**Recursive syllable structure in RCVP**

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## 1 Introduction

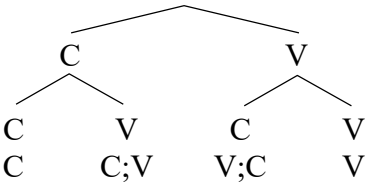
In van der Hulst (2010) I suggested that a case can be made for recursion in syllable structure, a proposal that develops a suggestion in Smith (1999, 2003) and other work. This idea runs counter to the usual statement that there there are no 'syllables inside syllables', or that phonology at large is not recursive, except where it copies recursive syntactic structure. In van der Hulst (2010, 2020) I focus on recursion in the rhyme of the syllable, which allows embedded syllables, to capture trochaic and dactylic feet. In this article, I explore recursion in the onset, which will be justified with reference to 'excessive' consonant clusters that exceed the option of maximally having an obstruent followed by a sonorant consonant. I show that a dependency approach does not require the adoption of empty nuclei to accommodate excessive clusters, while it does explain the maximal complexity of such clusters.

## 2 Syllable structure in RCVP

### 2.1 Four core positions

I will briefly discuss the way in which RCVP represents 'core' syllable structure (based on van der Hulst 2020; see van der Hulst, to appear for a synopsis). Faithful to the basic premise of RCVP, the syllable itself is a combination of the C and V units, which, if no further splitting applies, delivers the 'strict' CV syllable structure that all languages have. If languages exceed this minimal CV syllable, this results from splitting the C and/or V unit, which produces binary branching onsets and rhymes, respectively:

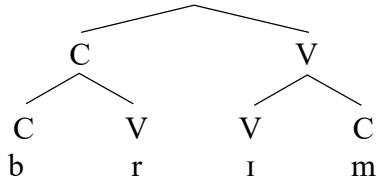
(1) a.




b. C C;V V;C V

While the four-way division as such implies no linearization (see section 2.3), when combined into a syllable structure, linear sequencing will be dictated by some version of the well-known 'Sonority Sequencing Generalisation', according to which the sonority level rises towards the nucleus and then descends:

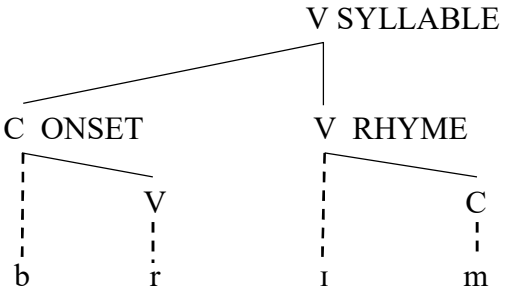
(2) a. syllabic positions, linearized




b.


A proper dependency representation of a syllable structure that contains all four syllabic categories is as follows (adding convenient unit labels for each construction and for each of the four segmental positions, although the labels have no formal status: they are just used for convenience when I refer to syllabic units):

(3) a.




b. EDGE BRIDGE NUCLEUS CODA

c. C C;V V V;C

I assume a strict dependency model, which means that there is no 'constituent structure'.[1]

In 'classical' Government Phonology (Kaye, Lowenstamm and Vergnaud 1990), it was assumed that a syllable with four positions represents the universally maximal expansion of a syllable that can occur freely (i.e. word-internally, as well as at the word beginning and end, although the edges may allow 'extra segments'[2]). This would once more seem to indicate that there is, in fact, a maximal two-way split that universally limits the degree of complexity within each domain, whether a segment-internal element class or a structural unit like the syllable.[3] Whereas element groups represent paradigmatic dimensions and the syllables represent the syntagmatic dimension, the structural possibilities are the same, indeed structurally analogous. It is significant that both dimensions, whether paradigmatic or syntagmatic, are subject to the same system of categorisation as captured by the C/V syntax of RCVP.

[1]I here ignore the claim in GP that the syllable unit as such is not required. Rather, in GP there is a lateral licensing relation between the onset and the rhyme unit which requires them to always occur together. Perhaps there is a resemblance between seeing all syntagmatic relation in terms of dependency and seeing them in terms of lateral licensing, as discussed by Scheer (2013), among others.

[2] These extra segments of course need an account. GP opts for allowing extra syllables with empty nuclei. I propose an alternative account in section 3.3.

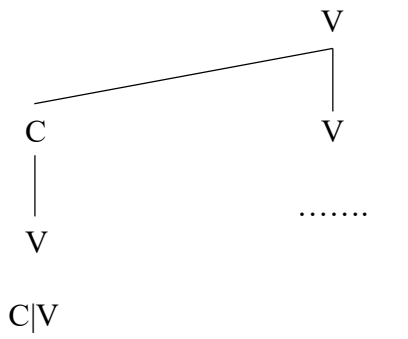
[3]Here I will not discuss the RCVP theory of segmental structure; see van der Hulst (2020) for a full account and van der Hulst (to appear) for a summary.

