

The Appendix

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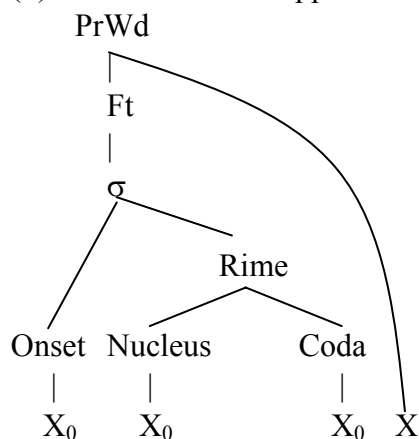
1. Introduction

Work on phonology since the time of the structuralists, and especially since the advent of Chomsky and Halle in the 1950s, has been characterized by tension between on the one hand formalists, who favor abstraction, formal elegance, and explanatory adequacy, and on the other functionalists, who favor concreteness and (sometimes) descriptive adequacy. During MIT's linguistic reign, which coincided with the tenures of Halle and Chomsky from the mid 50s to the mid 90s, theories of rules and representations attained a high level of intricacy, sophistication, and breadth of empirical coverage, but also a degree of abstraction that grated against some of the more functionally inclined. The rise in 1993 of Optimality Theory, with its emphasis on naturalness and avoidance of abstraction, especially abstract representational stages, opened the door for the return to the linguistic mainstream of phoneticians, functionalists, and other fans of surface-oriented approaches. A good example of this dynamic is syllable theory, which by 1993 had for many phonologists become highly articulated and abstract, with numerous elements that were not readily apparent in the acoustic signal such as syllables themselves, Rimes and Nuclear heads, sonority, and unsyllabified segments, as well as principles that were often not surface-true, such as Final Consonant Extraprosodicity and the Sonority Sequencing Principle. Since 1993 most phonologists have favored a simple moraic conception of the syllable that remains blissfully ignorant of the phenomena that gave rise to its more intricate predecessor, and some, notably Ohala and to a lesser extent Steriade, have gone so far as to advocate eliminating the syllable and its attendant baggage altogether, citing the absence of clear phonetic correlates for syllable breaks and constituents (Nolan 1994), inconsistency of native speaker intuitions regarding syllabification, and so on. On this matter I side with Anderson (1982:546), who states that "if we ask for a justification of the notion of phonetic segments, we see quickly that the facts of acoustics and of articulatory co-articulation make it quite impossible to segment and identify the speech stream directly in terms of such units. Their justification comes not from our ability to find them clearly in the physical facts of speech, but rather (like any other theoretical entity) from the degree of coherence and order they bring to our understanding of those facts. We describe speech in terms of an ideal string of segments and the complex and highly-structured ways in which the observed facts relate to this representation. Similarly, the justification for including syllable structure in our representation cannot possibly be expected to come directly from the observable facts of speech, but rather must derive from the augmentation in our understanding of those facts that results from the assumption of its presence."

In this paper I will show how careful examination of a wide range of complex internal and external linguistic facts reveals interesting abstract properties of the phonology. More specifically, I will be dealing with the behavior and representational status of consonants that do not fit happily into canonical syllable templates, such as the *s* in *stop*, the *dr* in French *mordre*, or the *ktkt* in Klamath *gankənktktdamna*. Many phonologists have suggested that such consonants do not in fact attach to syllables in the normal way (at least at some point in the derivation), but

such stipulations are normally formulated on an ad hoc, language-specific basis, and without regard for the behavior of other phenomena that also suggest the existence of extrasyllabicity, but in different ways. My purpose here is to survey the wide range of linguistic evidence and arguments that have been adduced in support of extrasyllabicity, and synthesize a representational theory that accounts for the subset of these that should be accounted for. We will see that some of the more famous phenomena cited as evidence for the appendix¹ are not actually probative, but on the basis of ample other evidence I will suggest that phonological segments can attach to prosodic nodes higher than the syllable, as in (1), and that the specific locus of attachment can vary both between and within languages.

(1) A word-final appendix



1.1. Explicanda

The facts to be explained range from the phonological—including sonority sequencing, epenthesis, and prosodic phenomena such as stress assignment, lengthening and shortening, reduplication, and infixation—to the morphological (syllable-counting rules, truncation), to external linguistic phenomena involving borrowing, language games, child language, and psycholinguistic experiments. Why for example do children and aphasics treat sC and OR clusters differently? Why are Cairene Arabic CVC syllables heavy in medial but not final position? Conversely, some phenomena commonly bundled into this inquiry are illusory and should *not* be explained, such as the limitation to morphemes (contra Marlo (to appear)) and to the word periphery (contra Rubach and Booij 1990, McCarthy 2001, Scheer 2004, and most work on extrasyllabicity), the size restriction to one segment per extrasyllabic sequence (contra Scheer 2004), and the restriction to coronals or other specific subsets of the phonemic inventory (contra Kiparsky 2003 and others). As we shall see, none of these generalizations withstands cross-linguistic scrutiny. Cho and King 2003:186 suggest that arguments based on static phonotactic distribution rather than phonological processes may be misleading as well. Many researchers have also suggested that extrasyllabic sequences invariably involve what would

¹ Also sometimes referred to as an affix (Fujimura and Lovins 1982, Treiman et al. 1992), prefix (xx), termination (Fudge 1969), satellite (Cairns and Feinstein 1982), adjunct (Gierut 1999), semisyllable (Kiparsky 2003), or extrasyllabic sequence (xx).

constitute violations of the Sonority Sequencing Principle if they were adjoined to the adjacent syllabic constituent, but Treiman et al. 1992 have shown that this is not the case for English s + sonorant clusters, and the same holds for Nxaʔamxcin OR clusters, English and Cairene Arabic final consonants, and so on. The key in all cases of the first two types is the inventory of possible core syllables, whereas in the latter two a separate principle of Final Consonant Extraprosodicity is involved.

Once we have weeded out these illusory characteristics, extraprosodic segments can be seen to share the properties in (2):

- (2) properties of extrasyllabic segments (based in part on Kiparsky 2003:156)
 - a. prosodically invisible
 - b. relatively loose phonetic and phonological bonds with neighboring segments
 - c. can be less sonorous than syllable nuclei
 - d. do not appear to obey the phonotactic constraints that otherwise hold over (core) syllables in the language

How can one best account for these properties? Many theories have been proposed, as summarized in (3), but to the best of my knowledge they have yet to be systematically compared, and the phenomena on which they are based have yet to be considered as a unified set.

- (3) possible treatments of these consonant sequences
 - a. **COMPLEX MARGINS:** more complex onset/coda clusters allowed at edges of certain prosodic constituents
 - b. **DEGENERATE SYLLABLES:** odd segments belong to syllables lacking nuclei and/or moras
 - c. **APPENDICES:** attached directly to higher-level prosodic node (normally PrWd)
 - d. **STRAY SEGMENTS:** not attached to anything
 - e. **RULE ORDERING:** segments violating sonority principle can plausibly be analysed as extrasyllabic at the levels at which the sonority principle is enforced (Kiparsky 1981, Clements 1992:64)

Theory (3a) is the most concrete of these options in the sense that it requires no new formal elements or intermediate representational steps. It moreover can be made to follow from a modified form of Clements' 1992 Dispersion Principle, a sonority-driven algorithm for computing the relative complexity of syllable margins represented in (4) and (5).

- (4) the Dispersion Principle (Clements 1992):
 - a. the preferred initial demisyllable maximizes sonority dispersion
 - b. the preferred final demisyllable minimizes sonority dispersion.
 - c. $D = \sum_{i=1 \text{ to } m} 1/d_i^2$ (where m is the number of segments in the demisyllable, including nonadjacent pairs)

(5) complexity rankings for demisyllables:

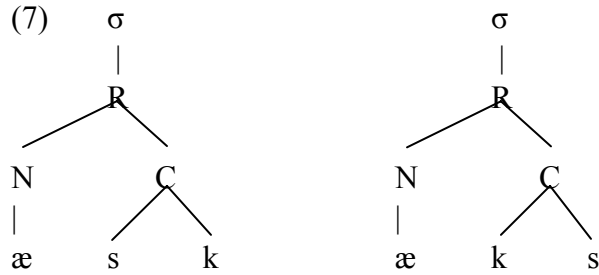
initial		final	
	D		D
OV	.06	V	—
		VGL	2.25
		VLN, VGN	1.36
		VNO, VGO	1.17
NV	.11	VG	1.00
LV	.25	VL	.25
OLV	.56	VLO	.56
GV	1.00	VN	.11
ONV, OGV	1.17		
NLV, NGV	1.36		
LGV	2.25		
V	—	VO	.06

By refining the formula in (4c) to distinguish in sonority between obstruents and fricatives—as we need to already for languages like Imdlawn Tachlhiyt Berber—and to distinguish positive values for rising sonority and negative values for falling sonority, we can generate values for clusters that violate the SSP, not just well-behaved clusters of the type in (5). The extended complexity hierarchy resulting from these modifications would look something like (6) for codas.

