not. The stance one adopts in this issue is of substantial relevance to the whole of a given theory. There are several questions that the existence or nonexistence of empty skeletal positions bears upon. To mention but a few: the association of segments in phonological strings to syllabic constituents will be seen radically differently if empty positions may occur and cases of segments alternating with zero must also be analysed differently if we are reluctant to accept that a skeletal position may be empty: the destructive, non-monotonous device of resyllabification is very often called for if one wishes to have only positions with melodic content on the skeleton.

Taking the first case, let us assume the conventional syllable structure comprising an onset, a nucleus and a coda. In the standard textbook account all three constituents come with a practically unbounded branching potential, i.e., the onset in English may contain 0–3, the nucleus 1–2 and the coda 0–5 segments (e.g., Giegerich 1992, 153, 167). Being empirically correct this analysis fares well for a description but is unusable when searching for an explanation; the number of branches for each constituent ranges within patently stipulative limits. One wonders why the onset may contain up to three segments, what inhibits it from having, say, four. The tacit assumptions behind this analysis are the axioms that syllable boundaries necessarily coincide with word boundaries[2] and that segments are fully integrated into the prosodic hierarchy, that is, each segment belongs to some syllabic constituent, each syllabic constituent belongs to some syllable and so on. The unfoundedness of the first axiom becomes apparent if we consider that on another level of the prosodic hierarchy, that of feet, boundaries do not necessarily coincide; words may begin with a degenerate foot and may end with a sole stressed syllable, which is not usually referred to as a degenerate foot, it still lacks a dependent second syllable. The second axiom, full integration of segments, has to be given up by theorists following this line as soon as it is realized that word edges tolerate a wider

[2] E.g., Blevins (1995, 209): "In all languages, syllable edges correspond with word/utterance edges..." Besides being unjustified, such a claim is also empirically false: there are several examples of word-final and word-initial consonants being extrasyllabic, i.e., not belonging to the preceding or following syllable.

range of phonotactic freedom,[3] and to handle such phenomena the notion of extrasyllabicity has to be introduced.[4]

There is yet another reason why Giegerich's (or other analysts' similar) constraints are spurious theoretically: while the two consonantal constituents, the onset and the coda may be absent from the representation, the same possibility is not available for the vocalic portion of the syllable, the nucleus. The excuse that may be brought up to explain this discrepancy is the head status of nuclei; as the head of the syllable they must not be empty. Again, if we move to other levels of the prosodic hierarchy the situation is different: both headless feet and headless segments[5] are possible.

As for segment–zero alternations, we have already seen a case where hypothesizing an empty skeletal position facilitates the analysis: liaison phenomena are neatly describable by positing an empty consonantal position before vowel-initial words. To take another instance, this time a vowel alternating with zero, consider the onset [m] of the unsyncopated [fæməli], which becomes a coda in the bisyllabic [fæmli]. A similar but converse situation often arises with morphological concatenation, e.g., the coda [l] of *tell* becomes an onset in *telling*. Both of these cases involve resyllabification in theories that want to maintain that prevocalic consonants are in an onset, but reject the possibility of having empty skeletal positions. Resyllabification, however, subverts the result of core syllabification, thereby representing a serious challenge to phonological parsing: if in a framework it is allowed that the syllabic status of elements be freely changed during the derivation, the possibility of tracing back the derivation, getting from the surface signal to the underlying representation, reduces radically.[6] One could argue that resyllabification is necessary because a word-final or preconsonantal consonant behaves differently from its prevocalic alternant. This, of course, is true, but one must also admit that resyllabification is simply a way of representing this fact, nothing that would offer any explanation. In such a framework we know a consonant is in coda

[3] If syllables in English could in fact begin with three consonants and end in five, we would expect eight-consonant-long intervocalic sequences within words, but this also turns out to be a disappointed expectation.

[4] E.g., Goldsmith (1990, 123): "*prosodic licensing,* which require[s] that all elements be a member of some syllable, or else be marked as contingently extrasyllabic."

[5] The head–nonhead distinction in segments is not universally accepted, but cf. Anderson–Ewen (1987), Kaye et al. (1985), Schafer (1995), among others.

[6] It was for similar considerations that Chomskyan syntax has abandoned the device of **movement,** replacing it with the notion of **chains**.

position because it behaves like consonants in coda position usually do. Since **being** in coda position is not an empirical issue, codas have no theory-external status, we have no independent evidence for the codahood of a consonant apart from the fact that it behaves like other consonants that we believe to be in the coda. If one wants to avoid applying resyllabification, the alternative analysis of segment–zero alternations and morphological concatenations will involve empty skeletal positions.

What apparently justifies theories of the skeleton that reject the possibility of empty positions is the assumption that this is the null hypothesis. That is, empty skeletal positions ought not to be posited unless there exist phonological phenomena with no other way to analyse them. While it is true that accepting skeletal positions that fail to be interpreted phonetically does bring some abstractness into a theory, it is controversial whether their rejection *is* the null hypothesis. The generative power of a theory having syllables of an unlimited size may be just as excessive as that of one having empty skeletal positions, what matters is whether there are adequate means of curtailing the possibilities.

