

Are branching syllabic constituents really necessary?

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Abstract

Ohala (1992) presents compelling arguments against the use of the sonority hierarchy (or similar ideas) for the syllabification of segmental strings. He then speculated that “*syllable chunking may be done for the sake of synchronizing suprasegmental and segmental events or to accommodate neuromotor constraints*”. This paper argues that branching structures are not necessary for the expression of segmental groupings. Evidence is drawn from the analysis of the consonantal patterning of French and Fongbe, two languages which exhibit Obstruent-Liquid (OL) consonant sequences but which apparently assign them to different structures. Until now, such a difference in syllabification of OL consonants has to be stipulated (Kaye & Lowenstamm 1984; Levin 1985; Blevin 1995).

This research suggests that the difference in syllabification is derivable from the acoustic modulations of segmental strings and the prosodic properties of the language. Ultimately, we are aiming at a minimalist approach to syllabification which appeals to neither the sonority hierarchy nor to branching syllabic constituents.

Introduction

Until recently, two fundamental assumptions have been made in the mainstream generative phonology approach to syllabic structures:

- 1) the sonority hierarchy (and similar ideas such as the sonority sequencing principle) to account for phonotactic constraints on syllabic structure
- 2) the existence of syllabic branching constituents (and similar ideas such as morpheme structure constraints, or positive/negative syllabic constraints).

The problem

- 1) The sonority hierarchy is circular, inadequate for the description of consonant phonotactics and phonetic patterns (Ohala 1992; Steriade 1999).
- 2) Morpheme structure constraints or branching constituents are *ad hoc* mechanisms to represent consonant groupings (Ohala 1992; BNN 2006).

Proposal

Syllables chunking results from the application of two universally available mechanisms: COMB(ine) and LICE(ense).

- 1) COMB(ine) parses elements into pairs of units called *phases*.
- 2) LICE(nse) checks whether or not the resulting units are phonetically interpretable.

The Branching Constituent Hypothesis

The Branching Constituent Hypothesis stipulates that the presence of branching onsets in a language is lexically determined (i.e. not derivable). A parameter (ON/OFF) specifies whether onsets are permitted or not (Selkirk 1982; Kaye & Lowenstamm 1984; Levin 1985; Encrevé 1988, etc.).

Branching onsets (of which the vast majority are Obstruent-Liquid (OL) sequences) obey the following four criteria:

- 1) co-occurrence restrictions: prohibition against certain types of sequences
- 2) varied distribution: attested in word-initial and word-internal position
- 3) compliance with the sonority sequencing principle: consonants rise in sonority depending on their closeness to the syllabic peak
- 4) asymmetry: if AB is a well-formed onset, then BA is not.

It is precisely these four characteristics that both the sonority hierarchy and the branching constituent hypothesis attempt to express and capture¹.

Three types of languages with OL sequences follow (see Kaye & Lowenstamm 1981; Feinstein 1981; Blevin 1995)

Type I: Branching onset languages (French, Italian)

- a) obey all the four criteria outlined above
- b) show co-occurrence restrictions i.e. not all possible combinations (the specific combinations vary depending on the languages) are attested
- c) occur in word-initial and word-internal position (see for instance, French word-initial *plat* [pla] “plate” as opposed to word-internal *patrie* [patRi] “homeland”).
- d) obey sonority sequencing (sonority rise to the nucleus).
- e) show asymmetry (e.g. OL are well-formed branching onsets, but not LO).

¹ Other common properties of branching onset consonants include the following: non-separability (no vocalic epenthesis), tautomorphic sequence, and correlation between the existence of branching onsets and coda consonants.

Type II: CV languages (with no coda consonant)

- a) do not obey co-occurrence restriction (e.g. Nasal-Liquid and Glide-Liquid sequences are allowed in Fongbe, Vata)
- b) vocalic epenthesis is often possible between the two consonants

Type III: CVC languages (with codas)

- a) do not obey to the second criterion (e.g. OL sequences are not attested in word-initial position in Mooré, Dagara, and Lobiri)
- b) vocalic epenthesis is often possible between the two consonants (e.g. in Moore, *lombre* “bell” is realized [lombðre] (*[lomðbre]), and *pondre* “frog” is realized [pondðre] (*[ponðdre]), whereas *wagdre* “thief” could be either [wagdðre] or [wagðdre] (cf. *wagda* “thieves”).