(6) revised complexity hierarchy for codas

most complex	...
	OL
	...
	stop-fricative
	OO
	GL
	LN, GN
	NO, GO
	G
	L
	LO
	N
least complex	O

In this scheme, the words *ask* and *axe* would have the representations in (7), wherein both clusters are assigned to complex codas, but the former is less complex than the latter.



This analysis encounters the problems in (8); most importantly, as in (8b), it runs afoul of the fact that sT clusters appear to be *less* complex than canonical onset clusters, as shown by Calabrese and Romani's (1998:98) finding that Italian aphasics tend to simplify complex onsets but not sT clusters, Gierut's (1999) finding that children learn sT clusters faster than complex onsets, and the existence of languages like Acoma that allow sC- clusters but not OC- clusters (Miller 1965, Goad and Rose 2003).

- (8) Problems with the complex onset/nucleus analysis
- a. **DISTRIBUTION:** predicts that such sequences should be possible in any syllable, not just peripherally
 - b. **MARKEDNESS** (see Morelli 2003 for further discussion of sT as least-marked cluster):
 - i. has trouble with Calabrese and Romani's 1998:98 observation that aphasic errors affect sonority in complex onsets but don't affect appendices
 - ii. Gierut 1999: children with delayed onset of speech learn sT clusters faster than complex onsets
 - iii.. languages like Acoma that allow sC- clusters but not OC- clusters (Miller 1965, Goad and Rose 2003)
 - iv. Pima infixing reduplication creates less marked syllables (Riggle 2003), but this includes forms like kosvuR → koks.vuR 'cocoons', kuʃva → kukʃ.va 'lower skulls'
 - c. **PERCEPTION:** sT- and -sT sequences have a perceptual advantage over onset clusters that obey the SSP (Engstrand and Ericsson 1999)

Based on the number and severity of these problems, it is reasonable to propose that the quirky segments under consideration do not in fact form tautosyllabic clusters with their more well-behaved neighbors.

The same arguments can be levelled against the hypothesis that our quirky consonants form complex monosegments with their neighbors, as has been proposed by Fudge 1969, Selkirk 1982, Duanmu 2002, and Broselow in various publications.

The notion that such clusters are heterosyllabic is buttressed by ample phonetic and phonological evidence, as we'll see for French and several other languages below.

In order to deal with these facts, many linguists have proposed that the quirky segments instead attach to a higher node in the prosodic hierarchy, as what I will henceforth call an Appendix. Until recently this was the favored strategy of phonologists; a representative sampling is provided in (9).

(9) phonologists who have used the notion of Appendix:

Haugen 1956?, Fujimura 1979, Kiparsky 1979, Halle and Vergnaud 1980, Fujimura and Lovins 1982, Steriade 1982, Vennemann 1982, Clements and Keyser 1983, Trommelen 1984, Van der Hulst 1984, Charette 1985, Kager and Zonneveld 1985, Levin 1985, de Haas 1986, Vennemann 1988, Wiese 1988, Trommelen and Zonneveld 1989, Davis 1990, Goldsmith 1990, Rubach and Booij 1990, Giegerich 1992, Hall 1992, Harris 1994, Vaux 1994, 1998, 2003, Fikkert 1994, Kenstowicz 1994, Sherer 1994, Spaelti 1994, Berens 1996, Spencer 1996:99, Grijzenhout and Joppen 1998, Siptar and Törkenczy 2000, McCarthy 2001:23, Duanmu 2002, Törkenczy 2003, etc. etc.

Supporters of the appendix generally maintain that the SSP holds only over the syllable; appendices, since they do not belong to syllables, are immune to its requirements (cf. Vennemann 1988). Appendices moreover are constructed by the syllabification algorithm only as a last resort (Törkenczy 2003); many derivational phonologists combine this postulate with rule ordering to get certain rules to ignore appendices, as with English Shortening.

2. Evidence for the appendix

Some researchers have been reluctant to accept the appendix hypothesis, because it violates the Strict Layering Hypothesis, requires a formal addition to the set of representational primitives provided by the core syllabification algorithm, and sometimes seems to contradict native-speaker intuitions about syllable affiliations. Why then do we need such a formal device? Many different sorts of evidence, both internal and external, have been adduced in its defense; in the next part of this paper I survey the range of phenomena most commonly invoked.

2.1. External evidence

In addition to the internal phonological and morphological evidence, which I find the most compelling and will therefore focus on at the end of this paper, there is a host of external evidence for the appendix in the domains of child and aphasic speech production, adult speech errors, psycholinguistic experiments, language games, loanwords, and metrical scansion.

2.1.1. Child language

Numerous studies have found, for example, that a significant subset of children acquiring English, Dutch, and German go through a stage where their treatment of initial clusters displays what Goad and Rose call the Head Pattern, wherein s+stop and stop+sonorant clusters retain the stop but stop+sonorant clusters retain the sonorant, as depicted in (10).

(10) The Head Pattern (Goad and Rose 2003)

- a. OR → O, sO → O, sR → R
- b. Dutch (Fikkert 1994, Gilbers and Den Ouden 1994), English (Velten 1943, Smith 1973), German (Elsen 1991, Grijzenhout and Joppen-Hellwig 2002)
 - i. English blo → bo, spun → pun (Smith 1973)
 - ii. Dutch stoel → [tuw], klok → [kok], slapen → [sapə] (Gilbers and Den Ouden 1994)

Spencer 1986 and Goad and Rose 2003 interpret this in terms of a preference for structural heads to survive, which relies on a theory of syllable structure in which all initial CR clusters are onsets but the /s/ in sO clusters is an appendix.

2.1.2. Aphasic speech

Calabrese and Romani 1998 find similar patterns in the speech of the Italian aphasic DB, who tends to simplify complex onsets (11) but makes only one error with sT clusters out of 391 initial clusters of this type.

(11) Percentages of deletion errors according to cluster type, ranked from least to most complex according to Clements' hierarchy (from Calabrese and Romani 1998)

	cluster type	% errors	#errors/chances
a.	OL	2.1	24/1161
b.	OG	7.0	61/865
c.	NG	16.3	17/104
d.	LG	34.4	136/396

As mentioned earlier, the data from child and aphasic speech production suggest that s+stop clusters are qualitatively different from initial clusters of rising sonority, which we can straightforwardly capture by assuming that the former are heterosyllabic whereas the latter are tautosyllabic.

These markedness-based considerations lead to the same conclusion as do several phenomena involving segmentation of words into linear chunks.

2.1.3. Language games

Pig Latin, for example, involves what superficially appears to be movement of one or more segments from the left edge of a word to the right, followed by suffixation of <-ay>. Nevins and Vaux's survey of 442 speakers of Pig Latin revealed two main dialects with respect to the amount of material targeted: dialect 1 targets the entire prevocalic cluster (12a), whereas dialect 2 targets only the first consonant in a cluster (12b). Interestingly, though, there are two dialects that treat initial clusters of rising and falling sonority differently: dialect 3 moves falling clusters but not rising clusters in their entirety (12c), and dialect 4 does the opposite (12d).

(12) Pig Latin (Nevins and Vaux 2003; *struck* was not the form used in the survey)

a.	Dialect 1	truck → uck-tr-ay struck → uck-str-ay	74%	325/442
b.	Dialect 2	truck → ruck-t-ay struck → truck-s-ay	10%	46/442
c.	Dialect 3	truck → ruck-t-ay struck → uck-str-ay	4%	17/442
d.	Dialect 4	truck → uck-tr-ay struck → truck-s-ay	2%	7/442

Additionally, preliminary results from a follow-up study show that many speakers of Dialect 1 have gradient intuitions for non-optimal candidates as well, preferring truck-s-ay over ruck-t-ay. Both this result and the behavior of Dialect 4 fit well with the hypothesis that initial sT clusters are heterosyllabic²; for example, Dialect 4 targets a word-initial consonantal constituent, which is the appendix *s* in *struck* and the onset *tr* in *truck*.

