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Ambisyllabicity in English: Aspiration and pre-fortis clipping¹

Takeshi Yamamoto

Abstract. This paper reconsiders Wells's (1990) syllabifications of such words as *satire*, where the /t/ is syllabified into the preceding syllable just as *litter* according to the principle that consonants are syllabified with the more strongly stressed of two flanking syllables. His syllabifications of the /t/'s in *satire* and *litter* account for the pre-fortis clipping of the preceding vowels, which is rarely considered when discussing syllabification, but do not account for the different realizations of the phoneme, which is aspirated in the former but tapped in the latter. We argue that the /t/ in *satire* is ambisyllabic but that the /t/ in *litter* is not, which is different from Kahn's (1980) ambisyllabicity. We also compare our approach with Hammond's (1999) geminate approach and point out that his approach does not account for pre-fortis clipping.

1. Introduction

It is widely accepted that the syllable is an essential concept in English phonology and plays an important role in the analysis of phonotactics, stress placement, and allophony. However, researchers disagree as to how words are syllabified. Two major pronunciation dictionaries, *Longman Pronunciation Dictionary* (Wells 2008) and *Cambridge English Pronouncing Dictionary* (Jones 2011), henceforth *LPD* and *CEPD*, respectively, indicate syllable boundaries in their transcriptions, but their principles differ. The following is *CEPD*'s.

(1) *CEPD*'s syllabification principle (Jones 2011: xiv–xv)

The 'Maximal Onset Principle', which is widely recognized in contemporary phonology, is followed as far as possible. This means that syllables should be divided in such a way that as many consonants as possible are assigned in the beginning of the syllable to the right [...] rather than to the end of the syllable to the left. However, when this would result in a syllable ending with a stressed /ɪ/, /e/, /æ/, /ʌ/, /ɒ/ or /ʊ/, it is considered that this would constitute a violation of English phonotactics, and the first (or only) intervocalic consonant is assigned to the preceding syllable [...].

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In contrast, *LPD* adopts a different approach. Its syllabification is based on Wells (1990), who proposes a principle of syllabification as in (2), which is sensitive to stress levels assumed as in (3).

- (2) The main syllabification principle and a provision for adjacent syllables of equal rank (Wells 1990: 80, 81)
 - (a) Subject to certain conditions [...] consonants are syllabified with the more strongly stressed of two flanking syllables.
 - (b) Where adjacent syllables are of equal grade, consonants are (again subject to the stated conditions) syllabified with the leftward syllable.
- (3) Stress levels (Wells 1990: 80–1)
 - 1. Primary word stress
 - 2. Pre-tonic secondary stress
 - 3. Tertiary (post-tonic) stress
 - 4. Unstressed but with full vowel
 - 5. Weak (reduced) vowel

substitution product 2, 5, 1, 5, 3, 4

Wells (1990) argues that his syllabification is based on the following phonetic phenomena.

- (4) Phonetic rules conditioned by syllable boundary (Wells 1990: 77–9)
 - (a) Aspiration
 - (b) Pre-fortis clipping
 - (c) /t/ tapping
 - (d) /t/ glottalling
 - (e) /r/ allophony
 - (f) Plosive epenthesis
 - (g) Elision of /t/ and /d/
 - (h) Other duration rules

Because it is evidenced by phonetic facts, *LPD*'s syllabification is more persuasive than *CEPD*'s. *CEPD* syllabifies the /t/'s in *glottalic* and *nostalgia* in British English as the coda of the preceding syllable ([glɒt'æɪ.ɪk]) and the onset of the following syllable ([nɒs'tæl.dʒə]), respectively, though the voiceless stop is realized as aspirated in the former and unaspirated in the

latter. These syllabifications follow the principle that syllables do not end with monopositional vowels, but are clearly inappropriate in terms of allophony.

However, it is also the fact that there are some inconsistencies and anomalies in Wells's syllabifications. In this paper, we will first focus in Section 2 on the syllabifications of /t/ realized as a tap or as an aspirated plosive in American English and reconsider his syllabifications of words such as *satire*, *protein*, and *centaur*. We will then propose an ambisyllabicity approach to accommodate pre-fortis clipping in Section 3, one of the phenomena that Wells thinks help determine a syllable boundary as in (4b) above but is rarely considered by other researchers. We will compare our proposal with Kahn's (1980) ambisyllabicity and Hammond's (1999) gemination in Section 4. We will conclude our discussion in Section 5.