Important observation: none of the languages *belonging to Type I* is a tonal language. On the other hand, several languages found in Type II and III do have lexical tone distinction. Therefore, the following questions are in order:

- a) Why do languages that allow branching onsets not have lexical tones?
- b) Why do languages that do not have branching onsets allow lexical tones?
- c) Can branching onsets be derived rather than stipulated?

Case study:

1. OL consonants in French

(1)	Italian	French
Obstruent + [l]	<i>il globo</i> [ilglobo] “the globe”	<i>le globe</i> [l@glob] “the globe”
Obstruent + [R]	<i>il cratere</i> [ilkratere] “the crater”	<i>le cratère</i> [l@kRatER] “the crater”

(2)	a)	O	R	O	R	b)	O	R	O	R
	/ \					^				
	/ \	N		N		/ \	N		N	
	/ \					/ \				N
	x	x	x	x	x	x	x	x	x	x
	g	l	o	b	o	k	r	a	t	e

(3) Typical branching onsets: obligatory clusters (Dell, 1995:11)
 /pl, pr, bl, br, fl, fr, vl, vr, tr, dr, kl, kr, gl, gr/

Other sequences are also observed, some are common (4a), others have low frequency with atypical sonority profile (4b).

- (4) Other word-initial sequences
 a. /sp, st, sk, sl, sm, sn, sv, sf, spl, spr, str, skl, skr/
 b. /pn, ps, pf, pt, kn, km, kv, ks, kt, tl, tm, ts, tʃ, gn, gz, zl, zv, zb, zgr, mn, ft/
- (5) Parsing of consonants in French (Dell 1995:14)
 a. a prevocalic cons. is tautosyllabic with the following vowel;
 b. in an obligatory cluster, the two cons. are tautosyllabic;
 c. a postvocalic consonant is tautosyllabic with the preceding vowel, provided no conflict arises with a. and b. above.

A crucial aspect of French is the schwa deletion rule. Given that, any sequence VCCV occurring at the phonetic level may derive from /VCCV/ or /VCØCV/. Determining the underlying representation is not a trivial matter (Dell 1995:8).

(6) Consonants followed by schwa

patisserie	[patisRi]	‘pastry’
samedi	[samdi]	‘Saturday’
vaseline	[vazlin]	‘jelly’
tannerie	[tanRi]	‘tannery’
kadna	[kadna]	‘padlock’

(7) Coda consonants

soldat	[solda]	‘private (army)’
partie	[paRti]	‘part’
somnoler	[sɔmnɔle]	‘to doze off’
souscrire	[susKRiR]	‘to subscribe’
surprise	[syRpRiz]	‘surprise’

Nota: consonant sequences in (6) all derive from schwa deletion, whereas those in (7) are underlying clusters. Furthermore, except for [samdi], the forms in (6) cannot be analysed as coda-onset sequences because they would violate the SSP. Not all languages syllabify such OL sequences as in French.

2. OL consonants in Fongbe

Fongbe and other Gbe lects are maximally CV (Greenberg 1963, Welmers 1973), yet they display OL sequences with the following properties:

Property 1: OL sequences occur in both word-initial and word-medial position

(8) a. C1

klu	[klu]	‘to scratch’
kple	[kple]	‘to gather’
hwla	[ɣwla]	‘to hide’
vle	[vle]	‘to imitate’
bli	[bli]	‘to roll’
m̩la	[m̩la]	‘to coil, to fold’
wla	[wla]	‘variety of yam’

b. C1 ~ Cr

tli	[tli/tri]	‘to be thick’
tlan	[tla~/tra~]	‘excessively’
dlo	[dlo/dro]	‘not ripe’
jlɛ	[dʒɛ/dʒɛ]	‘quarrell’
slan	[sla~/sra~]	‘mockery’
zlõ	[zlõ~/zrõ~]	‘to put down’
slu	[slu/sru]	‘to vomit’

Property 2: OL sequences cannot be analyzed as tautosyllabic

Property 3: no co-occurrence restriction (almost any consonant of the language may be the first member within a sequence, including glides, nasal, complex and labialized consonants).