2.1.4. Psycholinguistic evidence

A wide range of psycholinguistic experiments manipulating word chunks support the same division. Treiman, Gross, and Cwikel-Glavin 1992 for instance found in a battery of syllable manipulation tasks (summarized in (13)) that English speakers treat sT and sR clusters but not TR clusters as heterosyllabic, and suggested on this basis that initial s-clusters are syllabified with an appendix.

(13) Treiman's syllable division tasks

a. hyphenation

words: es-tate 69% vs. Ma-drid 85% (Treiman and Zukowski 1990)

nonwords: nus-peem 68% vs. nu-fleem 62% (Treiman et al. 1992)

b. oral syllabification task: say each "part" of the stimulus by itself

words: similar findings to (5a) (Treiman and Zukowski 1990)

nonwords: nus.peem 55% vs. nu.fleem 46% (Treiman et al. 1992)

c. oral pronunciation of nonwords, testing vowel reduction (Treiman et al. 1992)

basic idea: strong initial syllables protected from reduction (Fudge 1984, Hayes 1985)

wospeem: V₁ unstressed and full 22%, unstressed and reduced 4%

wofleem: V₁ unstressed and full 15%, unstressed and reduced 11%

generalization: reduction less common for s clusters than for non-s clusters (395)

Similarly, Treiman and Fowler 1991 used a speeded task in which people had to move just the first consonant of a consonant cluster. They found that s clusters were easier to break up than clusters of rising sonority. Finally, Stemberger and Treiman 1986 found that s is more likely to be lost in speech errors than are the first consonants of initial clusters of rising sonority.

All of these psycholinguistic results support the hypothesis that initial s+stop clusters are heterosyllabic in English.

2.1.5. Loan phonology

The same result appears in studies of Japanese, Setswana, and Swahili borrowings from English by Batibo 1996 and Lukusa 1999, who found that appendices but not other members of consonant clusters can be deleted under certain conditions.

2.1.6. Metrical scansion

And in the domain of metrical scansion, it is well known at least since Steriade 1982 that Classical Greek treats non-canonical clusters such as gn, sm, and kt as heterosyllabic, even in

² I believe that Dialect 3 is consistent as well, though how this is so is less immediately obvious.

word-initial position. The metrical facts of course cannot reveal anything about the syllabification of such clusters in absolute initial position, but their behavior in other positions is consistent with their initial members being appendices, especially when considered in tandem with the arguments in (8) against them being tautosyllabic. One can add to this the fact that the rule that debuccalizes s to h in syllable-initial position doesn't apply in #sT clusters (spero, etc.; Kenstowicz 1994:302).

(14) Metrical scansion in Greek (Steriade 1982, Green 2003)

- a. CV scans as light, CVC as heavy
- b. gn, sm, etc. scan as heterosyllabic

2.2. Internal evidence

Even more persuasive than this suite of external evidence, though, is the wide range of internal phonetic, phonological, and morphophonological evidence supporting the existence of appendices. This evidence ranges from coarticulation to weight-based phenomena such as shortening, lengthening, and stress assignment to phonological rules sensitive to syllable affiliation or position to prosodic morphological processes such as reduplication, infixation, and truncation.

2.2.1. Phonetics

Two sorts of phonetic arguments have been adduced in support of extrasyllabicity, both involving the degree of cohesion between neighboring segments. Huffman 1972 and Lovins 1977 found that falling-sonority clusters in Cambodian have a “weak intruded vocalism” between their segments, suggesting a looser connection of the outer segments of these clusters to the rest of the syllable (Huffman 1972, Lovins 1977, Bell and Saka 1983). More persuasive is Rialland's finding that French extrasyllabic consonants don't show the same degree of coarticulation with following segments as onsets do (1994:136). In French, onset but not coda consonants coarticulate with a tautosyllabic vowel, whether or not other consonants intervene, so for example in forms like ukɛi, k shows significant effects from the i, despite the intervening liquid (Zerling 1981, Vaissière et al. 1988, Rialland 1994:144). Crucially, comparable coarticulation does not appear with appendices, as with the k in knout [k.nut].

(15) Coarticulation in French

- a. onset but not coda consonants coarticulate with a tautosyllabic vowel, whether or not other consonants intervene (Zerling 1981, Vaissière et al. 1988, Rialland 1994:144)
- b. coarticulation: oucri [u.kɛi]
- c. no coarticulation: knout [k.nut]

The French facts make good sense if we assume that coarticulation effects of the relevant sort are syllable-bound, and segments like the k in knout are extrasyllabic.

2.2.2. Phonotactics and sonority

Moving to phonological arguments, one of the favorite arguments for appendices in the literature involves phonotactics. Such arguments are closely linked to the theory of the sonority hierarchy and the sonority sequencing principle. As Blevins 1995:240 observes for Klamath, “attested word-initial clusters do not appear to be constrained by any version of the SSG, as they include sonorant-obstruent clusters...rather than weaken the theory of syllable structure to allow blatant sonority violations, word-initial segments which cannot be syllabified are extraprosodic.”

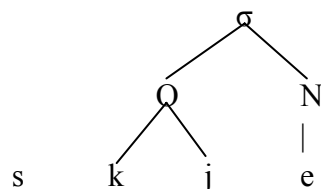
Many languages allow more complex clusters (in terms of sonority sequencing) at word edges; Blevins 1995:219 cites Totonac, English, Nisqually, Gilyak, Tamazight Berber, Cairene Arabic, Spanish, Dakota, Italian, and Mokilese as allowing more complex final clusters, and Klamath, Sedang, Italian, and Piro as allowing more complex initial clusters; this list can be expanded ad infinitum. Arguments for the existence of appendices based on phonotactic distribution include Chierchia 1983 for Italian, Green 2003 for Irish, Pierrehumbert 1994 for English, and many more.

2.2.3. Phonological rules

Static phonotactics are not entirely convincing; evidence of active phonological processes sensitive to differences in prosodic structure are more persuasive. Rialland 1994 provides a convincing array of such cases for French, summarized in (16) – (21). She shows that glide formation optionally applies to the first of two vowels if the onset contains only one consonant; the fact that forms like *skier* and *ptyaline* allow glide formation shows that their initial consonant is not part of the same syllable as the glide.

- (16) French glide formation (Rialland 1994:137)
- a. Optionally applies to first of two vowels if the Onset has only one consonant
 - b. French allows only CL and CG complex Onsets
 - c. 2C onset *lier* ‘to bind’ [lje] ~ [lije], *nouer* ‘to tie’ [nwe] ~ [nue]
 - d. 3C onset *plier* ‘to fold’ [plije] not *[plje]
 - e. appendix *skier* ‘to ski’ [skje] ~ [skije], *ptyaline* ‘ptyalin’ [ptjalin] ~ [ptijalin]

- (17) Rialland’s representation of extrasyllabicity in *skier* (1994:138)



Laxing changes schwa and e to ε in closed syllables, as in (18); the fact that sC clusters normally trigger laxing suggests that they are not tautosyllabic, and is consistent with the extrasyllabic analysis in (17).

- (18) French closed syllable laxing (Rialland 1994:139-40)
- ə and e occur only in open syllables; → ε in closed syllable (Selkirk 1972, Dell 1985)
 - OL clusters form onsets (*étriqué* ‘tight’ [e.tʁi.ke]); sC clusters do not (*espérer* ‘hope’ [εs.pe.ʁε]); but NB special behavior of prefixes, as in *restériliser* (Dell 1995:10))
 - medial C in CCC and CCCL clusters is extrasyllabic (Rialland 1994:140) [NB Dell 1995 says the s goes in the following onset in such cases]
 - expert* [εk.s.pɛʁ], *expier* ‘to expiate’ [εk.s.pje]

Third, word-final liquids can optionally delete before a consonant or pause, but only when syllabified as appendices, as in *arbre* (Dell 1985, Rialland 1994:149). Fourth, the optional rule of schwa deletion between identical segments followed by a liquid or glide, as in (19a), is not allowed before extrasyllabic consonants, as in (19b).