The four syllabic positions are very restricted in terms of which segment types can occupy them. In fact, the C/V encoding of the syllabic positions defines the major classes of the segments that they allow. The onset head (C) only allows obstruents, while the rhyme head (V) only allows vowels. The two dependent positions (C;V, V;C) are reserved for sonorant consonants. It is interesting that the C/V structure for the onset dependent is C;V, while the structure for the coda is V;C. This suggests that the onset dependent is 'stronger', that is, more C-like than the coda position, which comes out as weaker (and more 'sonorant'). That sonorant consonants are phonetically stronger in the onset than the rhyme is empirically shown by the difference, for example in English, between liquids in the onset and in the coda, where the latter have a much weaker constriction. The difference between the bridge and the coda position, apart from having an effect on the phonetic implementation of sonorant consonants, also provides a basis for the fact the latter often only allow a subset of sonorant consonants, such as the liquid. That said, the coda position can also be limited to a subset, such as only nasals; see van der Hulst (2020: section 4.3.3).[4]

## 2.2 Sonorant onsets and syllabic sonorants

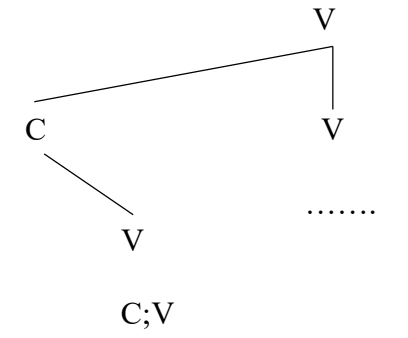
Let us now turn to the obvious point that it is not the case that only obstruents can appear in the edge position. Sonorant consonants can also form onsets by themselves and in that case they occupy the edge position. Likewise, we must be able to represent syllabic consonants, which means that the nucleus must be able to contain consonantal segments. To address these necessities, in (4a) and (4b) I propose two different structures for sonorant consonants when they occur as onset heads and as onset dependents:

(4) a.




sonorant consonant as onset head)

b.



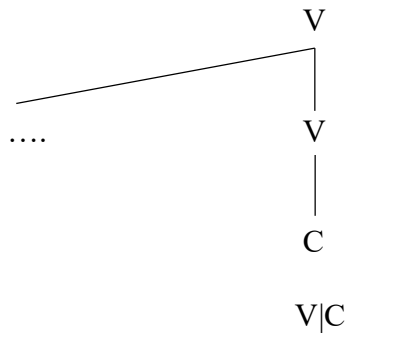

sonorant consonants as onset dependent

[4] For a discussion of the representation of long vowels, diphthongs and geminates, see van der Hulst (2020, § 4.5).

In both cases V is dependent on C and yet the syllabic position will reflect the difference between V being subjoined or adjoined to C. In (4a) I represent the former structure notationally as C|V, indicating that V is subjoined to C, rather than being adjoined as in (4b). The essential difference between X|Y and X;Y is that the latter leads to a linear order of both nodes, while the former does not.

Likewise, there are two different structures for syllabic sonorant consonants and coda sonorant consonants:

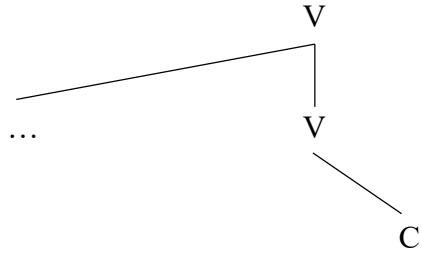
(5) a.




sonorant consonant as rhyme head, i.e. 'syllabic sonorant consonant'

V|C

b.




sonorant consonant as onset dependent

V;C

The distinction between subjunction and adjunction has already been used in the representation of the syllable as a whole (see 3), in which the V node is subjoined to itself so that the onset and the coda can be dependents at two different levels.[5] I refer to Böhm (2018) for a discussion of the distinction between adjunction and subjunction and the legitimacy of both in a dependency approach.[6]

We have to recognise that some languages may impose restrictions that narrow down even this restricted set of options for each syllabic position. Indeed, there are languages that disallow high-sonority consonants (specifically liquids and glides) in the onset head position; see Gordon (2016), Smith (2002) and Flack (2007). If, for example, only nasals are allowed as onset heads, we have to specify that only sonorant consonants that exhaustively contain C in their *manner* class are allowed, in other words, the most C-like sonorant consonants.

[5] I will also invoke this distinction in § 3.3 where I discuss recursion in onset structure.

[6] In the syntactic plane, Anderson (2011) uses the subjunction structure to represent category conversion in the lexicon, e.g. from noun to verb or vice versa.