It is common knowledge that there are languages (e.g., Hua) in which all phonological strings conform to a uniform CVCV...CV pattern on the surface. From this fact one can infer that there is one type of syllable in such languages, one which comprises a single onset consonant followed by a nucleus. Since this syllable type is also one that appears to exist in all human languages (cf. Blevins 1995, 217, also for the language names), we may conclude that CV is the basic syllable type. In another set of languages (including Cayuvava) we find consonantless syllables in addition to the basic CV type. One way of incorporating this fact in a theory is adding another syllable type, V, i.e., assuming that single vowels also form syllables in such languages. But increasing the syllable inventory is not an unavoidable necessity: one may also claim that only CV syllables exist in both types of languages, but in the second type the C part may remain unassociated to segmental material, i.e., may be empty and hence unpronounced. Other languages (e.g., Krenak, cf. Kaye 1990) involve a further complication: they have word-final consonants. We again have two ways to cater for these facts. Adding a new syllable type, CVC, to the existing inventory is possible, but the alternative offered above is also available: we may retain the one-member inventory (containing only CV) and have an empty V part this time. A CVC word is thus analysed as two CV "syllables", the second of which has an empty vowel. Harris–Gussmann (1998, 141) claim that the latter strategy is followed by syllabic writing systems: these assign non-prevocalic consonants to an independent syllable with an uninterpreted vowel

(dummy syllables as Harris–Gussmann refers to them). The theoretically desirable null hypothesis is to follow only one of the above methods to increase the number of surface syllable types: either to add new types to the inventory every time a language is found in which it is not possible to exhaustively parse any phonological string by the existing syllable types, or to adhere to the minimal set, containing only CV, and allow one or the other part not to surface. It is theories which simultaneously apply both strategies, that is, which allow **both** empty positions **and** syllables more complicated than CV, that depart from the null hypothesis. Since Indo-European languages are typically furnished with large sets of **superficial** syllable types, phonologists with such a linguistic background are bound to take it for granted that syllable inventories do contain such varied members. This bias may, however, be dismantled by starting out from the most basic—and perhaps only—syllable type, CV.

I hope to have shown that while the acceptance or otherwise of empty skeletal positions appears to be a matter of scholarly taste (analyses applying both approaches abound, after all), laying the burden of proof on theories with empty positions thinking that one has the null hypothesis on his side is not right after all. What the null hypothesis is thought to be in this issue is most probably a question of tradition.

2. Syllable structure

Many current theories of phonological representation assume one or more levels between feet and the skeleton in the prosodic hierarchy. These are occupied by so-called syllabic constituents which organize skeletal positions and other syllabic constituents into syllables. Syllabic constituents gain theoretical relevance when they prove to be indispensable in—or at least result in a substantial simplification of—the formulation of phonological generalizations.

Syllables, on the other hand, are not uncontroversial entities. The notion has been abandoned several times in the history of phonological theory, the best known case is probably that of the SPE (Chomsky–Halle 1968). From the 1970s mainstream phonology has gradually returned to applying this traditional concept, but interestingly in most cases[7] it is not the syllable constituent

[7] Reduplication may appear be an exception, though here again it is often not a syllable that is repeated, but the **head** of the first onset and the following nucleus (Brockhaus 1995, 215ff).

itself that is necessary for the analyses, but its subconstituents, the onset, the nucleus and the coda.

2.1. Why have syllable structure?

It has been noticed — e.g., by Kahn (1976, 22ff) — that certain consonantal processes favour the phonological environment depicted in (4).

(4) $$\_\left\{\begin{matrix} C \\ \# \end{matrix}\right\}$$

If syllables have a theoretical status, the environment in (4) can simply be referred to as the end of the syllable, i.e., its coda. There are two problems with this formula: first, it is not true that all preconsonantal consonants exhibit coda-like behaviour, for example, we find glottalization in an English word like *A*[ʔt]*lantic* but aspiration in *a*[tʰ]*ractive,* although the [t] is preconsonantal in both cases. Thus it seems that syntagmatic relationships in the string of segments are not in themselves enough to properly capture phonological environments. Second, even if they were so, the formula in (4) makes use of an unnatural disjunction: there is nothing more common in the word boundary and consonants than in, say, the word boundary and vowels.

As we have seen, the two contexts, _C and _#, can be unified by assigning both types of consonants to a coda constituent.[8] The relevant phonological rules can now be formulated by the structure in (5).

(5) coda
|
_

In the case of contrasts like *A*[ʔt]*lantic* vs. *a*[tʰ]*ractive* all there is to do is to assign one of the *t*'s to the coda and the other elsewhere — obviously to the following onset. In many cases such distinctions can be justified by independent evidence, in this one, for example, we can note that one of the clusters in question, *tl,* does not occur word-initially, the other, *tr,* does.

One cannot, however, be satisfied with this much. While a significant degree of descriptive adequacy is reached by the formulation in (5), explanatory

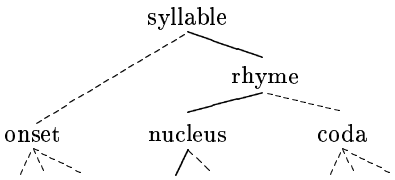
[8] Kahn (1976) himself does not apply syllabic constituents like coda, he unifies these positions as _$, i.e., the end of the syllable. The translation of this environment to "coda position" is, nevertheless, quite straightforward.

adequacy is still wanting. For example, lenition, a phenomenon typically associated with the coda position, manifested as glottalization in the previous example, may be adequately captured by the generalization that coda consonants lenite, there is, nevertheless, no reason why it should be the coda position of all that triggers weakening. One promising initiative to an explanation is made by Itô (1986) and Goldsmith (1990), who claim that codas have a weaker prosodic license than other domains of the syllable, therefore coda consonants are more prone to lenition. There is still ground for insisting on the question why it is codas that have a weaker prosodic license. An answer couched in the Government Phonology framework is proposed by Harris (1997), who posits a so-called licensing path in phonological domains ranging from the most prominent nucleus through least prominent ones to the onsets of these nuclei. The claim is that the further away a position is from the prime licensor, the more prone it is to lenition.