2. /t/ tapping and aspiration

2.1. Wells (1990)

Of the eight rules in (4), /t/ tapping can be confirmed, alongside (f, g), by some pronunciation dictionaries. Examples of tappable and untappable /t/ follow, provided in orthography with underlines and relevant syllable boundaries added.

(5) /t/ tapping (Wells 1990: 78)

[T]hose who tap /t/ do so when it is syllable-final.

<u>Tappable</u>	<u>Untappable</u>
butt <u>.</u> er, latt <u>.</u> er	
put <u>.</u> it over there	
might <u>.</u> I	my tie

Word-medial /t/ tapping typically occurs where /t/ is preceded by a syllabic with grade 1 stress, optionally followed by /n/, and followed by one with grade 5 stress by Wells's definition in (3) above. Here and hereafter, quotations of phonetic transcriptions are reproduced in complete forms even if the originals are abbreviated. Boldface in *LPD* is not reproduced; *LPD*'s spaces indicating syllable boundaries are replaced with periods for clarification purposes. *RDP* refers to Upton & Kretzschmar (2017), where tapped /t/ is denoted by [d] or, when preceded by /n/, by [(t)]; they do not indicate syllabification.

(6) Tappable /t/ placed between grades 1 and 5 stress syllabics in this order

	<i>LPD</i>	<i>CEPD</i>	<i>RDP</i>
(a) litter	'lɪt.ər	'lɪt.ə	'lɪdər
(b) liter	'li:t.ər	'li:t.ə	'lɪdər
(c) senator	'sen.ət.ər	'sen.ət.ə	'senədər
(d) winter	'wɪnt.ər	'wɪn.tə	'wɪn(t)ər
(e) painter	'peɪnt.ər	'peɪn.tə	'peɪn(t)ər
(f) carpenter	'kɑ:rp.ən.t.ər	'kɑ:r.pən.tə	'kɑ:pən(t)ər

However, it seems that /(n)t/ placed between grades 1 and 4 stress syllabics in this order is generally untappable as exhibited in the following, where and whereafter phonetic forms cited are enclosed in angled brackets (< >) when irrelevant to our discussion. *CEPD* exceptionally indicates /t/ tapping in *Hittite*. However, the [i] in *Boōtes* and the final [ou] in the second variant of *Kyoto* in *RDP* are considered to be weak vowels, thus these cases not being exceptions.

(7) Untappable /t/ placed between grades 1 and 4 stress syllabics in this order (boxes added)

	<i>LPD</i>	<i>CEPD</i>	<i>RDP</i>
(a) detail	'di:.terəl, <di.'terəl> <də.'terəl>	<dɪ.'teɪl>, 'di:.teɪl	'di,teɪl, <də'teɪl>
pretense	'pri:.ten's	'pri:.ten's	'pri,tens, <pri'tens>
retail (N, A)	'ri:.terəl	'ri:.teɪl	'ri,teɪl
contact (N)	'kɑ:n.tækt	'kɑ:n.tækt	'kantækt
contest (N)	'kɑ:n.test	'kɑ:n.test	'kan,test
context	'kɑ:n.tekst	'kɑ:n.tekst	'kantækst
intern (N)	'ɪn.tɜ:n	'ɪn.tɜ:n	'ɪn,tɜ:n
(b) atoll	'æt.ɔ:l, 'æt.ɑ:l	'æt.ɑ:l, 'eɪ.tɑ:l, 'eɪ.tɔ:l	'æ,tal, 'æ,tɔl
Boōtes	boʊ.'out.i:z	boʊ.'ou.ti:z	boʊ'oudiz
Hittite	'hɪt.aɪt	'hɪt.aɪt	'hɪ,tart
Kyoto	ki.'out.ou	ki:.'ou.tou, 'kjou.tou	ki'(j)ou,tou, ki'(j)oudou
protein	'proʊt.i:n	'proʊ.ti:n	'proʊ,tɪn
protest (N)	'proʊt.est	'proʊ.test	'proʊ,test
satire	'sæt.aɪ.ər	'sæt.aɪ.ə	'sæ,tai(ə)r
suttee	'sʌt.i:, <sʌ.'ti:>	<sə.'ti:>, 'sʌt.i:	'su,ti, <sə'ti>
Utah	'ju:t.ɑ:	'ju:t.ɔ:, 'ju:tɑ:	'ju,tɑ, 'ju,tɔ

cent <u>au</u> r	'sent.ɔ:r	'sen.tɔ:r	'sen,tɔ(ə)r
synt <u>a</u> x	'sɪnt.æks	'sɪn.tæks	'sɪn,tæks

In (7a), *LPD* syllabifies /t/ as the onset of the following grade 4 stress syllable, in which position voiceless plosives accompany aspiration as Wells assumes in the following way.