## 2.3 Linear order in the lexicon is limited

Anderson (1987a) questions the necessity of specifying the linear order of segments in the lexicon, if segments are organized in a syllabic structure. The argument is that an onset that groups an obstruent and a sonorant consonant will necessarily order these two consonants in that order if we assume that linear order can be predicted from the Sonority Sequencing Generalisation. The same point applies to segments that form a rhyme. Golston & van der Hulst (1999) accept this point, stating that if lexical representations are syllabified, the linear order of segments is predictable. These authors cite various arguments for why syllable structure is present in lexical representations, both linguistic and psycholinguistic. In the RCVP model, I will therefore also assume that segments within a syllabic unit are not linearly ordered.[7] The linear order of onset and rhyme can also be predicted given that the rhyme contains the sonority peak. Formally, the way in which the syllabic distribution of segments is stored amounts to specifying the syllabic affiliation for each segment in terms of a syllabic C/V specification and the unordered grouping of segments into onsets rhyme and syllable units:

(6)

| C | C;V | V | V;C |
|---|---|---|---|
| (( b | r ) | ( ɪ | m )) |

Given that major class distinctions are interpretations of syllabic positions and given that segments in the lexicon are syllabified – meaning they come with a piece of syllable structure – there is no need for an independent layer of major class specifications; the piece of syllabic structure that segments 'wear on their sleeves' *is* the major class specification. In the present framework, it does not make sense to think of the syllabic specification as being specified 'in the root node' of segments (as proposed in McCarthy 1988), or elsewhere. Given that segment-internal manner specifications are the head of the segmental structure, it will be those specifications that are projected upwards and will be visible on the root node of the segmental structure, so that they can interact directly with the syllabic affiliation specification. Thus, the syllabic specification is independent of the segmental structure and one can think of the metaphor 'wearing on their sleeve' as referring to an association relation.

(7)

| C | C;V | V | V;C | (syllabic affiliation) |
|---|---|---|---|---|
| : | : | : | : | |
| b | r | ɪ | m | (segmental structure) |

In RCVP, in conclusion, syllable structure is not a projection of segmental structure. Rather, it is specified on a separate 'tier' in association with the segmental structure.

## 2.4 Empirical issues

The proposal in the previous section makes very strong predictions about the maximal complexity of syllables and which segment types can occur in syllabic positions. Both onset and

[7] I will leave open here whether we can extend the elimination of linear order above the level of the syllable, although it is easy to see that syllables forming a foot can also be ordered, given that the foot type is fixed for the language as a whole.

rhyme can be maximally binary branching. In addition, we disallow onsets consisting of two obstruents, two sonorant consonants and sonorant consonant followed by an obstruent. We also disallow obstruents to function as nuclei and as codas. A similarly strict view was adopted by proponents of 'classical' GP. But this approach obviously faces a host of empirical problems.

For example, this position requires a reconsideration of so-called syllabic obstruents in Tashlhiyt Berber (see Dell & Elmedlaoui (2002)) and other languages (see Bell (1978)). It also needs to deal with the fact that in languages such as English and Dutch obstruents would appear to occur in codas almost as freely as sonorant consonants. Finally, consideration should be given to numerous cases in which consonant clusters in apparent onsets are not a sequence of an obstruent followed by a sonorant consonant, but two obstruents (Morelli (1999) and Kreitman (2008)), or cases in which the number of onset consonants exceeds two, as, Polish (Cyran and Gussman1999) and Georgian (Toft 1999; Butskhrikidze 2002; Ritter 2006)

Closer to home (for me at least), in English and Dutch, the left edge can have triconsonantal structures of a limited variety. They have to start with [s] followed by an obstruent + liquid cluster (see Trommelen (1983); van der Hulst (1984); Fudge (1987)). On the right edge, we find so-called superheavy rhymes containing a tense vowel followed by a consonant, or a lax vowel followed by two consonants.[8]Classical GP deals with such problematic cases by postulating empty nuclei, but van der Hulst (2020) argues against the use of empty structural positions (both segment-internally, such as 'empty class nodes', and in syllabic structure). In the following section, I will propose solutions for these types of empirical issues which will draw on allowing recursivity in onset structure. Unfortunately, I will not be able to offer detailed analyses for all of them.

## 3 Recursive syllable structure

### 3.1 Previous views

In van der Hulst (2020) I discuss the possibility of recursion in syllable structure, here understood as the possibility of embedding syllables inside syllables; that is, self-embedding tail recursion. A commonly held view in theoretical linguistics is that the formal organisation of phonology is fundamentally different from that of syntax, one manifestation of this idea being that recursion does not exist in phonology, except where phrasal phonology 'copies' recursive syntactic structure to some extent.

> Recursion consists of embedding a constituent in a constituent of the same type, for example a relative clause inside a relative clause […]. This does not exist in phonological structure: a syllable, for instance, cannot be embedded in another syllable. (Pinker & Jackendoff (2005: 10))

> […] syllabic structure is devoid of anything resembling recursion. (Bickerton 2000)

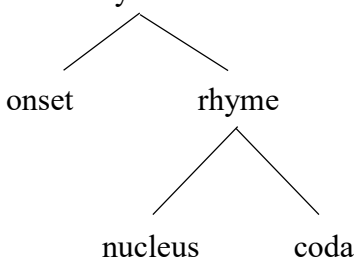
It should be noted that discussions about phonological structure and recursion are always carried out in a constituency-based approach. I have adopted a dependency approach which does not

[8] In English and Dutch, a further word-final syllabic unit (called the 'appendix') is possible. I will not discuss this unit, an additional rhymal adjunction, here (see Fudge (1987); van der Hulst (1984)).