2.2. Problems with the standard view

In (6) I give a diagram that shows my interpretation of the syllable tree most widespread in the literature (e.g., Lass 1984, 252; Durand 1990, 204; Giegerich 1992, 138; Carr 1993, 196; Kenstowicz 1994, 253; Roca 1994, 141; Blevins 1995, 213).

(6)



The solid lines in (6) represent obligatory associations, the dashed lines are optional, i.e., one nuclear segment is obligatory for any syllable,[9] all the others — another nuclear segment and practically any number of onset and coda segments — may or may not be added to complete a syllable.

Given this syllable template syllabifying strings is still not a trivial issue: the length of both onsets and codas is rather flexible. Nuclei can be found applying the **sonority sequencing principle** (cf. Jakobson–Halle 1956, 31f; Selkirk 1984, 116), one possible wording of which is quoted in (7).

[9] I do not claim that this **follows** from the presuppositions of the model, but that most theorists working in this framework work with this assumption.

(7) **The Sonority Sequencing Principle (SSP)**

Within a syllable sonority rises from the onset towards the nucleus and falls from the nucleus towards the coda.

That is, the sonority peaks of a certain string, away from which sonority falls in both directions, can be identified with the syllabic nuclei. Even if nuclei are spotted easily, the consonantal interlude streching between two sonority peaks must be properly distributed among the coda and the onset. To be able to do this in a principled way the **onset maximization principle**[10] (cf. Clements–Keyser 1983, 37, who call it the Onset First Principle) is formulated to the effect of (8).

(8) **The Onset Maximization Principle (OMP)**

If a consonant can be assigned both to a coda and the following onset, assign it to the onset.

Equipped with this principle, consonantal interludes can be unambiguously divided: in a $VC_nC_{n-1}\ldots C_2C_1V$ string C_1 always goes with the second vowel, then one has to test whether C_2C_1 is a valid onset, if yes it goes with the second vowel, else the syllable boundary is between C_2 and C_1, and so on. One difficulty comes with deciding whether a given consonant cluster is a valid onset or not. The assumption that the set of word-initial clusters is coextensive with that of valid onsets—and likewise that of word-final clusters with that of valid codas—is often accepted (cf. footnote 2) but rarely if ever supported by any evidence. In fact, what can be supported by empirical evidence is the falsity of this hypothesis, as, for example, the **closed syllable adjustment** rule of French shows. According to this rule [e] and [ə] surface as [ɛ] in closed syllables, and although sC clusters do occur word-initially, they also close a syllable: we find [ɛ] before sC clusters (Lowenstamm 1981, 598f). If sC clusters are heterosyllabic within a word, then it cannot be concluded that the set of well-formed onsets is that of word-initial clusters. On the other hand, in most—perhaps all—languages single consonants that can turn up before a vowel may also turn

[10] An alternative, negative name of the principle could be the "coda minimalization principle." Both names convey the superiority of onsets over codas. In Optimality Theory the same idea is manifest in the ONSET and NOCODA constraints.

up word-initially.[11] On the other hand, it is not true that in all languages single consonants that can turn up before a consonant may also turn up word-finally—this is most evident in the case of languages that have word-internal codas, but lack word-final consonants, like Italian. Also word-final consonants can very often not stand before a consonant word-medially—the distribution of English [ð] and the affricates could exemplify this situation.[12] Therefore, we may conclude that the only inference that can be drawn is the following: whatever is an onset may turn up at the beginning of a word. To schematize:

(9) The relationship of consonant(s) at word and syllable margins

NAIVE VIEW
word-initial consonant (cluster) ⇔ syllable-initial consonant (cluster)
word-final consonant (cluster) ⇔ syllable-final consonant (cluster)

EVIDENCED VIEW
word-initial consonant (cluster) $\begin{matrix}\not\Rightarrow\\ \not\Leftarrow\end{matrix}$ syllable-initial consonant (cluster)
word-final consonant (cluster) $\begin{matrix}\not\Rightarrow\\ \not\Leftarrow\end{matrix}$ syllable-final consonant (cluster)

Another method that may be of use in determining the end of the coda and the beginning of the onset, i.e., the syllable boundary, is provided by the **sonority dispersion principle** proposed by Clements (1990), quoted in (10).

(10) **The Sonority Dispersion Principle (SDP)**

(a) The preferred initial demisyllable maximizes the dispersion in sonority.
(b) The preferred final demisyllable minimizes the dispersion in sonority.