	Initial						Medial					
	w	j	l	r	m	n	w	j	l	r	m	n
T		?/1	(+)	+	-	-	[+]	-	(+)	+	-	-
D		-	(+)	+	-	-	[+]	-	(+)	+	-	-
K	[+]	?/1	+	-	-	-	[+]	-	+	-	-	-
G	[+]	?/1	+	-	-	-	[+]	-	+	-	-	-
tʃ		+	(+)/ 1	+	-	-	[+]	+	(+)	+	-	-
ɖ		-	(+)	+	-	-	[+]	-	(+)	+	-	-
kp		-	+	-	-	-	[+]	+	+	-	-	-
gb		-	+	-	-	-		+	+	-	-	-
xw		-/1	+	-	-	-		-	+	-	-	-
yw		-/4	+	-	-	-		-	+	-	-	-
f		+	+	-	-	-	[+]	+	+	-	-	-
v		+/-	+	-	-	-	[+]	+	+	-	-	-
s	[+]	+	(+)	+	-	-	[+]	+	(+)	+	-	-
z	[+]	+/1	(+)	+	-	-	[+]	-	-	-	-	-
x		+/1	+	-	-	-		-	+	-	-	-
y		+	+	-	-	-		-	+	-	-	-
b		+	+	-	-	-	[+]	-	+	-	-	-
ɖ		+/1	-	-	-	-	[+]	-	-	-	-	-
m	[+]	+	+	-	-	-		+	+	-	-	-
n		-	-	-	-	-		-	-	-	-	-
ɲ		-	(+)	+	-	-		—	(+)	+	-	-
l	[+]	+	-	-	-	-	[+]	+	-	-	-	-
w		+/1	+	-	-	-		-	+	-	-	-
j	[+]	-	(+)	+	-	-		-	(+)	+	-	-

Property 4: The only consonant sequences observed in Gbe lects consist of an obstruent followed by a non-nasal sonorant (liquid or glide).

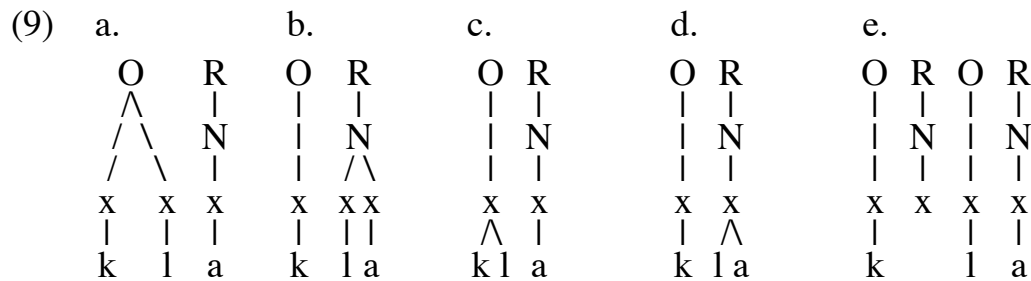
Property 5: Almost all consonants in Gbe (including labio-velars, palatals and sonorants)² may be followed by a liquid, and most may be followed by a glide.

Property 6: No consonant is allowed in word or syllable final position.

Issue: How to reconcile the syllabification of OLV with the CV hypothesis?

3. Discussion:

Five possible representations for Gbe OL sequences (9a-e).



Option 1: Branching onset hypothesis (9a)

1) Typical branching onsets exhibit co-occurrence restrictions, yet there is no motivated co-occurrence restriction in Gbe: word-initial sequences such as [wl], [nl], [zr] and [sr] are attested.

2) Since such potential branching onsets are not attested in typical branching onset languages, they would be highly marked in Gbe lects. Moreover, the allophonic variation is very atypical of branching onset languages.