(8) Aspiration (Wells 1990: 77)

English /p, t, k/ are aspirated when initial in a full-vowelled syllable.

<u>Aspirated</u>	<u>Less aspirated or none</u>
plum <u>p</u> ie	plump <u>p</u> eye
a <u>t</u> ease	at <u>t</u> ease
a. <u>t</u> tack	

Although *LPD*'s syllabifications in (7a) do not conform to the principle (2a), it seems that the words are syllabified according to the following condition.²

(9) The morpheme boundary condition (Wells 1990: 81)

In polymorphemic words, consonants belong to the syllable appropriate to the morpheme of which they form a part. This applies only to synchronic, psychologically real morphemes.

<u>Following the main principle</u>	<u>Affected by a morpheme boundary</u>
reap <u>.er</u>	fee# <u>p</u> aying, re# <u>p</u> rint, pre# <u>s</u> uppose
hyph <u>.en</u>	high# <u>f</u> aluting
Rom <u>.an</u>	bow# <u>m</u> an
bon <u>.us</u>	slow# <u>n</u> ess
high <u>n</u> .ess (regal term of address)	high# <u>n</u> ess (quality of being high)
prim <u>.a</u> donna	pre# <u>M</u> adonna
awf <u>.ul</u> , caref <u>.ul</u>	awe# <u>f</u> ul (full of awe)
Bart <u>.on</u> , Daws <u>.on</u> , Ben[^l] <u>s</u> .on	Cray# <u>f</u> ord
magne <u>.t</u> ism (more familiar)	Bonapart# <u>t</u> ism, puppet# <u>t</u> ism (less familiar)

² It is not clear whether *LPD*'s syllabifications of *el.bow* and *mil.dew* result from this condition.

The items in (7a) contain the prefixes *con-*, *de-*, *in-*, *pre-*, and *re-*, which are considered to be “synchronic, psychologically real morphemes,” thus inhibiting the main syllabification principle in (2), though the prefix *pro-* in *protest* in (7b) is not treated in the same way.

This effect of morpheme boundaries on syllabification seems plausible if we consider that the same prefix has different vowels in such pairs as *re-present* (“present again”)/*represent* (“stand for”) and *re-create* (“create again”)/*recreate* (“refresh”), where the former member of each pair contains a long vowel in the prefix while the latter contains a short vowel. Myers (1987) proposes a rule in (10a) and accounts for such vowel length alternations as in (10b).

(10) Closed Syllable Shortening (Myers 1987: 491, 495; bold in the original)

(a) $V \rightarrow \emptyset / V \text{ ___ } C_{\sigma}$ (root-level)

(b) [ay] ~ [ɪ]: **divine**/divinity

[iy] ~ [ɛ]: **deep**/depth

[ey] ~ [æ]: **nation**/national

[ow] ~ [a]: **cone**/conic

[uw] ~ [ʌ]: **deduce**/deduction

[aw] ~ [ʌ]: **profound**/profundity

It is obvious that the above-mentioned vowel alternations are of the same kind, where the long vowels, occurring in open syllables, are shortened in *represent* and *recreate*, the latter of which also undergoes stress reversal, primary stress placed on the antepenult just as *allocate* and *designate*. The assumed derivations are in the following.

(11) Vowel alternations found in verb pairs

(a) re-present (“present again”)/represent (“stand for”)

re-present [ˌɹiː#pɪɪ.ˈzɛnt]

↓

Morpheme boundary deletion

[ˌɹiːpɪɪ.ˈzɛnt]

↓

Closed syllable shortening

represent [ˌɹɛpɪɪ.ˈzɛnt]

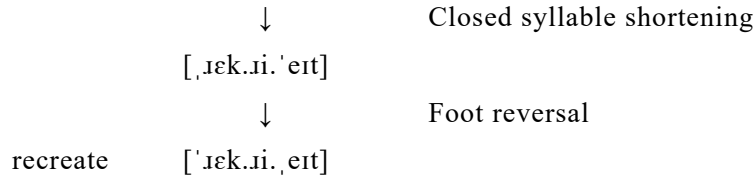
(b) re-create (“create again”)/recreate (“refresh”)

re-create [ˌɹiː#kɹi.ˈeɪt]