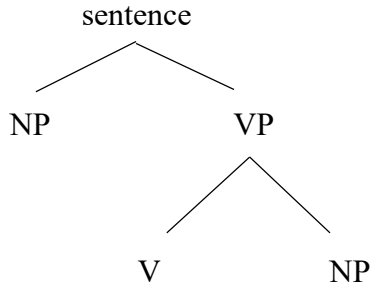
involve constituency. Nevertheless, it seems to me that the issue of recursion can also be addressed in a dependency approach.

It is well known that several linguists have pushed for structural analogies between syllable structure and sentence or phrasal structure (Kuryłowicz (1947); Pike & Pike (1947); Fudge (1987)):

(8) a.




b.




More recent claims to the same effect can be found in Levin (1985), Carstairs-McCarthy (1999) and Völtz (1999), among others. Whatever the merit of these parallels, no mention is made in these works of a potential further parallelism that would involve recursion. Most writers, while acknowledging that phonotactic structure is constituency-based (and referring to an X-bar(ish) organisation of syllables), propose that phonological (often called 'prosodic') constituency is 'strictly layered', which means that no constituent contains a constituent of the same type. This explicitly bars (self-embedding) recursion. With reference to 'higher' phonological/prosodic structure, recursion *has* been recognised, but here it is then said to reflect the recursive structure of syntax, at least to some extent (Ladd (2008); Wagner (2005); van der Hulst (2010); Hunyadi (2010)).[9] Limiting recursion in phonology to units that have morphosyntactic structure is tantamount to saying that no recursion will be found *within* morphemes (or simplex words), where whatever structure exists cannot be a mapping from morphosyntactic structure. A recent collection of studies (Backley and Nasukawa 2020), however, tackles the question of morpheme-internal recursion head on. In this volume den Dikken & van der Hulst (2020) offer an extensive demonstration of parallels between morpheme-internal phonological and syntactic structure.

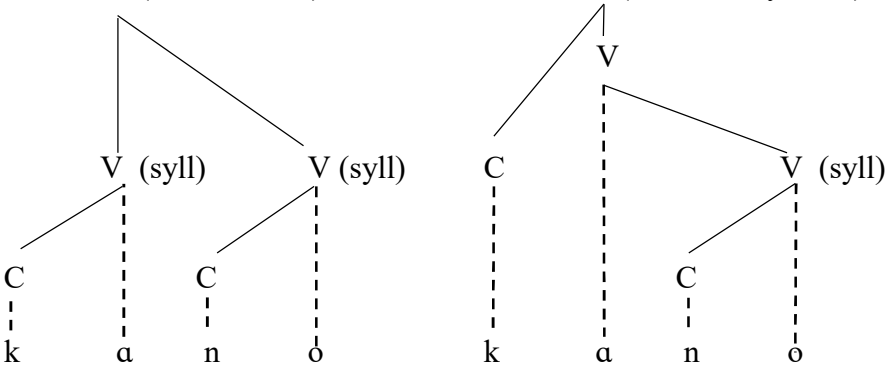
However, some phonologists – whose proposals differ in several ways that will not concern us here – have argued that syllable structure can display recursion (Smith (1999, 2003) Garcia Bellido (2005); van de Weijer & Zhang (2008); van der Hulst (2010)). The present article builds on van der Hulst (2010).

The point of departure is the syllabic model that was introduced in (3). The crucial idea in van der Hulst (2010) is that the coda position can form an entire syllable, making the coda the recursive node in syllable structure, just like the complement position in an X-bar-type organisation. Adopting the C/V dependency notation, the proposal in van der Hulst (2010) is that the structure for the traditional notion is a trochaic foot in (9a) can be recast as the structure in (9b) with significant explanatory gain. This is illustrated with the Dutch word *káno* 'canoe':[10]

[9] The claim of strict layering which prevents recursion was 'officially' abandoned in later work in prosodic phonology, albeit that the driving force behind recursive structures in prosody is still morphosyntax; see Selkirk (2011).

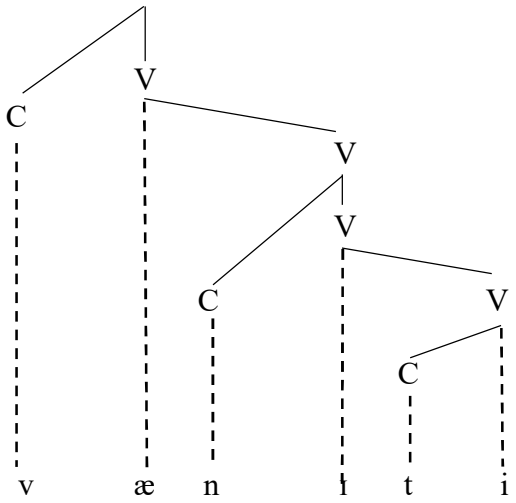
[10] The representation of both syllables requires a V node in (9a), which seemingly goes against the expectation that V heads take C dependents, and vice versa. The same issue arises in (9b). I address this issue below.

(9) a. V (trochaic foot) b. V (recursive syllable)




The embedding of syllables inside syllables does not have to stop here. A full structure of a so-called dactylic 'ternary foot', sometimes referred to as a 'superfoot' (as in English *vanity*), displays degree-2 embedding.