3) Finally, according to the syllable markedness theory proposed in Kaye & Lowenstamm (1981) and Feinstein (1981), the presence of branching onsets in a language entails the presence of branching rhymes. For all of these reasons, we reject the structure in (9a) as a possible representation of Gbe OL sequences.

Option 2: Branching nucleus hypothesis (9b)

1) Heavy diphthongs are generally composed of elements with decreasing sonority. The representation in (9b) has the opposite ordering, rendering such a type of branching nucleus, highly marked.

2) If such marked branching nuclei were to be attested in Gbe lects, one would expect less marked branching nuclei such as (tautosyllabic) long vowels to be

² The only two exceptions being [d] and [n].

found as well. Long vowels are not observed in Gbe lects, a gap that could not be accounted for if the grammar allowed for branching nuclei.

3) Finally, the branching nucleus hypothesis would be unable to account for the allophonic variation between [r] and [l] when the first consonant is coronal. For these reasons, we reject the branching nucleus structure for the analysis of CLV sequences.

Option 3: The complex consonant hypothesis (9c)

1) Languages with complex segments seldom exhibit the complete range of combinations of OL sequences (Greenberg 1963, Maddieson 1984).

2) This hypothesis would force one to posit complex consonants of the type [ml] and [nl] which are unlikely to occur in any language.

3) When a nasal and oral consonant combine to make a complex consonant, they are generally homorganic. The Gbe data eschew this generalisation.

4) Finally, since true complex consonants such as [kp] and [gb] are attested in Fongbe, the presence of combinations such as [kpl] and [gbl] would force one to posit unlikely segments composed of three root nodes.

For all of these reasons, we reject the complex segment hypothesis for the analysis of CLV sequences.

Option 4: The light diphthong hypothesis (9d)

This hypothesis assumes that the liquid and the vowel are both linked to the same nuclear position. It would thus account for the lack of co-occurrence restriction in Gbe lects between the initial consonant and the rest of the sequence. However, it could not account for the allophonic variation of [l], which is realised as /r/ when the first consonant is coronal. We therefore reject this representation for the analysis of CLV sequences in Gbe lects.³

Option 5: The empty nucleus hypothesis (9e)

Not only does this representation comply with all principles of syllabic structure, it is also consistent with other phonological properties of Gbe languages, including tonal and reduplicative patterns (not discussed here). The next section, presents a case of distributional gap that can only be accounted for if CLV sequences are considered to be bisyllabic.

³ More compelling arguments against a light diphthong structure, based on tonal and reduplication patterns can be made, but due to space limitation we are unable to explore these aspects in details (see Nikiema 1995 for discussion).

4. Evidence for the Empty Nucleus Hypothesis: A distributional gap

It has been observed that CVLV sequences are prohibited when the two vowels are identical (Welmers 1973, Bole-Richard 1983 and Capo 1991 among others).

(10) a. Cl		b. Cl ~ Cr
aglo	[aglo] ‘bag’	tlatla [tlatla/tratra] ‘skate (fish)’
kplakpla	[kplakpla] ‘raffia mat’	clɛclɛ [tʃɛtʃlɛ/tʃɛtʃrɛ] ‘flowing a lot’
jaxwle	[ɔ̃axwle] ‘scraping’	adla [adla/adra] ‘calamity’
levla	[levla] ‘latch’	ajlo [adʒlo/adʒro] ‘great’
kabli	[kabli] ‘monkey’	jiɲlɛ [ɔ̃ɲɛ/ɔ̃ɲrɛ] ‘example’
gbetɔ̃hla	[gbetɔ̃yla] ‘brute’	sisle [sislɛ/sisrɛ] ‘treason’
lanwliɖu	[laːwliɖu] ‘canine (tooth)’	azli [azli/azri] ‘vodoun’

In contrast, CVLV sequences are allowed when the two vowels are distinct (11), whereas the CVCV sequences occur with non-distinct vowels when the second consonant is not /l/ (12).