↓

Morpheme boundary deletion

[ˌɹiːkɹi.ˈeɪt]



Returning to (7), the words in (b) are puzzling in that, whereas /t/ is syllabified into the coda of the preceding syllable according to the principle (2a), tappability is not indicated contrary to (5). Some more examples follow, which have both a tappable variant, with /t/ followed by a grade 5 stress vowel, and an untappable variant, with /t/ followed by a grade 4 stress vowel. Note that *LPD* syllabifies both types of variants in the same way except for *NATO*.

(12) Tappable or untappable /t/ placed between grade 1 and grade 5 or 4 stress syllabics in this order

	<i>LPD</i>	<i>CEPD</i>	<i>RDP</i>
(a) an <u>t</u> i	'ænt̚.i, 'ænt̚.aɪ	'æn.t̚i, 'æn.taɪ	'æn(t)i, 'æn.taɪ
au <u>t</u> opsy	'ɔ:t̚.ɑ:ps̚.i, 'ɑ:t̚.ɑ:ps̚.i, 'ɔ:t̚.əps̚.i, 'ɑ:t̚.əps̚.i,	'ɑ:..ta:p̚.si, 'ɔ:..ta:p̚.si, 'ɑ:..t̚əp̚.si, 'ɔ:..t̚əp̚.si	'ɑ,tapsi, 'ɔ,tapsi
(San) Jacinto	dʒə.'sɪnt̚.ou, dʒə.'si:nt̚.ou	—	dʒə'sɪn(t)ou
ve <u>t</u> o	'vi:t̚.ou, 'vi:t̚.ou	'vi:..t̚ou	'vi,tou, 'vidou
(b) NA <u>T</u> O	'neɪt̚.ou, 'neɪ.t̚ou	'neɪ.t̚ou	'neɪ,dou

2.2. Other views on aspiration

Regarding *satire* in (7a), Nespor & Vogel (1986) state that the /t/ is aspirated and assume a two-foot structure as in (13a), proposing a rule as in (13b), which states that /t/ is aspirated foot-initially. Note that being foot-initial entails being syllable-initial by definition.

(13) Aspiration (Nespor & Vogel 1986: 91)

- (a) satire → sa[t^h]ire [sa]Σ[tire]Σ
(b) t → [+asp] / [____ ...]Σ

Likewise, Hayes (1995: 12–16) proposes four segmental diagnostics to test stresslessness, two of which are in relevance to our discussion.

(14) Diagnostics of stresslessness (Hayes 1995: 12–13, italics and bold in the original)

(a) Flapping

$$t, d \rightarrow r / [- \text{consonantal}] \text{ — } \begin{bmatrix} \text{V} \\ - \text{stress} \end{bmatrix}$$

data [déyrə] vs. *attain* [ətéyn]

(b) Medial Aspiration

$$\begin{bmatrix} - \text{son} \\ - \text{cont} \\ - \text{voice} \end{bmatrix} \rightarrow \begin{bmatrix} + \text{spread} \\ \text{glottis} \end{bmatrix} / [- \text{strid}] \text{ — } ([+ \text{son}]) \begin{bmatrix} \text{V} \\ + \text{stress} \end{bmatrix}$$

append [əp^hénd] vs. *campus* [k^hæmpəs]

accost [ək^hóst] vs. *chicken* [číkən]

As is evident from (14), his stresslessness refers to Wells's (1990) grade 5 stress in (3), with the other grades regarded as stressed. Therefore, Hayes considers that intervocalic /t/ is aspirated, but not tapped, before Wells's grade 4 stress vowels.

(15) Hayes (1995: 15; italics and bold in the original)

(a) Never Stressed

[ə, ŋ, m]

(b) Variable

[r]

[l] (*pull* [p^hl] vs. *apple* [æp^hl])

[i, ow] / — #, / — V, and in prefixes (*comprehend* = [k^hàmp^hrihénd, k^hàmp^hrəhénd])

[ɪ] / — ŋ

[yu] ~ [yə] / (*occupy* [ákyup^hày, ákyəp^hày])

(c) Always Stressed

[ey, ε, æ, a, ɔ, ʌ, u, ʊ] and [i, ow, ɪ] when not in the context of (b)

Hammond (1999) classifies the aspiration of voiceless plosives and affricates into the following 23 patterns.