(10) V (recursive syllable, 2 degrees)




This structure is a perfectly legitimate object also in, for example, English *Winnipesaukee*, *hippopotamus*. An interesting consequence of this proposal is that it is now immediately clear why in poetic rhyme the initial onset is ignored, but not the second (or indeed the third, in forms like *sanity ~ vanity*). The initial consonant of such structures is external to the whole sequence that forms the rhyming unit in the proposal made here. The recursive structures capture the special position of the initial onset, as opposed to the other more deeply embedded onsets (which must be identical). In the structures proposed here the rhyming subpart of the string forms a unit, which is not the case in a traditional foot structure in which all syllables are separate units, as in (9a).

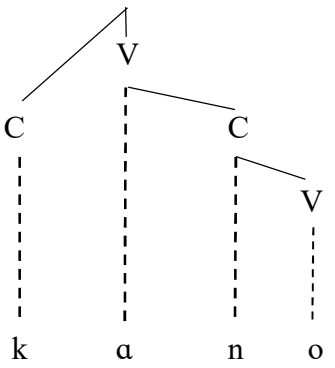
### 3.2 Recursive rhymes revisited

This proposal in (9b) and (10) faces two problems that went unnoticed in van der Hulst (2010). Firstly, the recursive node (the coda) is a 'bare' C position in a 'closed' syllable that has no

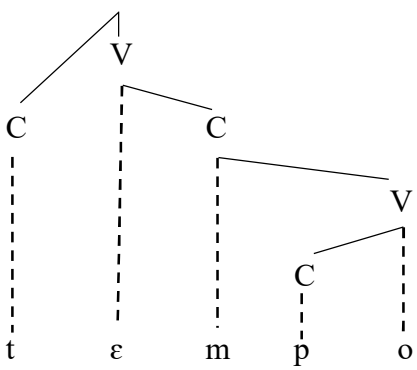
embedded syllable, while it seemingly must be a V position, when the coda is an embedded syllable. The second problem is that the matrix syllable can itself be a 'closed syllable', as in a word like [tɛmpo] (in either English or Dutch), which would seem to imply 'double occupancy' of the coda position.

To solve both problems, I propose in van der Hulst (2020, section 3.2.5) that the embedded syllable is the 'complement' of the C node in the case of [tɛmpo] (as in 11b), while it is *subjoined* to the C node in the absence of a coda consonant:

(11) a. V ('foot')



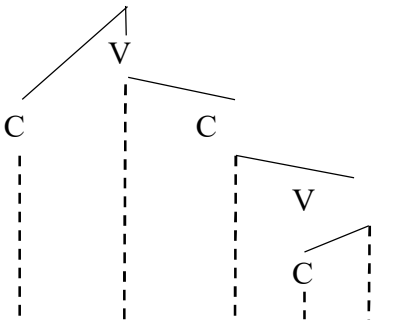

b. V ('foot')



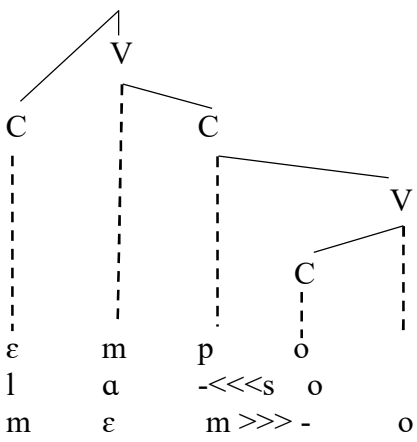

The embedded syllable is thus a C-type syllable, which accounts for its less prominent status in comparison to the head matrix syllable.[11]

Here I consider an alternative for (11a), while adding some further examples for (11b):

(12) a. V ('foot')




b. V ('foot')

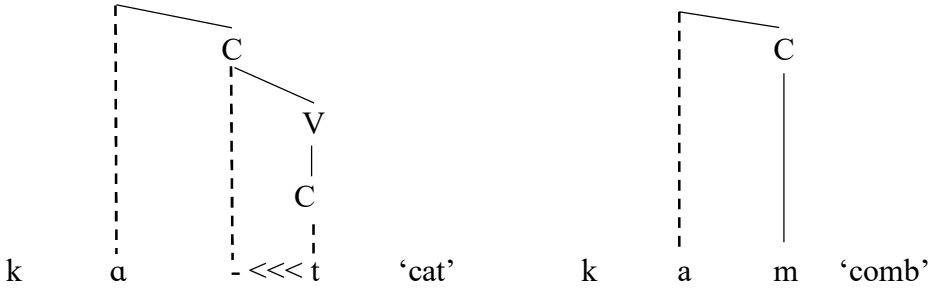



In (12a), the '>>>' indicate 'virtual gemination of the 'long' vowel. Under (12b) I also added the examples *lasso* and *menno*, which both have a virtual geminate for the so-called 'ambisyllabic' consonant (as proposed in van der Hulst (1985, 2003), albeit with different headedness. While the coda position in (3) calls for sonorant consonants, it was noted in section 2.4 that in

[11] Several other 'solutions' to the problem of double occupancy are discussed and rejected in den Dikken & van der Hulst (2020), which explore a somewhat different development of van der Hulst (2010). This article proposes to 'enlighten' phonology with the introduction of a parallel to the syntactic notion of 'light *v*', an idea that is not adopted here.

languages such as Dutch and English, obstruents can also make an appearance in a rhyme headed by a lax vowel. But if the syllabic position encodes the major class of segments, then the coda position simply cannot dominate an obstruent. I therefore locate the obstruent as an onset within the embedded syllable which produces a right-headed virtual geminate (even in word-final position):

(13) a. b.