An initial demisyllable is the first half of the syllable up to and including the vowel—with certain language specific differences in the case of long vowels and diphthongs—, a final demisyllable is the second half from and including the vowel; i.e., the onset with the (first half of the) nucleus and the (second half of the) nucleus with the coda, respectively. Sonority dispersion is maximized if the individual members of the demisyllable are evenly distributed on the sonority

[11] Counterexamples include [ɾ] and [ŋ] in English, as Péter Siptár (*voce*) points out. To explain them away, the first is a variant of [t] or [d], thus its status is not obvious, the special status of the second is copiously documented, see Gussmann (1998) for a recent discussion. In other words, these segments are positional (and these positions do not include word-initial position) variants of others.

[12] The only counterexamples are *rhythmic* and *logarithmic* for [ð] — both have forms, *rhythm* and *logarithm,* in which the [ð] and the [m] are not adjacent (both [-ðəm])—, and some other syncope created clusters like in *natural* [ˈnætʃrəl] for the affricates.

scale: in an initial demisyllable the first member being the least sonorous (an obstruent[13]), the last the most sonorous (a vowel) and if there is a further member between them then that should be a liquid. In the final demisyllable, sonority dispersion is minimized, that is, the best case is not to have a coda at all, or at least have very sonorous segments in it. The OMP is a derivate of the SDP: it is not only preferable not to have a coda, but also to have an onset and thereby a large — or at least some — sonority distance in the onset–nucleus sequence.

In the case of a string like *atla* the SDP prefers the syllabification *a.tla,* yet in many languages, including English or French, *at.la* is the accepted division, since *tl* is not encountered word-initially and — as already noted — the [t] behaves differently before [l] and [r]. The third logical possibility, *atl.a,* is the worst, it even violates the SSP, introduced in (7). What we end up with is a situation where in order to satisfy the OMP, the SDP has to be frustrated. One way out of this situation is to abandon the apparently self-evident hypothesis that superficial adjacency is evidence of adjacency at all levels.[14] Syntacticians have long noticed this fact,[15] for phonologists it still is not always obvious. Accepting the — let's call it — adjacency hypothesis makes it seem trivial to determine syllable structure simply by looking at the string of segments constituting the word. The price to pay is that we have to content ourselves with dispreferred syllable structures and contacts, on the one hand, and the excessive complexity and number that syllable types will exhibit, on the other. If we are not willing to pay this price, we have to allow some degree of abstraction — although it is controversial whether this is indeed a departure from the null hypothesis after all, as shown in section **1.2** —, dispensing with the view that adjacent segments are necessarily adjacent underlyingly. In this way, syllable structure can be radically simplified.

[13] Clements assumes a five-step sonority scale: obstruents < nasals < liquids < glides < vowels. He claims that the algorithm he gives for measuring sonority dispersion also works for more refined scales, but argues that such scales lose cross-linguistic generalizations and become too language specific.

[14] Miklós Törkenczy (*voce*) notes the intriguing fact that the opposite is not true: in the mainstream phonological literature it is often argued that superficial **non**-adjacency involves elements that are adjacent in the representation, in e.g., long-distance assimilation and dissimilation phenomena.

[15] For example, current syntax posits an empty category in the string *the man I want* ∅ *to go* but not in *I want to go* in order to explain, among other things, the impossibility of *wanna*-contraction in the first.

3. Empty nuclei in the skeleton

In this section I am going to introduce a train of thought that allows skeletal positions to remain empty, abandoning the adjacency hypothesis. Government Phonology (GP), especially Kaye et al. (1990), Kaye (1990) and Charette (1991), is one theory that uses empty vocalic positions, but is not unique in this respect, cf., for example, Anderson (1982), Spencer (1986), Burzio (1994), Siptár–Törkenczy (2000).[16]

One motivation for Kaye et al. (1990) to assume empty nuclei bears close resemblance to the impasse situation encountered above, the syllabification of *atla*. The claim is that any two consonants that are indeed adjacent are in a governing relationship with each other, i.e., one of them governs the other. The governing potential of specific consonants is determined by their melodic content:[17] some consonants are typically governors, others typically governees. As a result, if a consonant cluster xy is established as a coda x followed by an onset y—in which then y governs x—, the opposite, yx, will definitely not be the same type of cluster, coda–onset in this case, since that would require the previous governing relationship to be swapped, the governor y to now be governed by the governee x. This is deemed impossible, because codas must always be governed by the following onset—the theory claims.

Translated to our case, if *alta* is syllabified *al.ta*—and there is good reason to do that: having a small sonority distance in the nucleus–coda sequence and a great one in the onset–nucleus sequence, it perfectly matches the requirements of the SDP—, *atla* cannot be analysed as a coda–onset cluster too, i.e., **at.la*.[18] If we are also unable to squeeze both consonants into the onset (**a.tla*) or the coda (**atl.a*), there is no possible syllabification in a model that accepts the adjacency hypothesis. It would be desirable to say that the *t* of *atla* is an onset

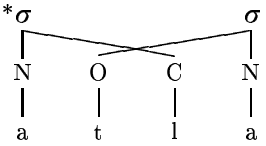
[16] It is interesting to note that hypothesizing empty consonantal positions is more obvious — and chronologically earlier (e.g., Selkirk–Vergnaud 1973; Clements–Keyser 1983) — than empty vocalic positions: the silence of the former is more straightforward than that of the latter.

[17] In some versions of the theory governing potential is a function of the charm value of the given segment (e.g., Kaye et al. 1985; 1990), but then charm is dependent on melodic content.

[18] Note that Clements's (1990) theory would allow this option, albeit as a highly marked and unpreferable syllable contact. By doing so, Clements is paving the way towards Optimality Theory, where "anything goes," constraints are more or less preferably violable (cf. Prince–Smolensky 1993).