(16) Aspiration patterns summarized (Hammond 1999: 227–8)

	$\acute{V} _ \acute{V}$	$\acute{V} _ \check{V}$	$\check{V} _ \acute{V}$	$\check{V} _ \check{V}$
VCV	C ^h	C	C ^h	C
Tense	motel	motor	—	—
Lax	raccoon	pity	—	—
Schwa	—	—	attack	vanity
V{L, N, O}CV	C ^h	C	C ^h	C
Tense	yuletide	fealty	—	—
Lax	alcove	bulky	—	—
Schwa	—	—	until	neckerchief
VC{L, G}V	C ^h	C	C ^h	C
Tense	macron	okra	—	—
Lax	patois	mattress	—	—
Schwa	—	—	attract	discipline
VsCV	C	C	C	C
Tense	—	feisty	—	—
Lax	cascade	rascal	—	—
Schwa	—	—	mesquite	sacristan

Aspiration occurs when the following vowel is strong, which accords with Nespor & Vogel's view in (13b) and Hayes's in (14b). It seems that most researchers consider aspiration occurs in the onset of the following stressed, i.e., unreduced syllable, thus regarding the untapped /t/'s in (7b), such as in *satire*, *protein*, and *centaur* as aspirated and as in the onset. The crucial point is whether the following syllable is stressed or unstressed, but not whether the following syllable is more or less stressed than the preceding.

Thus, Wells's syllabification of /t/, when it is preceded by a syllabic with grade 1 stress, optionally followed by /n/, and followed by one with grade 4 or 5 stress, should be restated as in the following, where a grade 1 or 4 stress syllabic is represented by " \acute{V} " and a grade 5 stress syllabic is represented by " \check{V} ."

(17) The syllabification of /t/ (to be revised later)

(a) /t/ → [t^h] / in the onset

~ \acute{V} [t] \acute{V} ~ satire, protein
~ \acute{V} n[t] \acute{V} ~ centaur

- (b) /t/ → [ɾ] / in the coda
- ~V⁺[t̚]V̄~ litter, liter
- ~V⁺n[t̚]V̄~ winter, painter

3. Pre-fortis clipping and ambisyllabicity

In the previous section, we concluded that the /t/'s in *satire*, *protein*, and *centaur* are aspirated and thus in the onset, while admitting Wells's (2008) view that tapping occurs syllable-finally; however, a question remains as to what motivates Wells to syllabify those /t/'s as the coda of the preceding syllable. It is very likely that he attributes the syllabifications to pre-fortis clipping in (4b), which is rarely considered by other researchers when discussing syllabification.

(18) Pre-fortis clipping (Wells 1990: 78)

Vowels are subject to pre-fortis clipping when followed by a fortis consonant within the same syllable.

Clipped	Not clipped
sh <u>e</u> lf	sh <u>e</u> lve
s <u>e</u> lf, s <u>e</u> lf.ish, d <u>o</u> lph.in	sh <u>e</u> ll#fish, f <u>u</u> n#fair
f <u>e</u> et, f <u>e</u> a.ture	f <u>e</u> e#paying, t <u>e</u> a#kettle
l <u>a</u> p, l <u>a</u> mp, h <u>a</u> pp.y, h <u>a</u> mp.er	sl <u>a</u> b, ch <u>a</u> m.ber

In fact, he states what follows regarding the syllabification of the word *apex*, in which a voiceless plosive is preceded by a grade 1 stress vowel and followed by a grade 4 stress vowel just as in *satire*, also suggesting that there might be dialectal differences.

(19) Wells (1990: 81)

[T]he /p/ in *apex* should go with the first, stressed, syllable: /'eɪp.eks/. This seems correct for RP, though it may well be not correct for some other varieties of English. [...] The /p/ of *apex* does indeed condition pre-fortis clipping of the /eɪ/, and must therefore be in the first syllable.

All his non-clipped examples with a voiceless consonant following a sonorant in (18) are compounds, i.e., containing a morpheme boundary in-between, which is likely to inhibit resyllabification as stated in (9) above. However, one would like to know how this phonetic phenomenon relates to syllabification.