- (19) French schwa deletion with geminates (Rialland 1994:153)
- optional schwa deletion allowed / C₁C₁(L,G)
 - il viendra c(e) soir [...sswɔʁ]
 - il n’y a pas d(e) drap [...paddʁa]
 - not allowed before extrasyllabic consonant
 - *il n’a jamais pratiqué c(e) sport * [...sspɔʁ]

Fifth, French contrasts single consonants with their false geminate counterparts at word boundaries, as shown in (20), but does not allow this contrast when the second member is extrasyllabic.

- (20) French false geminates at word boundary (Rialland 1994:154)
- / _ V laisse s’établir [lesse...]
 - / _ CL, CG un bac crevé [...bakkʁə...]
 - disallowed before extrasyllabic C *laisse strier* doesn’t contrast with *laisse trier*

Finally, the phoneme /r/ is realized as a glide in coda position, as in (21), so the fact that the r in (21b) surfaces as a uvular trill, not a glide, suggests that it is not a coda. Since French phonotactics prevent it from resyllabifying into the onset of the following syllable, it must be extrasyllabic.

- (21) Allophones of French /r/ (Rialland 1994:155)
- coda /r/ realized as glide (Simon 1967)
 - uvular trill, not glide, in *on r(e)commence* ‘shall we start again?’ [ɔ̃ʁkɔmãs]
 - can’t resyllabify as onset of following syllable, therefore must be extrasyllabic

2.2.2. Syllable weight

Many prosodic phenomena in various languages support Rialland’s arguments for the appendix, such as Italian and Icelandic vowel lengthening in stressed open syllables (Chierchia 1983; Harris and Gussmann 200x, Green 2003), the latter of which is schematized in (22).

- (22) Icelandic (Green 2003, from earlier sources)
- a. Metrical lengthening requires stressed (i.e. initial) open syllable to contain long vowel.
 - b. Single final consonants and some clusters do not count for this computation (Harris and Gussmann 200x, Green 2003)
 - c. *knaiva* ‘to project’ vs. *εk.na* ‘to bait’
 - d. *bε:.^hrɪ* ‘better’ vs. *pan.ta* ‘order’
 - e. only steep-rising clusters of s or stop + r or glide are tautosyllabic internally
 - f. all others that are permitted initially (e.g. s or stop + l/n; fricative + sonorant; s + stop; nasal or liquid + j) are heterosyllabic internally.
 - g. most final consonant clusters do not count: *t^ha:l* ‘number’, *sny:pr* ‘scolding’, etc.
 - h. Thráinsson 1994:150: “either we need a more sophisticated theory of syllables, namely one that does not consider final consonants and certain final consonant clusters part of the preceding syllable in some sense, or the length of stressed vowels in Icelandic does not depend on syllable boundaries.”

Conversely, English and Wolof closed syllable shortening don’t apply in final syllables, suggesting that word-final consonant sequences are extrasyllabic in these languages, at least at the stage in the derivation where shortening applies (Kenstowicz 1994, Charette 1985).

2.2.3. Rules that refer to syllable affiliation or position

Rules that refer to syllable affiliation or position can also sometimes be used to identify appendices. The most famous case of this type is Italian *radoppamiento sintattico*, but this turns out to be problematic for various reasons and hence won’t be considered here (see McCrary 2002 for further details). A better example is aspiration in Nxaʔamxcin, which as in other Salish languages applies to voiceless stops everywhere but in syllable onsets (23a). The fact that the initial p in ‘spit’ in (23b) aspirates suggests that it is not in the onset with the following unaspirated t, from which we can conclude that it must be extrasyllabic. All of the facts in (23) fall out nicely if one assumes maximal CVC syllables + extrasyllabicity.

- (23) Nxaʔamxcin aspiration (Czaykowska-Higgins and Willett 1997:405)
- a. stops aspirate everywhere but in onset
 - b. *p^htiχ^w* spit
k^ht^hpanaʔəʔan I covered it
 - c. *ʔarasik^{wh}* turtle
t^ʔək^{wh}p^h burst
q^wup^hsaʔ great-great-grandparent/child

Davidson-Nielsen 1974 has suggested that the English aspiration rule can also be used as a diagnostic for syllabification, under the assumption that it targets syllable-initial voiceless stops (cf. Kahn 1976). If, for example, the /s/ of *fastidious* belongs to the first syllable, then the t should aspirate since it begins the second syllable. He concludes that since such t’s are normally

unaspirated, these words are divided before the s.³ There are a few problems with this analysis, though. First, if Fudge 1984 and others are right that English unstressed vowel reduction happens in open but not closed syllables, then the s in *fastidious*, *gastronomy*, etc. should attach to the preceding syllable. Second, as we can see in (24), aspiration appears to be the elsewhere case in English, failing to surface on voiceless stops only when overridden by more specific rules like flapping and glottalization. Were it not the elsewhere case, we would have trouble deriving cases of non-syllable-initial aspiration like in (24b).

- (24) English aspiration
- a. p^hət^hero
 - b. hæʔ^h ~ hæʔt^ʔ
 - c. dɪ.stend vs. dɪs.t^hest
 - d. wɪs.k^hʌn.sʌ vs. wə.skʌn.sʌ

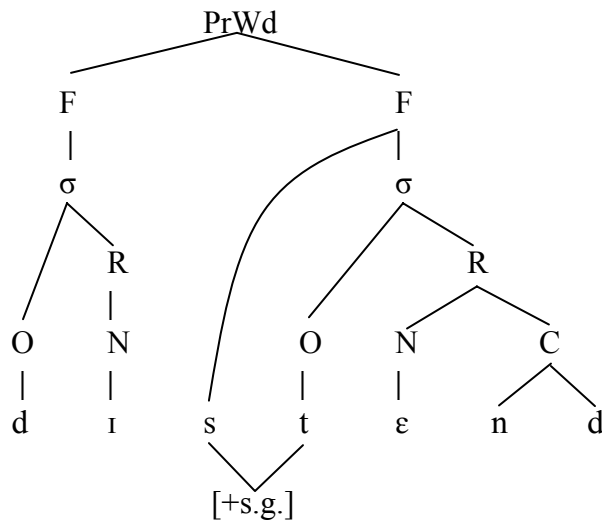
Third, Kim 1970 demonstrated that the voiceless stop in sT clusters is actually produced with [spread glottis], even though this articulatory specification does not produce its normal acoustic correlate, aspiration. If the voiceless stops in words like *ski* actually undergo the aspiration rule, then we cannot use its effects as evidence for syllabic affiliation.

The picture is further complicated by the data in (24c-d), which show that (contrary to popular belief) stops sometimes do show up with acoustic aspiration after s, as in *distaste* and exophonic *Wisconsin*. It appears that there is a non-trivial mismatch between the phonological feature [spread glottis] and its primary acoustic correlate, aspiration. I suggest a resolution along the lines of Iverson and Salmons 1995, wherein all of the stops are specified as [+sg] when not superseded by competing phonological rules, and this feature specification surfaces in different guises according to the prosodic context. Specifically, let us assume the syllabifications in (24c-d) and the representations in (25)—in which with bound morphemes s adjoins to the foot and shares its [sg] specification with the following stop—and let us postulate that one of the phonetic realization rules for [sg] in English is that it surfaces as degree-zero aspiration (i.e. no aspiration) when preceded by tautopodic s. With these assumptions, one should find appendix s only at the beginnings of words or of stressed syllables. It is not clear how one could derive this intricate set of facts without assuming that s can be an appendix.

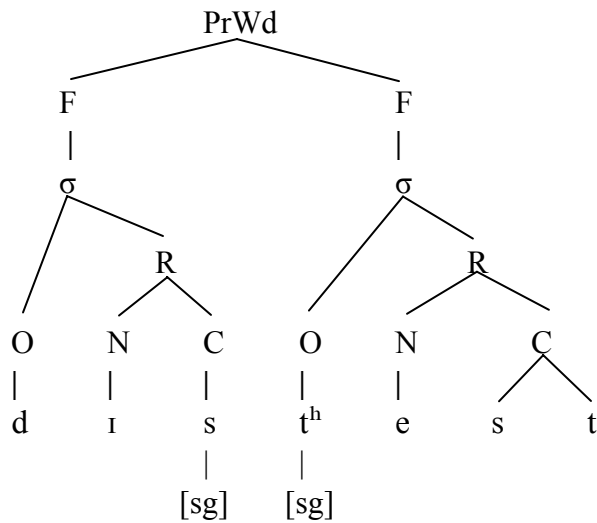
³ Treiman et al 1992:398 respond that aspiration may not be a good test, because according to Kahn 1976 voiceless stops may only aspirate when unambiguously syllable-initial. The s may be ambisyllabic, which would block aspiration.