When a lax vowel is followed by a sonorant consonant, this consonant can occupy the coda position. When there is a following vowel this creates a left-headed virtual geminate, as shown in (12b). In van der Hulst (2008) it is shown that diminutive allomorphy in Dutch is different for syllables with a lax vowel ending in a sonorant consonant or in an obstruent: *kat**je*** vs. *kamm**etje***, with the syllable ending in a sonorant taking the so-called long form *-etje*; see van der Hulst (2008: 1295) for details.

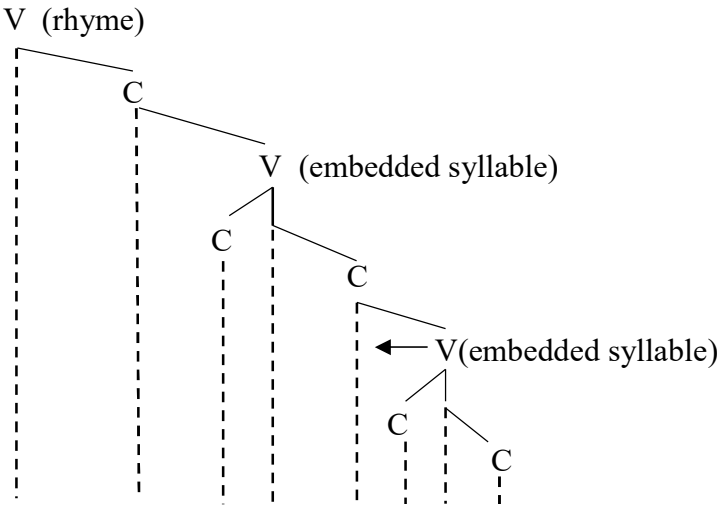
The difference between the stressed vowel in *kano* and *lasso* is that the former is a tense [a], which can occur in an 'open syllable', whereas the latter is a lax [ɛ], which requires a closing consonant which is the left half of a virtual geminate. With respect to stress, tense vowels behave as light, whereas lax vowels (occurring in a close syllable) are heavy; see van der Hulst (1984).

We can extend the degree of embedding and accommodate more cases, all with initial stress. The following list of Dutch words is representative of the various syllable structures that need an account:

(14)

| | | |
|---|---|---|
| a. | lasso | 'lasso' |
| b. | menno | (proper name) |
| c. | kano | 'canoe' |
| d. | tempo | 'tempo' |
| e. | la | 'drawer' |
| f. | lam | 'lamb' |
| g. | raam | 'window' |
| h. | sambal | 'Indonesian spice' |
| i. | dominee | 'minister' |
| j. | almanak | 'almanac |
| k. | atlas | 'atlas' |
| l. | spelonk | 'grotto' |
| m. | grotesk | 'grotesque' |

(15)




| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| a. | l | ɑ | - | <<< | s | o | | | | (virtual right-headed c:) |
| b. | m | ɛ | n | >>> | - | o | | | | (virtual left-headed c:) |
| c. | k | a | >>>> | - | n | o | | | | (virtual v:) |
| d. | t | ɛ | m | p | o | | | | | |
| e.l | | a | >>>> | - | | | | | | (virtual v:) |
| f. | l | ɑ | m | | | | | | | (final coda) |
| g. | r | a | >>>>> | - | m | | | | | (virtual v:, stranded onset[12]) |
| h. | s | ɑ | m | b | ɑ | l | | | | (final coda) |
| i. | d | o | >>>> | - | m | i | >>>- [13] | n | e | (virtual v:) |
| j. | | ɑ | l | m | a | >>>- | n | ɑ | k | (stranded onset) |
| k. | | ɑ | t[14] | l | ɑ | | s | | | (virtual v:, final coda) |
| l. | spl | e | >>>> | - | l | ɔ | ŋ | k | | (virtual v:, stranded onset) |
| m. | gr | o | >>>> | - | t | ɛ | s[15] | k | | (virtual v:, stranded onset) |

It would seem that the coda unit (the 'complementizer') can have a complement, but there appears to be no 'need' for a specifier. However, this may be a limitation for internal specifiers only, if we allow a specifier position at the highest level (not indicated in 15) for 'rising' diphthongs like [ja, wo], etc. Perhaps this option can also be used for so-called short diphthongs which are also typically rising. If, then, only internal specifiers for codas are not needed, this is perhaps just be an instance of dependent units displaying a simpler structure than head units; see Dresher and van der Hulst (1997).