It is considered that pre-fortis clipping is a sort of compensatory shortening in a syllable rhyme: a voiceless consonant, because being a fortis, has a longer duration than its voiced counterpart, resulting in a shorter duration of the rest of the rhyme. On the other hand, aspiration occurs in the onset of a syllable. Would it be possible that a voiceless consonant causes pre-fortis clipping and is itself aspirated at the same time?

If we assume that the /t/'s in *satire*, *protein*, and *centaur* are ambisyllabic, i.e., belong both to the preceding syllable as a coda and to the following syllable as an onset, they will cause pre-fortis clipping and themselves be aspirated simultaneously: clipping is caused by the longer duration of the hold phase and, possibly, the closing phase of the /t/'s, whereas aspiration involves the release phase of the /t/'s. Our revised formulation follows, where [^ht] denotes an ambisyllabic /t/.

(20) The revised syllabification of /t/

(a) /t/ → [t^h] / in the coda and in the onset

~V⁺[^ht]⁺V~ satire, protein

~Vn⁺[^ht]⁺V~ centaur

(b) /t/ → [ɾ] / in the coda

~V⁺[ɾ]⁺V~ litter, liter

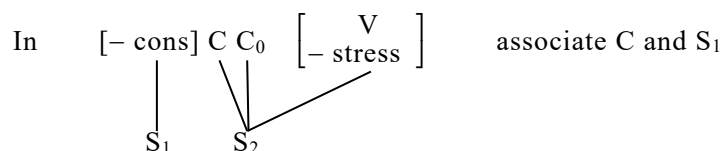
~Vn⁺[ɾ]⁺V~ winter, painter

4. Kahn's (1980) ambisyllabicity and Hammond's (1999) gemination

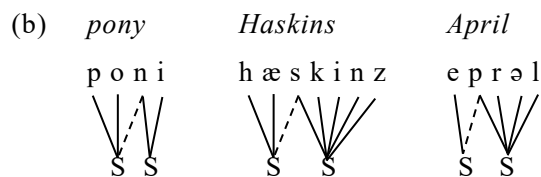
It is important to note that our assumption differs from Kahn's well-known ambisyllabicity. Kahn (1980: 47–8) claims that word-medial ambisyllabicity occurs only when the following syllable is unstressed, specifying that words such as *senile*,³ *rabbi*, and *latex* do not involve ambisyllabic medial consonants. His formulation of ambisyllabicity, alongside his examples, follow, which clearly does not explain pre-fortis clipping found in such words as *satire*.

(21) Word-medial ambisyllabicity in normal rate and faster speech (Kahn 1980: 48, 55)

(a) Rule III



³ Many words ending in the suffix *-ile* such as this actually have an [-əɪ] variant in addition to the [-,aɪ] variant that he seems to mean here.



Hammond (1999: 217–18) adopts a gemination approach to English syllabification, where a double affiliation of a single segment to two adjacent syllables is admitted, and accounts for aspiration in the framework of Optimality Theory. (22) is a table repeated from (16), with his transcriptions containing relevant syllabifications and, for comparison, *LPD*'s transcriptions with syllabifications added.^{4, 5} He uses the constraints in (23) and proposes a ranking in (24).

- (22) Aspiration patterns summarized (Hammond 1999: 227–8; his transcriptions and relevant syllabifications (pp. 228–40) and *LPD*'s transcriptions with syllabifications supplemented in brackets)

	Ů_Ů	Ů_Ů̃	Ů̃_Ů	Ů̃_Ů̃
VCV	C ^h	C	C ^h	C
Tense	motel	motor	—	—
Hammond	[mò.t ^h éɪ]	[mót.ɾ]		—
<i>LPD</i>	[_(,) moʊ.ˈtɛl]	[ˈmoʊt̚.ɹ̚]		
Lax	raccoon	pity	—	—
Hammond	[ræk.k ^h ún]	[pít.i]		
<i>LPD</i>	[ræ.ˈkuːn]	[ˈpɪt̚.i]		
Schwa	—	—	attack	vanity
Hammond			[ə.t ^h æk]	[vænət.i]
<i>LPD</i>			[ə.ˈtæk]	[ˈvæn.ət̚.i]
V{L, N, O}CV	C ^h	C	C ^h	C
Tense	yuletide	fealty	—	—
Hammond	[yúlt.t ^h àyd]	[fílt.i]		
<i>LPD</i>	[ˈjuːl.taɪd]	[ˈfɪː.əl.ti]		

⁴ When *LPD* gives more than one form, the closet one to Hammond's is listed.