(25) Relevant representations

a. *distend*



b. *distaste*



2.2.4. Prosodic morphological processes

Let us turn next to prosodic morphological processes that provide evidence for extrasyllabicity.

2.2.4.1. Reduplication

The most famous cases involve partial reduplication in Greek, Sanskrit, and Bella Coola, as outlined in (26) – (29). The Greek and Spokane Salish cases with fixed segmentism in (26) – (27) copy the initial consonant of the base if it's syllabified, and otherwise do not, thereby suggesting that consonants such as the *s* in (26c) and the *p* in (27c) are extrasyllabic. Similar reasoning holds for the Sanskrit and Bella Coola cases in (28) – (29), where extrasyllabic material evades duplication.

- (26) Greek (Steriade 1982:197)
- copy initial consonant of base if syllabified, otherwise don't
 - fixed perfect vowel -e-
 - ge-graph- 'endure' vs. e-spar- 'sow'

compare Spokane Salish:

- (27) Spokane Salish repetitive formation (Bates and Carlson 1992:654)
- repetitive infix /-e-/ ([a] if followed by uvular anywhere in word)
 - maximal CVC syllable
 - attaches to right of initial unsyllabified root consonant
 $\sqrt{\text{pta}\chi^w}$ 'spit' \rightarrow s-n-p-e-ta χ^w -mn \rightarrow (sn')pta χ^w m'n' 'spitooon'
NOM-in-REP-spit-INSTR
 - otherwise -e- is preceded by copy of the root-initial consonant
 $\sqrt{\text{šil}}$ \rightarrow š-e-šil 'chopped repeatedly'
REP-chop

- (28) Sanskrit (Steriade 1982, Frampton 2003, etc.)
- du-droh- be hostile
 - si-ṣṇeh- be sticky
 - ti-ṣṭha- stand

- (29) Bella Coola (Nater 1984, 1990, Bagemihl 1991)
- OO [pɫa]
 - (C)OR

stn	s-tn-tni	tree-diminutive
pɫkn-ɫp	pɫt-kn-kn-ɫp	bitter cherry tree
sma	sm-sma	tell a story
 - Bagemihl 1991: prefix reduplicative template (e.g. CV) to initial (core) syllable
 - Carlson 1997 and Cho and King 2003:204 object that the facts can be gotten in OT via alignment + reduced markedness in reduplication, without any need for reference to syllable structure [but this doesn't explain why you get a null output for reduplication of C-only words; they should surface with epenthesis]

Though the extrasyllabic analysis of the reduplication facts is appealing, it encounters at least one problem, namely that it is also possible to analyse the same facts in terms of fitting as much segmental material into the reduplicant syllable as possible, subject to reduplicant-specific markedness constraints. If one is justified in having such morpheme-specific constraints, as optimologists assume, then these reduplicative processes say nothing about the syllable structure of the base, as Cho and King 2003 point out.

2.2.4.2. Truncation

The same argument can be extended to the treatment of truncation. Kenstowicz 1994 observes that the ungrammaticality of *Victy, *Lest, *strept throat, and so on in the face of forms like

Marty that allow preservation of consonant clusters makes sense if we assume that such truncations involve mapping of the base segments to a core syllable template, followed by deletion of stray segments and then affixation in the case of nicknames. Clusters like *rt* are licensed as codas in this core syllable, but SSP violations like [kt] are not. The fact that these clusters are allowed in final position of non-truncated words suggests that the *t* in these cases is actually an appendix rather than part of the final syllable.

- (30) English truncation
- a. Martin → Marty
 - b. Victoria → Vickie, *Vicky
 - c. streptococcus → strep, *strept

2.2.4.3. Infixation

I believe that Nxaʔamxcin infixation may circumvent the domain-specific markedness arguments that optimologists could employ against the extrasyllabic analysis of reduplication and truncation. As you can see in (31), various reduplicative processes in Nxaʔamxcin are infixational in character, and Czaykowska-Higgins and Willett 1997 demonstrate that the locus of infixation can be characterized insightfully if one assumes extrasyllabicity and core syllabification almost identical to that proposed for Bella Coola by Bagemihl.

- (31) Nxaʔamxcin infixation (Czaykowska-Higgins and Willett 1997)
- a. inchoative -ʔ- (394-5)
 - i. $C_1VC_2 \rightarrow C_1V?C_2$ (pʔiq → pʔiʔq ‘gets warm’)
 - ii. $OO- \rightarrow OV?O-$ (cʔqʷunm → cʔaʔqʷunm ‘read’)
 - b. out of control reduplication (395) always copies C_2 and places it before C_2
 - c. C_1C_2 can’t be complex onset, because infixation never breaks up complex onsets
 - d. infix after first mora of root
 - e. characteristic reduplication (402)
 - i. suffix syllable to first maximal syllable of root
 - ii. $C_1VC_2 \rightarrow C_1VC_2-C_1VC_2$ (qʔil → qʔil-qʔil-t ‘it hurts’)
 - iii. $C_1VC_2C_3 \rightarrow C_1VC_2-C_1VC_2-C_3$ (picχʷ → pic-pic-χʷ-t ‘disgusting’)

The problem for the domain-specific markedness people here is that picking a locus for infixation does not involve identifying a set of reduplicant-specific markedness constraints. One can come up with another unrelated set of constraints to select the infixational locus, but this loses the connection between the various infixational and reduplicative processes that was captured in the extrasyllabic analysis.

2.2.4.4. Morpheme selection

Another phenomenon at the morphology-phonology nexus that is relevant to extrasyllabicity involves rules of vocabulary insertion that are sensitive to the phonological content of the bases to which they are added. One can find rules of this type that distinguish between appendices and syllabified clusters, such as the Homshetsma tree suffix (Berens 1996), the Spanish diminutive

(Harris 1983:5), the Polish comparative (Booij and Lieber 1993), and the Armenian plural. As I argued recently (2003), Armenian generally selects one plural allomorph for monosyllabic stems and another for all other stems, but in Western Armenian the selection process ignores appendices whereas in Eastern Armenian it does not. Some representative forms and representations are provided in (32) – (37). The Armenian facts will become important later when we compare the appendix and degenerate syllable theories.

(32) Western Armenian plurals (Istanbul dialect)

	singular	plural	gloss
a.	ts ^h i	ts ^h i-er	horse
	k ^h ar	ɸar-er	rock
	k ^h ir-k ^h	k ^h ir-k ^h -er	book
	asɖɤ	asɖɤ-er	star
	razm	razm-er	battle
	ɖak ^h r	ɖak ^h r-er	brother-in-law
b.	moruk ^h	moruk ^h -ner	beard
	jereχa	jereχa-ner	child

(33) Vocabulary Insertion rules governing the plural in Istanbul Armenian

In the context [+plural, _]:

σ	↔	-er
elsewhere	↔	-ner

(34) Eastern Armenian plural selection with Appendices (Atjarjan 1957, 1971)

	singular	plural	gloss
	skizb	skizb-ner	beginning
	spa	spa-ner	officer
	stak	stak-ner	money, coin
	stor	stor-ner	windowshade
	part-k ^h	part-k ^h -ner	debt
	kurts-k ^h	kurts-k ^h -ner	breast
	vagr	vagr-ner	tiger
	astɤ	astɤ-ner	star

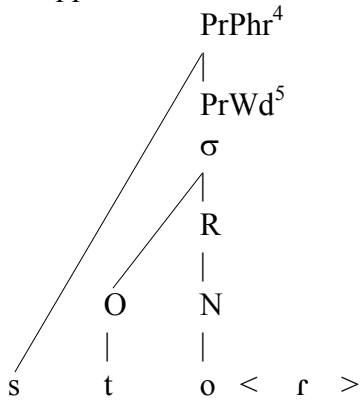
(35) Standard Eastern Armenian plural selection