[12] I am here accepting the proposal in Polgárdi (1998) that word-finally a 'stranded' onset is permitted.

[13] The virtually long versions of tense vowels are only required in stressed syllables, which must have a branching rhyme as proposed in Trommelen (1983) and Lahiri and Koreman (1988). This means that the second unstressed open syllable in (15i and 15j) does not need a virtual geminate vowel. Instead, the following (also unstressed) syllables can be subjoined under the preceding C position, which is indicated by the left-pointing arrow in the tree structure in (15).

[14] Note that I have place an obstruent in coda which overrides the prohibition. This is due to the fact that lax vowels are subcategorized for occurring with coda consonant.

[15] Here the occurrence of [s] in the coda position is strictly speaking irregular given that this position is reserved for obstruents. The reason for allowing this obstruents is as in the previous footnote.

### 3.3 Recursive onsets

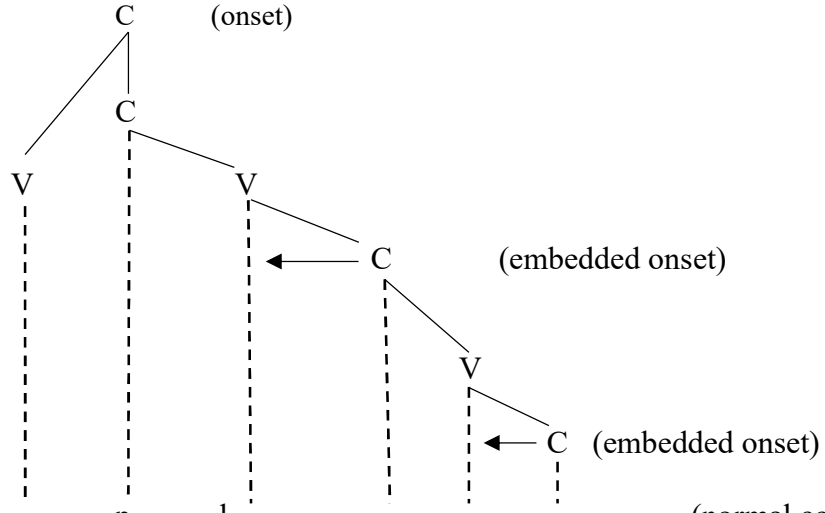
In this section I will propose that the notion of recursivity can also do work for us in the onset unit of the syllable.[16] For onsets I propose the following, which is largely parallel to the rhyme structure in (15). For starters, for the onset we could have a (word-initial) specifier position for, among others, [s]:

(16) Examples of word-initial onset clusters[17]

| | | |
|---|---|---|
| a. | pl | (Dutch: plek 'place') |
| b. | sp | (Dutch: spin 'spider') |
| c. | spl | (Dutch: splinter 'splinter') |
| d. | sl | (Dutch: slak ' |
| e. | kn | (Dutch: knie 'knee') |
| f. | pt | (Hungarian: ptózis 'ptosis', dzéta 'zeta') |
| g. | zd͡ʒbw | (Polish: źdźbwo 'blade (of grass)') |
| h. | gᵛpr͡kᵛn | (Georgian: gwprckwni 'you peel us') |
| | mt͡sʼᵛrtn | mtsʼwrtneli 'trainer') |
| i. | crm | (sesquisyllables in Kammu: cr.mɔɔl 'sowing season') |

The structure in (17) can accommodate all cases in (16):[18]

(17)




| | | | | | |
|---|---|---|---|---|---|
| a. | | p | l | | (normal complex onset) |
| b. | s | p | | | (spclusters) |
| c. | s | p | l | | (spl clusters |
| d. | s | l | | | (sl clusters) |

[16] Here I develop ideas that were presented in a talk at *The form of structure, the structure of form - Three days of linguistics for Jean Lowenstamm*, January 15-17, 2015, University Paris Diderot – Paris 7.

[17] Dutch (16a-f): Trommelen (1983) van der Hulst (1984); Hungarian (16g): Törkenczy and Siptár (1999); Polish (16h): Cyran and Gussmann (999); Georgian (16i): Toft (1999); Butskhrikidze (2002), Ritter (2006); Kammu (16f): Svantesson (1983); van der Hulst and Ritter (1998).

[18] I suspect that the word-initial vowel in Arrernte (Green 1999) may also find an account in this onset model, with the vowel occupying the specifier position and the following consonant(s) being the onset, which Green argues to be missing in this language.

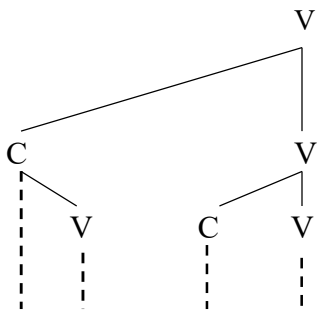
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| e. | g | n | | | | | | | | (obstruent - nasal clusters) |
| f. | | p | Ø | t | | | | | | (Hungarian clusters) |
| g. | z | d͡z | Ø | b | | Øw | | | | (Polish clusters) |
| h. | $g^v$ | p | | r | $c\widehat{k}^vØ$ | | n | | | (Georgian clusters[19]) |
| | m | $t\widehat{s}^w$ | | r | | t | | n | | |
| i. | | c | | rm | | | | | | (sesquisyllables in Kammu) |

Again, we do need an internal specifier for C except at the highest level, so maybe this is a general constraint. But V also does not have/need an (internal) specifier, due to reduced complexity in dependent units, of which the onset is itself a case.