(11)	beli	[beli] ‘to bow’
	gali	[gali] ‘cassava’
	gbelan	[gbelaː] ‘game (meat)’
	honli	[hɔ̃ːli] ‘doorway’
(12)	baba	[baba] ‘mud’
	baka	[baka] ‘canary’
	dɔ̃ɔ̃	[dɔ̃dɔ̃] ‘trembling’
	duwu	[duwu] ‘big (reference to eyes)’
	futu	[futu] ‘to shuffle’
	logo	[logo] ‘hip’

This distributional gap could not easily be explained if we were to adopt options 1-4. Following Nikiema (1995), we suggest that CLV sequences result from the deletion of an intervening vowel under an identity constraint. Forms such as [aglo] and [klu] are historically derived from /agolo/ and /kulu/ respectively. Furthermore, Bole-Richard (1983) reported a) that an identical deleted vowel reappears in Gengbe traditional songs (e.g. [fuflu] is realised [fufulu]), and b) that loanwords show deletion of the first of two identical vowels with an intervening liquid (13).

(13) Borrowed forms from Ewe (Bole-Richard 1983:75)

Ewe	Gen	
abolo	ablo	‘cornbread’
agala	agla	‘crab’
xɔ̃lɔ	ɛxlɔ	‘friend’

If the bisyllabic hypothesis is correct, then all underlying representation of CLV sequences are in fact /CV_iLV_i/, i.e. bisyllabic sequences with identical vowels, as illustrated in (14).

(14) a.	O R O R	b.	O R O R O R
	N N		N N N
	x x x x		x x x x x x
	gb e l e		a ɔ̃ o r o
	[gble]		[aɔ̃lo/aɔ̃ro]

Two conditions must be met in order for CVLV sequences to reduce to CLV: (i) the two vowels must be identical, and (ii) the intervening consonant must be a liquid or a glide, an observation expressed in Capo (1991:92) in terms of a Morpheme Structure Condition.

Question: why is it that the vowel needs to be deleted in this particular context?

Deletion: a parametric option of OCP

Yip (1988) suggests two ways of implementing OCP: a) fusion (multiple linking) of the elements involved as in (15a), or b) deletion of one element (15b).

(15) a. Double linking of segments

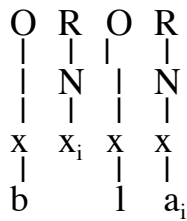
x	x	⇒	x x
			\ /
d	d		d

b. Segmental deletion

x	x	⇒	x x
d	d		d

As shown in Nikiema (1995), the fact that liquids and glides are the only consonants allowing deletion under identity suggests, in the spirit of Paradis & Prunet (1991), that liquids and glides are transparent, contrary to all other consonants which are opaque. If liquids and glides are transparent in Gbe, then the vowels that immediately precede and follow them are adjacent. They are therefore subject to OCP under deletion.

(16) Deletion option of the OCP /bala/ [bla] 'to tie'



In conclusion, not all languages syllabify OL sequences in the same way. French appears to syllabify them as tautosyllabic, whereas Fongbe assigns them to different syllables as in (17).



Questions:

- 1) Why are the French OL sequences analyzed as branching onsets, but not the Fongbe sequences?
- 2) How are branching constituents created?

5. Towards a Minimalist Approach to Syllabic Structure (MASS)

5.1 Assumptions:

- (18) a) Preformed branching constituents are dispensable
- b) sequences of (apparently) tautosyllabic consonants are artifacts.

5.2 The architecture of the model

- (19) a) *Inventory*: a set of segments, or active features
- b) *Computational component* with 2 operations: COMB(ine) & LICE(nse)
- c) *Phonetic implementation component* where expressions are realized

COMB parses segments into binary units called *phases* which are either strong (i.e. interpretable by the phonetic component) or weak (i.e. not yet directly interpretable by the phonetic component, thus requiring licensing).

LICE values uninterpretable features of consonants by Match with interpretable features of periodic elements through *LEX(icalization)* of segmental and suprasegmental units, or HARM(onization) with periodic elements (sonority).

The algorithm derives the so-called universal CV frame (Clements & Keyser 1983, Lowenstamm 1996).