In the context [+plural, _]:

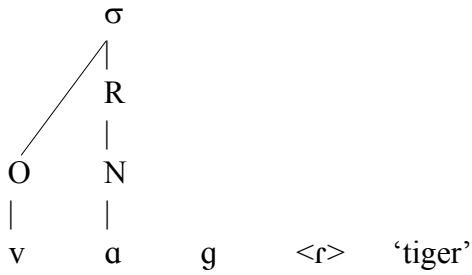
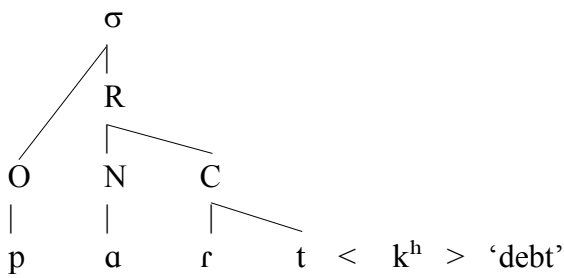
minimal σ	↔	-er
elsewhere	↔	-ner

(36) Prosodic structure of relevant forms at the time of plural selection (valid for both dialects)

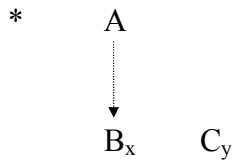
a. initial Appendix



b. final Appendix



(37) The Sonority Blocking Constraint (SBC) (Vaux 1998)



where: A = a syllable constituent
 B = a segment targeted for syllabification
 C = an unsyllabified segment
 x and y = degrees of sonority, x ≤ y

⁴ PrPhr = Prosodic Phrase.

⁵ PrWd = Prosodic Word.

3. Formal representation of the appendix

It should be clear from the phenomena just surveyed that certain segments are clearly not tautosyllabic with their neighbors. How exactly should we capture this fact? Numerous theories have been proposed, which can be lumped into the categories in (38): rule ordering, appendices, degenerate syllables, and stray consonants + lack of Stray Erasure. In what follows I focus on the two most popular strategies, involving appendices and degenerate syllables.

- (38) ways of dealing with non-canonical prosodic behavior by segments
- a. rule ordering (late adjunction; Hayes 1980, etc.; used for Cairene Arabic, Bella Coola, etc. NB doesn't require any sort of appendix position, though Kiparsky uses one for Arabic and Bagemihl does for Bella Coola)
 - b. appendices
 - c. degenerate syllables
 - d. stray consonants + abandon Stray Erasure

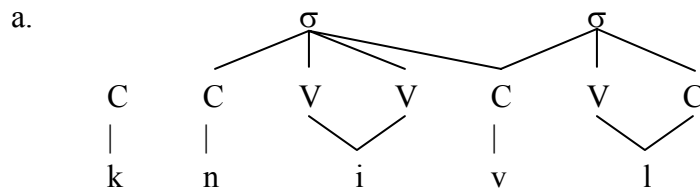
Let us begin with the appendix theory. *Where* in the prosodic structure should it attach? Almost every conceivable locus has been proposed in the literature, as summarized in (39).

- (39) Loci of appendix attachment
- a. **NOTHING** (stray segments + no Stray Erasure; Newman 1947, Clements and Keyser 1983 (cf. (40)), Cook 1994, Pierrehumbert 1994? (41), Bye 1997, Grijzenhout and Joppen 1998 (42))
 - b. **ONSET** (Cairns and Feinstein 1982 (for *asparagus*), Steriade 1982, Harris 1983, Calabrese and Romani 1998:92)
 - c. **CODA** (Hall 1992:122—attached to coda (late in derivation) in German Jagd, etc. to get devoicing)
 - d. **MORA** (McCarthy and Prince 1986, Bye 1997; also used in much OT work as intermediary between extrasyllabic segment and PrWd (moraic licensing)—Hyman 1985 for Gokana, Zec 1988 for Bulgarian, Bagemihl 1991 for Bella Coola, Buckley 1994 for Kashaya, Lin 1994, 1995 for Piro, Czaykowska-Higgins and Willett 1997, Kiparsky 2003 (cf. (47))
 - e. **RIME** (Lapointe and Feinstein 1982, Dell 1995 (cf. (46)))
 - f. **SYLLABLE** (Fujimura 1979, Halle and Vergnaud 1980 (cf. (43)), Cairns and Feinstein 1982, Charette 1985, Sherer 1994, Giegerich 199x, Spencer 1996:98-99, Gierut 1999:709, Törkenczy 2003 (cf. (44))); also attached to the syllable in English words like *constable* by van der Hulst 1984, Levin 1985, Zonneveld 1993, Booij 1995, Goad and Rose 2003, even though some or all of these say the default pattern is to attach the appendix to the PrWd; McCarthy 1979 and Harris 1999 uses something like Chomsky-adjunction of the appendix to the syllable (cf. (45))
 - g. **FOOT** (may be needed for English aspiration and internal appendices; also Hagstrom 1997 on Mohawk and Passamaquoddy, Kiparsky 2003:168 on Piro initial geminates, Green 2003 on Irish consonant clusters; NB foot attachment doesn't work for Arabic

(unless appendices are non-moraic), because appendices don't count for prosodic minimality and stress (Kiparsky 2003:160))

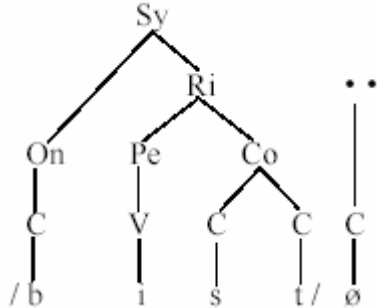
- h. **PROSODIC WORD** (Steriade 1982 for Greek, Borowsky 1986, Goldsmith 1990, Rubach and Booij 1990, Rialland 1994:148⁶, Harris 1994:62, Rubach 1997, Dyck 1999 on Cayuga, McCarthy 2001:23, Goad and Rose 2003, Kiparsky 2003:151 on Arabic (cf. (48))
- i. **PROSODIC PHRASE** (Vaux 1998 for word-initial appendices in Armenian)
- j. **VARIABLE** (Rialland 1994:156, Vaux 1994, 1998, 2003, Kiparsky 2003:153, Green 2003)

(40) permanent extrasyllabicity: *Knievel* according to Clements and Keyser 1983

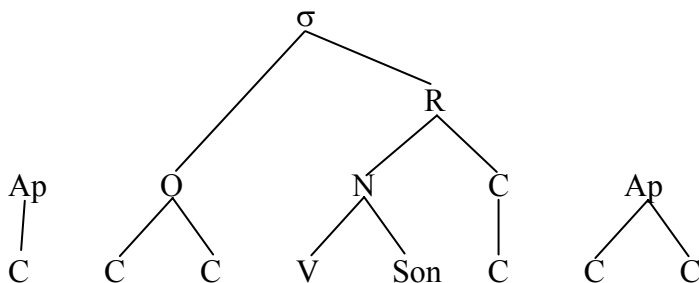


- b. Stemberger and MacWhinney 1984:357 object that unsyllabified consonants as in (10) don't encode sufficient information for linear order/motor programming; it gets the timing, but not the linear order, because "the syllable tier controls the ordering of positions on the CV-tier"

(41) Pierrehumbert 1994 for *beast, beasts, etc.*:

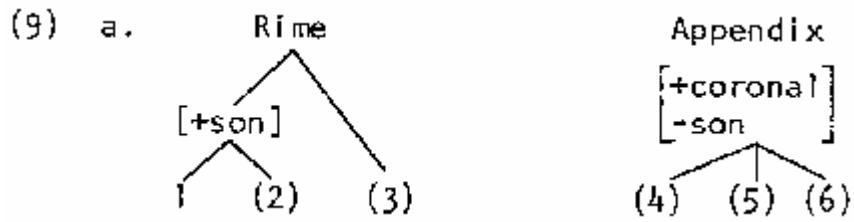


(42) German Syllable Structure (Grijzenhout and Joppen 1998:8 (or 2002?))