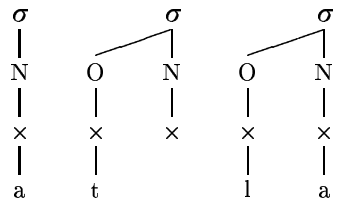
and the *l* a coda, since—as the SDP suggests—*t* is an ideal onset consonant, and *l* is okay for a coda. This would unfortunately lead to a violation of the constraint banning crossing lines as shown in (11), where σ denotes the syllable node, O, N and C should be obvious.

(11)



Allowing melodically empty skeletal positions into our theory offers a solution to this problem: we are now able to say that the two consonants are not adjacent underlyingly, there is an empty vocalic[19] position ($\emptyset$) between them. Thus we can have both consonants in separate onsets (*a.t∅.la*), in an onset and a coda (*a.t∅l.a,* this is a possible manifestation of the idea in (11)) or in separate codas (*at.∅l.a*), though the second option is a bit strange, the last one rather perverse and neither is favoured by the SDP. The two-onset representation is the most plausible, (12) shows this option syllabified with an empty skeletal position. The skeletal tier is now included since once we have empty positions on it the alphabetic symbols abbreviating melody cannot simultaneously represent skeletal positions anymore.

(12)



It is an interesting question to ask how the SDP would react to the syllabification *a.t∅.la*. The sonority of an unpronounced segment is undefined, therefore the sonority rise in the syllable *t∅* is indeterminable. Nonetheless, the absence of codas is of merit in the eyes of the SDP; onset maximization is fully performed.

There seems to be a difficulty with this solution. As we have seen in section **1.1,** the phonetic interpretation of melodically empty skeletal positions

[19] Of course, one might hypothesize an empty consonantal position between the two consonants but that would not bring him any closer to a viable analysis: hosting the extra C position is yet another pain in the neck.

is not obvious: it may be the most unmarked vocalic segment ([ə ɯ ɨ] or something similar) if dominated by a nuclear position, or the most unmarked consonantal segment (the identity of which is debatable and indeed debated in the literature) if dominated by a nonnuclear position, i.e., the onset or the coda. This means that the phonetic interpretation of the representation in (12) should be [atəla] or [atɯla], a pronunciation that would cause no debate in phonologist circles as regards its syllabification. If we are to maintain the results of section **1.1** and posit **unpronounced** empty positions simultaneously we have to claim that some melodically empty skeletal positions are pronounced, others are not. The theory must provide some means to predict the pronunciation or nonpronunciation of a skeletal position in each case. GP's solution is the formulation of the phonological **empty category principle,** of which I will here mention but one clause: "a melodically empty skeletal position remains unpronounced if properly governed [...]" (Kaye et al. 1990, 219). I am not going to present all the details of proper government at this point. Let it suffice that a vocalic position is properly governed if followed by one consonant and a pronounced vowel. It is in fact this vowel that is said to govern the one that precedes it, i.e., in the configuration V_1CV_2 V_2 properly govern V_1.

To conclude the discussion of empty positions, we may say that by positing empty nuclear positions in the skeleton the theory reduces the cases where consonants are syllabified into the coda position. This tendency is in line with the generally accepted view that onsets are to be preferred over codas in syllabification. One salient feature of GP is its affinity to turn generalizations that other theories look at as universal preference statements into unviolable constraints. This property distinguishes the approach quite radically from Optimality Theory, where any constraint is violable. In the case discussed above, the fact that an obstruent–liquid cluster is a dispreferred coda–onset cluster is tightened to the claim that it **is never** a coda–onset cluster. If one dares take this thought to its conclusion, the next question to ask is if codas exist at all, after all the optimal final demisyllable is one without a coda. We are going to proceed in this direction.

4. Does the coda exist?

What we have to examine is the arguments supporting the existence of the coda position. As it was already noted there is a sharp asymmetry between the two margins of the syllable, the onset and the coda. The most unmarked syllable type, available in all languages, is CV, i.e., one that contains an onset

but no coda. Furthermore, while in the unmarked case the onset is obligatory, it is the marked case to have a coda.

One of the reasons why codas are posited in the first place is the assumption that syllable boundaries and word boundaries coincide. If consonants are found at the right margin of words then they obviously occupy the right margin of a syllable. But, as we have seen, there is also phonological evidence which indicates that word-final consonants are not uncontroversially codas.

Codas also have explanational value in the formalization of stress rules. In languages with unfixed stress, rules are often sensitive to syllable weight. The usual case is that syllables with only a short vowel count as light (therefore usually unstressable), while syllables more fleshy than that—either closed by a consonant or containing a long vowel—are heavy (and attract stress). Positing a constituent, the rhyme, dominating the nucleus and the coda facilitates the definition of heaviness: syllables with rhymes containing one segment are light, those with multisegmental rhymes are heavy. Unfortunately, neither the branching of the rhyme, nor that of the nucleus may be held to be responsible for heaviness, all we can say is that one of the two must branch. Another problematic aspect of this approach to syllable weight is the fact that onsets (apart from very few and therefore suspect cases) do not contribute to it. One either stipulates that only the size of the rhyme is relevant or offers some theory that assigns weight, standardly referred to as mora, to the appropriate segments. However, even the latter option does no more than formalizing the observation that coda consonants do, while onset consonants do not influence the weight of a syllable, without explaining why this and not the opposite should be the case. The alternative to be discussed below fares better in both respects: it explains why both closed and long-vowelled syllables are heavy and why onsets do not count.