The structure in (17) suggests an appeal to empty nuclei, which van der Hulst (2020) has tried to ban. However, empty nuclei can be circumvented by subjoining V under C (in a sense making a 'vertical' CV unit) as indicated by the left-pointing arrow.

### 3.4 Iambic feet

The proposal for recursion in syllable structure provides an alternative to the representation of so-called trochaic (SW) and dactylic (SWW) feet that has been proposed in Metrical Theory. This theory has also made use of iambic feet and various proposals for a complete foot typology have been proposed. Here I will not discuss how RCVP can be applied to 'iambic' foot types, apart from saying that as proposed in van der Hulst & Ritter (1998) so-called iambic feet can be analysed as super syllables, with a C adjunct to the left of the head syllable:

(18)  ('iambic foot')


This then is more like the original iambic foot structure, although I would argue that the unit as a whole is just another kind of extension of core syllable structure, in this case with a left-adjunction structure, as suggested in den Dikken and van der Hulst (2020: section 4.3).

## 4 Why recursion is less pervasive in phonology

The central thesis of van der Hulst (2010, 2020, and much previous work), following Dependency Phonology's notion of Structural Analogy, is that phonology and syntax have recourse to the same computational system, i.e. that both modules are maximally analogous. This

[19] The unit 'ck' is a so-called *harmonic* clusters which I here analyze as a complex segment (Butskhrikidze (2002: 103)). The written <w> is analyzed as a secondary articulation (Butskhrikidze (2002: 93)).

thesis goes beyond the claim that both phonology and syntax build hierarchical structures. This claim is commonly made (though not supported by all linguists) with the proviso that the nature of the hierarchical organization is fundamentally different with phonology adhering to 'strict layering', while syntax displays recursive structure. Accepting that recursion is available to phonology does not entail that phonology will display the same amount of recursive structure as morphosyntax. The kinds of structures that are employed in both modules do not exist in a vacuum, but rather are formed to accommodate the substances that these structures are grounded in. There is a simple reason for why recursion in phonology is less pervasive. If we accept the fact that semantic, conceptual structure (Anderson would say 'conceptual *substance*') is inherently recursive, we expect morphosyntax to be isomorphic to this semantic, conceptual structure as much as is possible. Phonological structure accommodates phonetic-perceptual substance, which arguably is not inherently recursive. Rather, as the result of motoric actions, it is essentially sequential and rhythmic. This may lead to the view that phonology is 'flat' (see Scheer 2013), perhaps only displaying recursion when expressions are morphosyntactically structured. But recursion in phonology is limited even in this case because there is a 'flattening force' that causes disrhythmic structures that contain lapses (sequences of weak units, 'SWWW…') to flatten by breaking up into smaller rhythmic units (i.e. SW SW), as shown in Giegerich (1985). This in itself shows that phonological structure is not entirely flat. After all, if there is rhythmic structure this means that the units (syllables, words, etc.) display a structure in which certain units are 'subordinated' to others. Standard metrical phonology has chosen to formally represent this 'subordination' by grouping units into binary, headed constituents. The crucial point of van der Hulst's (2010) proposal was that subordination can also be encoded in terms of embedding, which then establishes a perfect formal parallel with recursion in syntax. The same flattening force that limits phonological recursion in morphosyntactically complex expressions, also prevents more than three levels of recursion in monomorphemic units. A sequence of four syllables is therefore not structured as a quaternary 'foot' which would have a dysrhythmic sequence 'SWWW' that does not match the rhythmic structure of a quadrisyllabic sequence. Indeed, a string of four CV units is likely to display an alternating rhythmic structure (SWSW), which suggests the presence in the structure of two consecutive units, each with level embedding. Beyond the 'magic number' 3, unbounded recursion gives in to rhythm in phonology.

## 5 Conclusions

In conclusion, the argument that recursion is unique to morphosyntax is not compelling. It is a manifestation of a syntactico-centric way of thinking that a computational device that the human mind has would only apply within one component of the grammar. It is simply not reasonable to claim that the mental power to combine units that themselves are the product of combining (thus allowing self-embedding as a logical option) is limited to grammar, let alone to one component in the grammar. In this article, I have shown that by allowing recursion in syllable structure, we can account for recurrent phenomena that involve the phonological dimension of language. Recursivity in the rhyme provides a rationale for the type of poetic rhyme that refers to the stressed vowel and everything that follows in a 'foot', but traditional foot structure provides no formal basis for the rhyming sequences. What I have added in this article is the idea that recursivity can also be applied to onset structure, allowing precisely the maximal complexity that

has been observed for languages with excessive onsets (such as Polish and Georgian), although a more detailed account of these and other cases is certainly called for. I conclude that recursion in phonology is real, and its results are revealing.

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