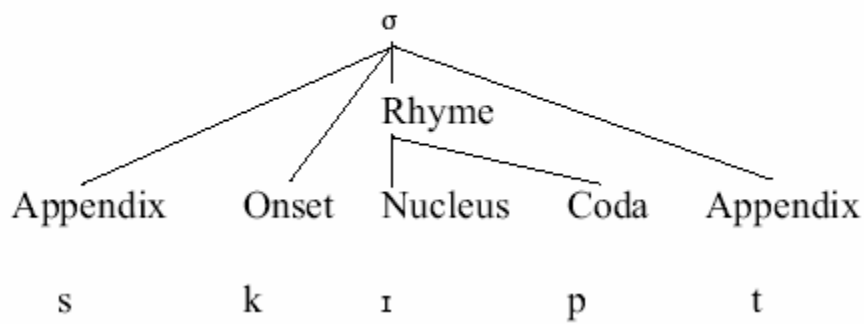
⁶ The fact that the French appendix attaches to the PrWd is shown by the fact that it undergoes regressive voicing assimilation, which is a word-level phonological rule, not syllable-level (as shown by liaison consonants not participating).

(43) Halle and Vergnaud's 1980 Appendix

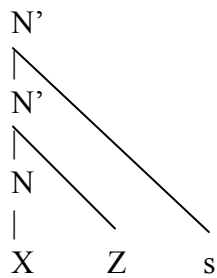


(44) from Törkenczy 2003 lecture notes:

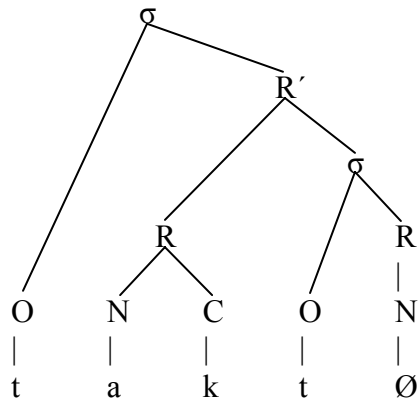
(4) Extended syllable: Appendix + onset; Coda + Appendix



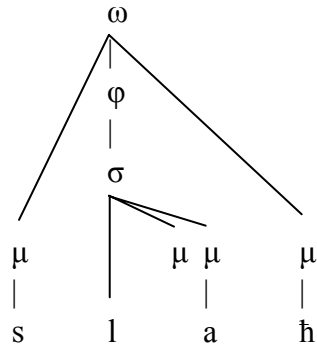
(45) Harris 1999



(46) Dell 1995: "super-rime" (ex. derived from pp. 10, 22)

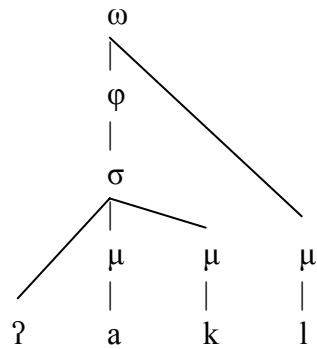


(47) slaah ‘plowshare’ in VC and C dialects (Kiparsky 2003)

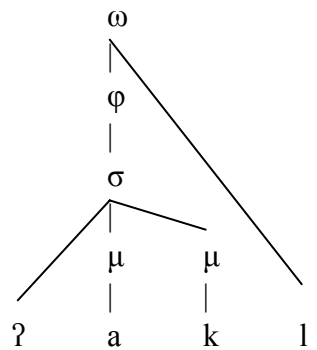


(48) Attachment to the Prosodic Word: Kiparsky 2003:156-7

a. VC and C dialects



a. CV dialects

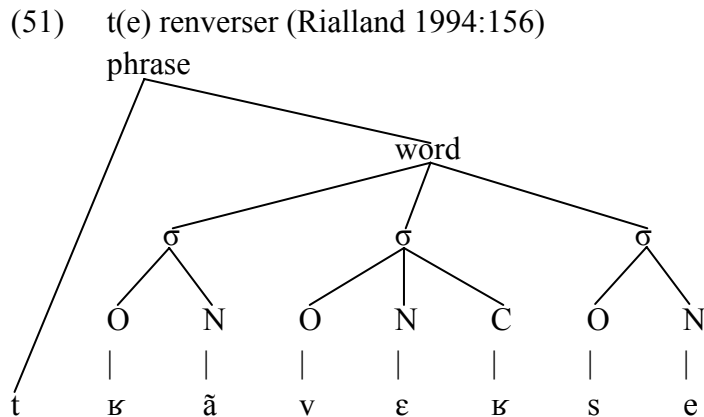


Attaching quirky segments to the syllable or any of its dependents fails to account for the evidence of heterosyllabicity discussed earlier, and also predicts *ceteris paribus* that appendices should freely attach to any syllable in a word, so we can immediately throw out theories (39b-f). Theories in which quirky segments attach to moras create additional problems, summarized in (49): they do not fit happily with the fact that appendices normally don't count for stress and don't contribute weight, and they don't make sense for non-moraic languages.

- (49) Problems with attaching all appendices to moras
- appendices don't count for stress, as in Georgian and Polish (Cho and King 2003:206)
 - appendices don't count for weight, as in Der ez-Zor Arabic (Jastrow 1978, Kiparsky 2003:157)
 - doesn't work well for non-moraic languages

This leaves us with the Foot, the Prosodic Word, and the Prosodic Phrase. Kiparsky 2003:153 points out that OT, because of violability and free ranking, predicts appendices at any and every level, adding (2003:154) that one expects the attachment to be as low in the hierarchy as possible, to avoid greater violations of strict layering. Variability in appendix attachment was already proposed by Rialland 1994 and Vaux 1994, in order to account for schwa deletion plus voicing assimilation in French (50-51) and phrasal syllabification in Armenian respectively. Green 2003 adduces similar arguments for Irish. Though we have good evidence for appendices at the foot, word, and phrase levels, it appears that they most often adjoin to the Prosodic Word.

- (50) Schwa deletion and voicing assimilation in French (Rialland 1994:156)
- “when schwa drop strands a consonant in the same word as the following consonant, voicing assimilation may apply to it: s(e)cond [zgɔ̃]”
 - “when the stranded consonant is in a different word, it does not undergo voicing assimilation: il va t(e) gronder ‘he’s going to scold you’ [...tg...], not *[…dg…]”
 - word-internal appendices attach to Word node, clitic appendices attach to Phrase node



4. Degenerate syllables

The variable appendix theory is not out of the woods yet, though. Several scholars, represented in (52), have objected that it overgenerates, predicting the existence of more cluster types than actually occur.

(52) Overgeneration

a. Broselow 1995

“allowing some segments to be licensed by moras rather than syllables increases the power of a grammar, since it permits virtually any sequence of segments to be a possible word.”

b. Cho and King 2003:200

“Rubach and Booij [in their 1990 analysis of Polish employing appendices] incorrectly predict more types of clusters than actually occur; for example, unlimited obstruents or multiple obstruents with stray adjoined segments, such as initial mpt, kpt, medial kmnpt, kmsnpt, and so on.”

c. Scheer 2004

“One overt shortcoming is the prediction that a language could well support two, five, eleven or thirty-six extrasyllabic consonants in a row: since everything that is not parsable by the syllabification algorithm is left astray, and since the later integration into the prosodic hierarchy does not obey any co-occurrence restrictions, a string such as [fdgltpkrt] should be perfectly well-formed in a language that allows for extrasyllabicity /fdgltpk-/ being an extrasyllabic cluster). As a matter of fact, such monster clusters do not occur at edges of any natural language.” [response: actually they do]

To address this problem, many scholars have recently suggested that the quirky consonants under consideration here actually belong to degenerate syllables, i.e. syllables with a null nucleus or lacking a nuclear position altogether. The basic idea with this move is to piggyback on the phonotactic constraints already required for core syllables in order to limit the inventory of possible quirky segments and sequences. Degenerate syllable theory has the two principal avatars in (53):