The minimal word phenomenon, that constrains the size of lexical words in a number of languages as diverse as English, Hungarian, Beijing Mandarin, Khalkha Mongolian and Turkish, also depends on a plausible formulation of heavy syllables. The observation is that in these languages a lexical word cannot be a single light syllable, it must minimally either be a heavy syllable or two light syllables. In monosyllables the necessary weight is provided either by the length of the vowel or a final, allegedly coda, consonant.

One of the standard arguments for constituenthood in the subsyllabic domain is the existence of phonotactic constraints. For instance, the very strict restrictions holding between the two members of a branching onset — disregarding sC clusters now—may be seen as evidence that such consonants form

a constituent. Similarly, in nuclei the types of attested vowel clusters, i.e., diphthongs and long vowels, is restricted to a small subset of all the possibilities. As opposed to this, very few qualitative phonotactic constraints apply to VC clusters, that is, within the rhyme. Where we do encounter phonotactic constraints between consonants is in intervocalic and word-final clusters. Intervocalic clusters of the type [nt], [mp] are rather unanimously analysed as heterosyllabic, coda–onset clusters. Yet, it is not usual to consider these clusters as members of the same syllabic constituent. Therefore, we may conclude that the existence of some phonotactic constraint between two segments does not necessarily imply that they share their host constituent.[20]

Recall that different syllabifications were suggested for *al.ta* and *a.tØ.la,* as shown here. If we accept that some intervocalic consonant clusters are coda–onset clusters, while others are onset–onset clusters containing an empty nucleus between them, our theory becomes indeterminate. Nothing excludes the syllabification *a.lØ.ta*: there will be no way of knowing whether a cluster that satisfies the criteria for coda–onset clusters is to be analysed as such or as an onset–onset cluster that accidentally happens to contain consonants which would also make a coda–onset cluster.[21]

To summarize: the theoretical status of the coda is strongly challenged. It is an outcast in markedness universals: onsets may even be obligatory but are never impossible in languages, codas are never obligatory and may even be impossible. Though positing a coda position seems to help in distinguishing heavy and light syllables, there are serious problems with the formulation. Finally, the possibility of analysing some clusters both as coda–onset and as onset–onset clusters loosens the theoretical tightness of the framework.

5. Without codas

Making a constraint out of the preference of the Sonority Dispersion Principle, one may claim that all syllables have an onset and none have a coda

[20] Notice that this conclusion also threatens the status of the onset as a constituent.

[21] Of course, phenomena like closed syllable shortening or heaviness for stress assignment may tilt the balance in this or that direction, but only in case C.C and CØ.C are treated differently in the analysis of these phenomena.

(cf. Lowenstamm 1996).[22] Setting aside for the time being the possibility of having more than one consonant in a single onset constituent, this means that whenever we find a consonant that is not followed by a vowel it must be followed by an empty nucleus — to make it, at least theoretically, an onset.

It is important to bear in mind that the question whether something is in coda position or not is not an empirical one; this property does not in itself have any physical correlate. The rationale of positing a coda position is to unify the contexts that pattern together in certain phonological phenomena. If these contexts may be unified by other means there is no strong argument for keeping codas in the theoretical vocabulary, unless one needs them for descriptive purposes, as a dated but useful term, similarly to the way a syntactician would refer to S(entence)s even after showing that they are I(nflection)P(hrase)s or C(omplementizer)P(hrase)s. This is the sense the word coda will be used hereafter. Actually, if codas do not have a theoretical status then it does not make much sense to talk about onsets either, even if — what is kept in benign ignorance — they are imagined to be potentially branching; the onset constituent becomes **the** consonantal domain, as opposed to the nucleus, which is, and always was, the vocalic domain. What are thus left of syllabic constituents is a consonantal and a vocalic constituent.

Having stripped syllabic constituency so brutally, one might as well take the last move and claim that neither the consonantal, nor the vocalic constituent ever branches, that is, the skeleton contains a strict alternation of consonantal and vocalic **positions**; this is exactly what Lowenstamm (1996) does. Arguments for this final step do not readily offer themselves, some motivations will, nevertheless, be pointed out in the next section. Even without explicitly arguing against branching nuclei and branching onsets, formal simplicity is a criterion that opts for nonbranching constituents. Recall (from section **1.2**), starting out from the simplest syllable inventory, containing exclusively CV, it may be possible to resist any extension of that set by imagining one or the other side of the CV syllable to be empty.

[22] Note that GP theorists regularly argue that the coda **consituent** is nonexistent in their theory. There still is a coda **position** in GP, since rhymes may branch, what the right branch dominates is the coda as opposed to the other two consonantal positions that are in the onset (which may also be branching), i.e., the term coda is a shorthand for the "postnuclear rhymal complement". My aim above, however, was to show that as regards their skeletal status all consonantal positions are equal, the only difference is whether a consonantal position is followed by an interpreted vocalic position or not.