⁵ The transcription [ælk.k^h.òv] that he gives for *alcove* (p. 231) is obviously a typographical error. Regarding *until*, the variant [ənt.t^hɪl] should be listed rather than that he gives, [ʌnt.t^hɪl] (p. 232). These errors have been amended.

Lax	alcove	bulky	—	—
Hammond	[ælk.k ^h òv]	[bʌlk.i]		
LPD	['ælk.ouv]	['bʌlk.i]		
Schwa	—	—	until	neckerchief
Hammond			[ənt.t ^h íl]	[nékɾč.əf]
LPD			[ən. 'tɪl]	['nek.ə ^h r.tʃɪf]
VC{L, G}V	C ^h	C	C ^h	C
Tense	macron	okra	—	—
Hammond	[mék.k ^h ràn]	[ók.rə]		
LPD	['meik.ra:n]	['ouk.rə]		
Lax	patois	mattress	—	—
Hammond	[p ^h æt.t ^h wà]	[mæt.rəs]		
LPD	['pæt.wɑ:]	['mætr.əs]		
Schwa	—	—	attract	discipline
Hammond			[ət.t ^h rækt]	[dísəp.lɪn]
LPD			[ə. 'trækt]	['dɪs.əp.lɪn]
VsCV	C	C	C	C
Tense	—	feisty	—	—
Hammond		[fáyst.i]		
LPD		['faɪst.i]		
Lax	cascade	rascal	—	—
Hammond	[kæs.skéd]	[ræsk.ɪ]		
LPD	[(,)kæ.skeɪd]	['ræsk.əɪ]		
Schwa	—	—	mesquite	sacristan
Hammond			[məs.skít]	[sækrəst.ən]
LPD			[mə. 'ski:t]	['sæk.rəst.ən]

(23) Relevant constraints on syllabification in English (Hammond 1999: 218–21)

- (a) BIMORAICITY
Syllables must be bimoraic.
- (b) ONSET
Syllables must have onsets.
- (c) MAX-CODA
Affiliate as many consonants to the left as possible when there is more than one.
- (d) NOGEMINATES
Consonants can occupy no more than one syllabic position.

- (e) NOONSET
A stressless syllable has no onset.
- (f) ASPIRATION
Voiceless stops and affricates are aspirated syllable-initially.

(24) A proposed ranking (Hammond 1999: 227, 239)

$$\text{NOONSET} \gg \text{ONSET} \gg \left\{ \begin{array}{c} \text{MAX-CODA} \\ \text{BIMORAICITY} \end{array} \right\} \gg \left\{ \begin{array}{c} \text{ASPIRATION} \\ \text{NOGEMINATES} \end{array} \right\}$$

When a consonant is preceded by a stressed syllable and followed by an unstressed syllable, it is syllabified into the coda of the preceding, stressed syllable regardless of whether the preceding vowel is tense as in *motor*, lax as in *pity*, or schwa as in *discipline*. These syllabifications accord both with Wells's (1990) and with ours in (20b), thus /t/ tapping appropriately explained.

The following are all the geminate cases extracted from (22), with two non-geminated cases added for comparison.

(25) Geminates created by Hammond's syllabification (boxes added)

	Geminated	Cf.	Not geminated
(a)	raccoon [ræ ^h k.k ún]	(a')	motel [mò ^h t él]
(b)	yuletide [yúlt.t ^h àyd]		
(c)	alcove [ælk.k ^h òv]		
(d)	until [ənt.t ^h íl]		
(e)	macron [mék.k ^h ràn]		
(f)	patois [p ^h æt.t ^h wà]		
(g)	cascade [kæs.skéd]		
(h)	attract [ət. t ^h rækt]	(h')	attack [ət. t ^h æk]
(i)	mesquite [məs.skít]		

When a voiceless stop occurs between two stressed vowels, it is geminated after a lax vowel to satisfy BIMORAICITY, which outranks NOGEMINATES, but is not after a tense vowel (25a). When a voiceless stop is preceded or followed by another consonant, it is geminated irrespective of what the preceding vowel is (25b–i), so as to satisfy MAX-CODA, also outranking NOGEMINATES; MAX-CODA does not apply when there is only one intervocalic consonant as in *attack*.

It may appear that Hammond's gemination is similar to our ambisyllabicity; but he does not aim to account for pre-fortis clipping. He employs gemination so that BIMORAICITY will always be satisfied, which in this sense is comparable to *CEPD*'s syllabification principle quoted in (1) above.