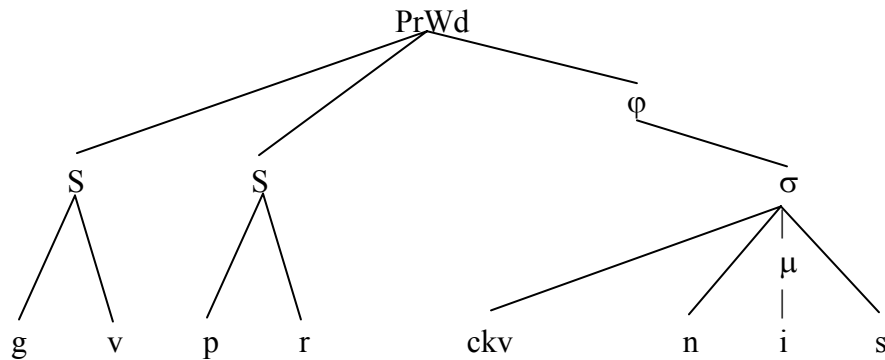
(53) degenerate syllable theories

b. SEMISYLLABLES (Shaw 1993, 1996, Cho & King 1996, Féry 2003, Kiparsky 2003; cf. (54))

c. SYLLABLES WITH EMPTY NUCLEI (Fudge 1976, Aoun 1979, Vergnaud et al. 1979, Selkirk 1981, Anderson 1982, Svantesson 1983, Kaye and Lowenstamm 1984, McCarthy and Prince 1986, government phonology (Harris and Gussman 2003, Kaye 1990, Charette 1991, Gussmann and Kaye 1993, Harris 1994, Scheer 2004), Nepveu 1994, Dell 1995, Burzio 1998)

Some scholars combine the two theories in (53); Kiparsky 2003:155 for instance suggests that Kammu may provide evidence for two kinds of degenerate syllable: (i) semisyllables, which contain a single C and are toneless (e.g. c.mool ‘to sow’), and (ii) degenerate headless syllables, which contain two consonants and can bear tones (e.g. hr.maal ‘soul’). Most optimologists treat degenerate syllables as onsets, though they disagree about whether they are attached to moras or not: for Kiparsky 2003 they are moraic, whereas for Cho and King 2003 and Féry 2003 they are not, and instead attach to degenerate syllable nodes.

(54) gv-prckvn-i-s ‘he is peeling us’ (Cho and King 2003)



Degenerate syllable theories encounter a number of problems, summarized in (55). In a nutshell, their importation of core syllable phonotactics works well for some languages like French and Polish, where recent vowel deletion processes have left behind onset clusters, but since vowel deletion is not the only source of quirky consonant sequences (e.g. borrowing, affixation), it constrains some appendices too much (as in Bella Coola, which basically allows any imaginable appendix sequence) and some too little (as in Armenian, which has a highly articulated core syllable but allows only single-segment appendices consisting of s or aspirated k).

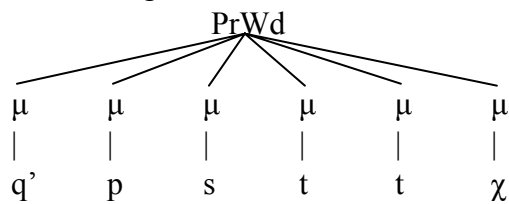
(55) Problems with degenerate syllable analyses

- a. syllabic phonotactics constrain some appendices too much (Bella Coola) and some too little (Armenian). The fact that the inventory of appendices in French and Polish looks so much like their inventory of onsets can be connected to the historical loss of certain unstressed nuclei. NB (i) this is probably not the only source of stray consonants (other possibilities include affixation (Dell 1995:9), borrowing, metathesis), (ii) subsequent changes can obscure the connection to onset-hood. It is therefore unwise to tie appendices to nuclei (or to codas for that matter).
- b. when implemented in Moraic Theory, identity of special segments is unclear
 - i. (w/moraless degenerate σ) unclear if appendices are onsets or codas (onset effects and coda effects have to be derived via Align-L and Align-R constraints respectively. A single special segment would fall under the purview of both sets of constraints, e.g. it should be subject to phonotactic restrictions on coda inventory, so one can't really say (contra Féry 2003 and others) that degenerate syllables are onsets without nuclei.)
 - ii. (w/moraic degenerate σ) appendix should pattern with “nuclei” or “rimes”, because the latter are distinguished from “onsets” and (sometimes) “codas” by being moraic
- c. syllable-counting rules
- d. languages allowing more than one appendix position (problem specifically for GP)
- e. unrelease in coda position
- f. laryngeal neutralization

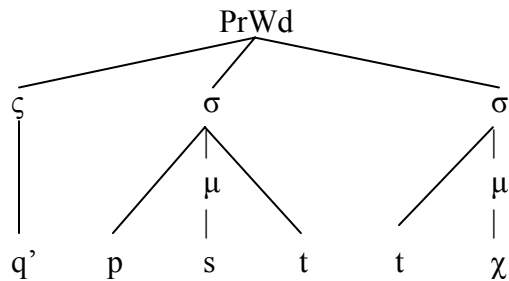
Because it postulates many extra syllables, degenerate syllable theory also runs afoul of the facts with regard to syllable count. Rialland 1994 points out that her appendix-based account of French not only captures the sequencing facts, but also explains why words like *strict* are perceived and scanned as monosyllables; degenerate syllable theory is unable to do so. Nor can it explain why Russian words with quirky consonants like *mgla* ‘mist’ count as monosyllabic with respect to stress and versification (Kiparsky 2003:155). The basic problem can be seen in the representation of Bella Coola ‘taste it’ in (56); Bagemihl’s extrasyllabic theory assigns it *no* syllables, while Cho and King’s semisyllable theory assigns it *three*.

(56) relevant representations wrt syllable-counting phenomena: Bella Coola q’psttχ ‘taste it’

a. Bagemihl 1991



b. Cho and King 2003:205



Degenerate syllable theories also fail to account for syllable-counting processes like the Armenian plural selection rule in (33); I can see no coherent way to formulate the process if one adds a syllable node for every appendix consonant.

Degenerate syllable theories don’t appear to generate weight-controlled stress systems well either. For example, a simple procedure like ‘stress the leftmost heavy syllable’ becomes something like ‘stress the leftmost syllable followed by a syllable containing an empty nucleus’.

I would like to add that what Scheer 2004 touts as an important advantage of Government Phonology’s version of degenerate syllable theory actually ends up shooting GP in the foot. He states that “my best argument is the fact that languages produce only one extrasyllabic consonant at a time. In all extrasyllabic scenarios that I know, nothing withstands the existence of five or twenty extrasyllabic consonants. Since empty Nuclei are subject to the ECP and every extra consonant implies the existence of an additional empty Nucleus, there can be one extrasyllabic consonant at most.” This prediction is rampantly falsified by the data, as I demonstrate briefly in (57); many languages allow long strings of quirky consonants, both peripherally and medially.

- (57) virtually limitless extrasyllabic sequences
- a. “[in languages like Bella Coola and Sipakapense Maya] there is essentially no limit to the number of unsyllabified initial segments” (Marlo (to appear))
 - b. Spokane Salish sčk^wλ’k^wλ’ustn ‘little eyes’ (Bates and Carlson 1992)
 - c. Sipakapense Maya ʃtqsb’χaχ ‘they are going to whack him/her/it’ (Barrett 1999)
 - d. Pima totpk ‘purr’ (Riggle 2003)

5. Conclusions

To summarize, I have argued that there is ample evidence of many different sorts—phonetic, phonological, morphological, and psycholinguistic, internal and external—for the existence of extrasyllabicity. I have suggested that these facts are best modelled by a Variable Appendix theory, which attaches quirky segments directly to prosodic nodes above the syllable, with the choice of node varying both within and across languages.

There are several larger implications of this investigation. First, it argues against superficial statistically driven phonological models that attempt to derive syllabic generalizations solely from the distribution of initial and final clusters (Pulgram 1970, Hooper 1972, Selkirk 1982, Steriade 1998, etc.). In rejecting this surface and analogy-driven trend I side with Goldsmith 1990, Treiman et al. 1992, Harris 1994, and many others who believe that the set of initial and final clusters differs from the set of other cluster types. Second, it argues against those who are unwilling to look inside the linguistic black box and prefer to imagine that reality consists of nothing more than what the box emits, in this case phonetics. Pace Ohala 1990:324, syllable appendices are *not* “purely ad hoc strategies designed like the Ptolemaic epicycles ‘to save the appearances’ of the data”. Instead, in the spirit of Chomsky and Halle and of Anderson 1982, the justification for the appendix comes from the insight and coherence that they bring to the facts. By postulating highly abstract formal entities such as syllables and appendices we begin to bring order to a vast array of seemingly disparate facts that would otherwise remain unconnected and unhelpful.

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