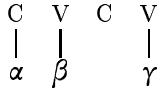
In this section we are going to see the way the CVCV framework handles some coda-related phenomena discussed in section **4.**

5.1. Heavy versus light syllables

In a theory comprising only CV pairs to represent syllable structure, a light syllable will be made up of one such pair, while a heavy syllable will contain two of them as shown in (13), where the Greek letters stand for any, potentially identical, melodic material (if identical, the two symbols are merged in (13b)):

(13) (a) LIGHT SYLLABLE

(b) HEAVY SYLLABLE TYPE I



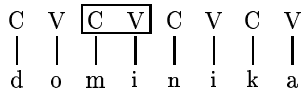
(c) HEAVY SYLLABLE TYPE II

The advantages of the representations in (13) are the following: (i) the formulation of what constitutes a heavy syllable is much more elegant than if we were using the coda, all that has to be distinguished is one vs. two CV pairs, as opposed to statements like "**either** the nucleus **or** the rhyme is branching." (ii) We get an explanation of why onsets do not contribute to syllable weight: paradoxically rhymes do not contribute either, the question itself loses its significance. All we need for a heavy syllable is two pronounced CV pairs, that is two CV pairs both containing some melodic material.[23] The onset of such a syllable is the C of the first pair but whether it is filled or not is immaterial, since its V will be filled, that is why it is taken to be a syllable in the traditional approach. In a sense then a CV slice of the skeleton is the equivalent of the mora in frameworks that measure syllable weight by that means, but unlike moraic frameworks we get a nonstipulative account for the lack of onset weight. The CVCV approach, however, still owes an explanation for why word-final consonants often fail to contribute to syllable weight.

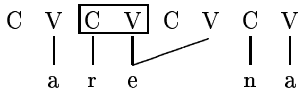
[23] In a subset of the languages distinguishing heavy and light syllables only (C)VV, but not (C)VC counts as heavy. In such languages it is apparently the pronunciation of the V part of the CV unit that is taken into account. Crucially, no language takes (C)VC to be heavy to the exclusion of (C)VV. This falls out neatly in the CV model: in such a language the interpretation of the V should matter in the first, but that of the C in the second CV pair. With rhymes and nuclei it is not so evident why there exist no languages where the branching of the rhyme would make a syllable heavy, that of the nucleus would not.

Note also that in languages like Latin or English, where stress rules typically take the form "if the penult is heavy stress it, if it is light stress the antepenult," there is room for a simplified formulation: e.g., stress the third last CV pair, boxed in the Latin words illustrating the rule in (14):[24]

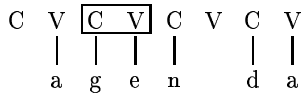
(14) (a) *domínica* 'lord adj.fem.'



(b) *aréna* 'sand'



(c) *agénda* 'things to do'



It is rather complicated to capture the minimal word constraint, which limits the size of content words to two moras at least, in the traditional GP framework. Since word-final consonants are claimed to be onsets followed by an empty nuclear position, one has to say that either the nucleus of the only syllable of the minimal word must branch or the word must contain two onset–rhyme sequences.[25] The CVCV formulation is trivial: the minimal word contains two CV pairs (perhaps in order to be stressable).

5.2. Compensatory lengthening

Compensatory lengthening is another phenomenon that appears to call for coda positions in representations. After the total lenition of a consonant in a weak prosodic position the loss is made up for by the propagation of either the preceding vocalic or the following consonantal material, for example, the reconstructed Greek form *[esmi] is realized in Classical Attic as [e:mi] 'I am', while Aeolic has [em:i]. The latter event, where the place of a consonant is taken up by another consonant, is rather easy to handle for both theories. Vowel lengthening on the other hand happens again in violation of structure preservation in the coda approach: what used to be a consonantal position,

[24] The situation is not as neat as depicted here. Difficulties arise in the following cases: the third last CV pair may contain an empty V position, stress in this case appearing on the fourth (*fórmula* 'rule'), word-final long vowels count as if short (*fáci-o* 'make') and word-final consonants do not count (*ácidus* 'sour').

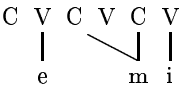
[25] An alternative, slightly less disjunctive but no more plausible formulation is the following: a minimal word must contain two slots dominated by a nuclear node.

coda, is lost and a vocalic, nuclear position appears instead. The model offered by the CVCV approach does not face such problems: the vacation of the C position by the loss of [s] either opens the way for the following C position to occupy it (15c) or removes the obstacle that has prevented the preceding V from taking it (15b). Which of the two strategies is applied can be predicted on a language—here dialect—specific basis: it looks very much like a parameter.

(15) (a) Reconstr. *[esmi]

(b) Attic [e:mi]

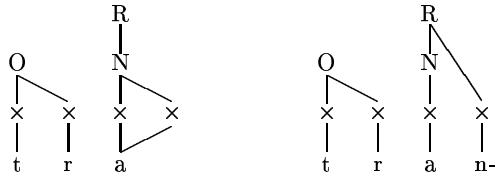
(c) Aeolic [em:i]



6. Against constituency

All three syllabic constituents, the onset, the rhyme and the nucleus, are imagined to be potentially branching by GP theorists and most mainstream researchers alike (for the latter, even the coda is potentially branching). In the former, more restrictive, framework a maximal syllable has one of the structures depicted in (16).