5.3 Interpretability and syllabic structure licensing

Consider the following acoustic properties (periodicity) of segments:

(20) *Acoustic properties of segmental units*

- a. Vowels are periodic with a well-defined formant structure and a high level of acoustic intensity. As such, they are phonetically interpretable (i.e. are both pronounceable and perceivable).
- b. Sonorants (and glides) are semi-periodic. They are rich with respect to acoustic intensity and formant structure, but less so than vowels. Depending on the individual language, sonorants and glides may be directly interpretable or may require *F-valuation*.
- c. Obstruents are aperiodic elements, therefore uninterpretable at the phonetic level, unless valued by a periodic element.

(21) *Licensing Conditions*

- a. Vowels are universal licensors; they are phonetically interpretable on their own and they enhance the features of adjacent segments.
- b. Sonorants and glides can be licensors in which case they do not require licensing by another element. Sonorants and glides partially enhance the features of adjacent segments.
- c. Obstruents, however, must be properly licensed in order to be interpreted phonetically. In other words, their features require enhancement by an adjacent unit.

Therefore, we define a ***strong phase*** as one containing a vowel, and a ***weak phase*** as one with no vowel. The latter must be licensed by either a lexicalized vowel (epenthesis), or harmonized by a (semi) periodic element from an adjacent strong phase.

6. Application

(22a-b) illustrate strong phases; (22c) a weak phase, and (22d) a non-phase. Neither LEX nor HARM has applied in (22c) or (22d).

(22) a. /pa/ b. /øa/ c. /pø/ d. /øø/

More puzzling cases are those in (23a-c):

(23) a. /sakø/ b. /katr/ c. /kart/

The question is how to derive those forms? Let us assume the condition in (24):

(24) Spell Out Condition

Spell Out (Transfer) applies at the next strong phase (Chomsky 2001)

Under (24), a strong phase remains in use in the computational component until it reaches the next strong phase. In other words, interpretable features of a periodic element P1 are accessible for feature valuation in the following phase.

Thus in (23a), the strong phase (/sa/) is not sent to the phonetic component before the weak phase (kø) is valued under HARM of the empty nucleus by features of the interpretable vowel (/a/). We take this valuation by HARM as the reason why the final consonant has been considered a coda.

The same mechanism recursively applies to (23b-c), leading to a tautosyllabic analysis of the two last consonants in /katr/, but a heterosyllabic one in /kart/. The key difference here lies in an active periodic feature of sonorants (to be identified).

Finally, our approach accounts for the fact that [pla] is well-formed in French-like and Gbe-like languages, whereas the reverse order (/lø/-/pa/) is illformed in those languages. The illformedness of /løpa/ follows from the unavailability of a probe with interpretable feature to value the active periodic feature of the sonorant. This accounts for why a form such as /aløpa/ is fine, whereas another one such as /køløpa/ is not, as the two consonants are not licensed.

7. Conclusion

Clements & Keyser (1983) suggested in their CV Phonology model that all languages begin with the optimal CV syllable (see also Lowenstamm 1996). It turns out that their claim about how syllabic inventories are build is basically correct, but not for the reasons they presented. We have presented an approach to syllabification which offers four advantages :

1) The asymmetric nature of phonological expressions ([pla] vs. *[lpa]) can now be explained by the licensing properties of segments and the phase accessibility conditions.

2) A theory of syllabification is possible without appealing to the sonority hierarchy.

3) The absence of complex segments ([tʃ], [dʒ]) within OL consonants in French-like languages and their presence within OL consonants in Fongbe-like languages may be accounted for in terms of a single application of COMB per constituent.

Finally, 4) a distinctive feature of this proposal is that cross-linguistic variations observed in syllabification patterns lie in the licensing properties of consonants, and not in the computation of strings which always consists of COMB

and LICE. This is tantamount to saying that all phonological information related to syllabification lies in consonants ; vowels are needed to license and allow phonetic interpretability of expressions. This conclusion is consistent with the fact that in cross words puzzles, consonants bear more information (than vowels) for the identification of lexical items. It is therefore not an accident that consonantal melodies are so central to the morpho-phonology of semitic languages ; they are indeed crucial information in the phonology of all natural languages.

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