Below is a comparison of the syllabifications in (25) with their *LPD* equivalents.

(26) Comparison of the two syllabifications (boxes added)

	Hammond	<i>LPD</i>
(a) raccoon	[ræ ^h <u>k.k</u> ún]	[ræ. ^h <u>k</u> u:n]
(a') motel	[mò.t ^h él]	[_(,) moov. ^h tel]
(b) yuletide	[yúl <u>t.t</u> áyð]	[^h 'ju:l. <u>t</u> aid] ⁶
(c) alcove	[æ <u>l.k.k</u> òv]	[^h 'æ <u>l.k</u> .oov]
(d) until	[ən <u>t.t</u> í]	[ən. ^h <u>t</u> il]
(e) macron	[mé <u>k.k</u> ràn]	[^h 'mei <u>k</u> .ra:n]
(f) patois	[p ^h æ <u>t.t</u> wà]	[^h 'pæ <u>t</u> .wa:]
(g) cascade	[kæ <u>s.s</u> kéd]	[_(,) kæ <u>s</u> keid]
(h) attract	[ə <u>t.t</u> rækt]	[ə. ^h 'trækt]
(h') attack	[ə.t ^h æk]	[ə. ^h 'tæk]
(i) mesquite	[mə <u>s.s</u> kít]	[mə. ^h 'ski:t]

Satire, *protein*, and *centaur*, for which we posited ambisyllabicity as in (20a), are classified into (26a, a', c), respectively. Hammond's gemination can explain pre-fortis clipping in *satire* and *centaur* but cannot explain that in *protein*, where the /t/ is not geminated.

5. Conclusion

We have argued that voiceless stops preceded by a grade 1 stress syllabic and followed by a grade 4 stress syllabic are ambisyllabic in that they are aspirated and simultaneously cause pre-fortis clipping. This dual nature of voiceless stops is also found when they are preceded by an approximant or nasal consonant as in *alcove* (26c), or when they are followed by an approximant consonant as in *macron* and *patois* (26e, f), where aspiration is usually regarded as realized as the voicelessness of the following approximant.

⁶ *Yuletide* is clearly a compound, thus the morpheme boundary inhibiting resyllabification in *LPD*'s transcription. It seems that there are very few monomorphemic words, if any, classified here.

However, problems remain as to whether the rest of the preceding rhyme is clipped or not when voiceless stops are followed by a grade 1 stress syllabic and preceded by a grade 2 stress syllabic as in *raccoon* and *motel* (26a, a') or by a grade 5 stress syllabic as in *until*, *attract*, and *attack* (26d, h, h'), because *LPD* syllabifies these voiceless stops as the onset of the following syllable according to the principle in (2a) above. In like fashion, it is not clear whether the first vowels are clipped or not in *cascade* and *mesquite* (26g, i) while the /k/'s are unaspirated as *LPD*'s syllabifications indicate. Phonetic surveys will resolve the problems.

REFERENCES

- Hammond, Michael. 1999. *The phonology of English: A prosodic optimality-theoretic approach* (The phonology of the world's languages). Oxford: Oxford University Press.
- Hayes, Bruce. 1995. *Metrical stress theory: Principles and case studies*. Chicago: The University of Chicago Press.
- Jones, Daniel. 2011. *Cambridge English Pronouncing Dictionary*, 18th edn. Ed. by Peter Roach, Jane Setter, & John Esling. Cambridge: Cambridge University Press.
- Kahn, Daniel. 1980. *Syllable-based generalizations in English phonology* (Routledge Library Editions: The English language, vol. 15). London & New York: Routledge.
- Myers, Schott. 1987. Vowel shortening in English. *Natural Language and Linguistic Theory* 5(4), 485–518.
- Nespor, Marina & Irene Vogel. 1986. *Prosodic phonology* (Studies in generative grammar 28). Dordrecht: Foris Publications.
- Upton, Clive & William A. Kretzschmar, Jr. 2017. *The Routledge Dictionary of Pronunciation for Current English*, 2nd edn. London & New York: Routledge.
- Wells, J. C. 1990. Syllabification and allophony. In Ramsaran, Susan (ed.), *Studies in the pronunciation of English: A commemorative volume in honour of A. C. Gimson*, 76–86. London: Routledge.
- Wells, J. C. 2008. *Longman Pronunciation Dictionary*, 3rd edn. London: Pearson Education.