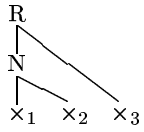
(16)



In a GP-like framework the nonexistence of codas amounts to the claim that the rhyme constituent does not branch, and if it does not branch it is not a syllabic constituent—it shares the fate the coda has suffered earlier. It is in fact a felicitous development of the theory to have got rid of the rhyme constituent, which is a nuisance in more than one respect. For one thing, the rhyme is the only syllabic constituent that does not dominate exclusively skeletal slots but also another syllabic constituent, the nucleus. This fact has led to uncertainty about whether and why a branching nucleus may occur in a branching rhyme. In one view (that of, e.g., Kaye et al. 1990) it cannot, because in such a constituent—shown in (17) for those with a visual disposition—no head can be assigned. The two constraints that head and dependent must be adjacent and that their relationship is unidirectional destroys the hopes

of all three possible candidates: the first is not adjacent to the third, the second would have one dependend on the left, one on the right, the third is not adjacent to the first.

(17)



However, when forced to accept the structure in (17), as Harris (1994, 68f, 76f, 82f) is in order to cater for words like *dainty, easter, b*[ɑ:]*sket, saint, post, wild*[26] etc., one may seek refuge in the idea that the head of the rhyme is not on the skeleton, but it is the nuclear node itself. It is not unreasonable to look for the head of a constituent among its daughters, after all. If the rhyme should no more exist, the dilemma also perishes.[27]

If syllable heaviness is not (merely) a function of the number of skeletal positions in the rhyme, representing long vowels and diphthongs by branching nuclei becomes much less obvious. The wish to keep syllables together as onset–rhyme sequences is also in vain if codas are let loose. The "phonetic unity" of long vowels—whatever that should mean—is not a strong argument: a long vowel is just as much a unit as a long consonant, the latter is, nevertheless, a coda–onset cluster, thus not one constituent, in most frameworks. (Not to mention the fact that without codas long consonants hopelessly become C∅C clusters.)

The claim that "all feet are minimally binary and that the word in many languages must consist minimally of a foot" (made by McCarthy–Prince (1986) and quoted by Harris (1997)) suggests that just as [tata] and [tat] (the latter obviously *tat*∅) are binary feet—hence qualify for minimal words in the languages concerned—, [ta:] must also somehow make a binary foot. The number of vocalic positions involved in the string is undisputedly two, but the immediate constituens of foot nodes are usually either syllable nodes or, in their absence, nuclei. Only by analysing the [a:] as two nuclei, i.e., N∅N, do we obtain a binary foot, thus satisfying the minimal limit on word size. Note that the same argument was already brought up in section **5.1** cast in a slightly different form.

[26] Though Harris does allow type (17) superheavy rhymes (1994, 69, 83), he also has to strictly limit their occurrence to ones with coronal and very few other consonant clusters.

[27] The problem of superheavy rhymes unfortunately does not disappear with this move.

Kaye (1985, 290f) and Lowenstamm–Kaye (1985–1986, 99f) claim that there is an implicational relationship between branching rhymes and branching onsets. The observation, called the **rhyme-dominant principle,** is that languages having branching onsets invariably have branching rhymes (i.e., closed syllables), while the opposite is not true, languages with branching rhymes may or may not have branching onsets. To put it in other words, branching onsets are more marked than closed syllables.[28] Whether this calls for the abandonment of the hypothesis that onsets, or rather, the consonantal constituent, may branch is not fully obvious. The question basically boils down to the markedness of branching constituents and that of empty skeletal positions.[29] Theoretical uniformity requires either the retention of constituency throughout the whole range of syllabic constituents or their total abandonment, which means positing a C∅C structure to branching onsets as well.

One last consideration that is relevant for the total rejection of syllabic constituency is that if the skeleton contains strictly alternating C and V positions — no adjacent Cs and no adjacent Vs — then it is trivial to parse a phonological string, provided the listener can distinguish consonants and vowels: whenever he encounters two instances of the same category an empty position of the opposite type must be inserted between them, while two different categories will be adjacent.[30] This advantage is not available in a system where at some points one may assume two adjacent Cs or Vs, at another they will be separated by an empty category. Consequently, allowing empty skeletal positions into phonological representations concludes to the hypothesis that the phonological skeleton must be made up of strictly alternating Cs and Vs.

[28] Lowenstamm–Kaye (1985–1986, 111) also claim that long vowels are more marked than closed syllables, that is, there exist no languages with long vowels and/or heavy diphthongs and only open syllables. If one accepts the proposal suggested here, this is a further argument for the V∅V representation of long vowels.

[29] There is a third possibility, branching onsets could be considered to be contour segments (cf. Steriade 1993; Rennison 1998). This idea includes large scale reshuffling of segmental representations, space limitations inhibit further discussion here.

[30] This is only true if two adjacent empty positions are not allowed, two instances of the opposing categories may or may not be adjacent (C∅∅V or V∅∅C).

7. Conclusion

In this paper I collect evidence for a rather impoverished model of prosodic structure, one that involves strictly alternating consonantal and vocalic positions. These two skeletal primes are not incorporated in further structures, thus the traditional notions syllable and syllabic constituent are dispensed with, as well as the need for any dispute about hierarchic vs. flat syllable structure and moraic vs. other weight metrics. Whether their functions can exhaustively be taken over by the simplistic organization proposed is beyond the scope of the present paper, but indications of a positive answer are suggested by recent work in the area (e.g., Harris 1997, Ségéral–Scheer 1999, Dienes–Szigetvári 1999).

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