Consonant Epenthesis:
Natural and Unnatural Histories[*]

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1. Introduction.

Phonological rules of consonant epenthesis occur in many of the world's languages, and often involve insertion of a glide adjacent to a vowel. Phonological descriptions of consonant epenthesis tend to focus on the recurrence of pre-vocalic consonant insertion (1). Analysis of this recurrent sound pattern invokes two distinct types of universal markedness constraints. First, the position of the inserted segment is attributed to a syllabic markedness constraint which demands that syllables have onsets (2). Many researchers, including Jakobson (1929) and Greenberg (1978:75) suggest, on the basis of typological studies, that there is a strong preference for CV syllables, where C is a single consonant.[1] In a wide range of theoretical approaches (e.g. Prosodic Phonology, Optimality Theory, Government Phonology) rules of consonant epenthesis in intervocalic contexts are claimed to satisfy this preference, supplying the onsetless syllable with a requisite onset. A second component of the analysis attributes the quality of the inserted segment to segmental markedness constraints (3). Segmental markedness may be defined on the basis of articulatory parameters (e.g. Archangeli and Pulleyblank 1994), perceptual parameters (Steriade, to appear), or some more abstract parameters (McCarthy 2002:14-15), but the general claim is that universal properties of synchronic phonologies play a role in the determination of epenthetic consonant quality.

(1) A common phonological description of consonant-epenthesis

There is a recurrent sound pattern $\boldsymbol{V > C_iV}$

(2) Why the general pattern $\mathbf{V > C_iV}$? Universal syllabic markedness

ONSET: Syllables need/require onsets($_{Syllable}$[V…])*

(3) In $\mathbf{V > C_iV}$, why is C_i inserted instead of C_j ? Universal segmental markedness

C_i is less marked than C_j.

In this chapter, I suggest four general problems for the description in (1), and the proposed analyses in (2) and (3). First, many rules of consonant epenthesis are restricted, at their origins, to either word-initial position, intervocalic position, or word-final position. In this case, the description in (1) is inaccurate. As I illustrate in section 2, a more accurate description of recurrent sound patterns involving C-epenthesis adjacent to vowels includes three distinct subcases, as spelled out in (4).

(4) Recurrent general patterns of consonant-epenthesis (see section 2)

i. Intervocalic: $\mathbf{VV > VC_iV}$

ii. a. Prosodic domain-initial: $\mathbf{_{Pr}[V > [C_jV}$
b. Prosodic domain-final: $\mathbf{V]_{Pr} > VC_j]}$

In the pattern described by (4i), an epenthetic consonant occurs between vowels, but not word-initially before vowels. In (4iia), an epenthetic consonant occurs at the beginning of a prosodic domain before vowels, but not intervocalically within the same domain. And in (4iib), an epenthetic consonant occurs at the end of a prosodic domain after vowels, but not intervocalically within the same domain. If, as I suggest below, these are the most common recurrent patterns of general consonant epenthesis adjacent to vowels, then the onset-filling account in (2) is difficult to maintain. Under (2), consonant epenthesis provides onsets for *all* onsetless syllables: the general pattern expected is one where consonant-insertion occurs word-initially before vowels *and* intervocalically. The rarity of such patterns severely undermines ONSET-based accounts.

Three other problems involve the segmental markedness constraints invoked in (3). First, segmental markedness constraints are unable to account for a striking cross-linguistic generalization: in the majority of cases where the historical phonology can be reconstructed, and where segments are *not* phonetically predictable, epenthetic consonants are precisely those for which earlier consonant-loss is evidenced. In addition, segmental markedness constraints are unable to account for rare but attested cases of highly marked epenthetic consonants; in these cases also, historical rules of consonant loss are attested. A final problem for such accounts is that in some languages, the inserted epenthetic consonant is not a contrastive segment, and hence, is unlikely to be a direct consequence of phonological segmental markedness constraints.

I suggest that the four problems just noted arise from misguided analyses of consonant epenthesis grounded in universal synchronic constraints and markedness principles. Here, I present alternative diachronic explanations for a range of sound patterns involving consonant epenthesis, illustrating how and why reference to segmental and syllabic markedness should be replaced with substantive constraints on sound change, in the general spirit of Greenberg (1965, 1978). Like many other common sound patterns, regular consonant epenthesis may have a natural history, reflecting the phonologization of earlier phonetically conditioned sound change, or an unnatural history, reflecting something else. Unnatural histories include rule inversion, rule telescoping, where a sequence of natural changes yields cumulatively unnatural alternations, analogy, or language contact. The failure of universalist models to distinguish these diachronic origins results in the range of local problems for treatments of consonant epenthesis noted above, as well as non-local problems in phenomena in which the same set of universal constraints are claimed to play a role.[2] The study as a whole supports Greenberg's (1978:89) conclusions regarding the central nature of diachrony in defining and explaining cross-linguistic generalizations:

> Diachronic principles are involved in the explanation of both low and higher level synchronic generalizations. In so doing, they often explain exceptions. They also go even further than synchronic typology in subsuming under general principles not only non-universal typological traits, but often even highly idiosyncratic language-specific rules which can be treated as evidence of transitions between less complex, and more widely occurring types.

This study is framed within Evolutionary Phonology (Blevins 2004a). Evolutionary Phonology shares with many contemporary approaches the view of language as a complex adaptive system where regular sound patterns are emergent probabilistic properties, resulting from the repeated interaction of innate perceptual and articulatory biases, self-organizing properties of sound systems, and aspects of language use within a population (e.g. Lindblom et al. 1984; Lindblom 1992; Steels 1997, 2000; Blevins and Garrett 1998; Bybee 1998, 2001, this volume; de Boer 1999, 2001; Pierrehumbert 2003; Mielke 2004; Wedel 2004; Oudeyer 2005). Within this framework, recurrent sound patterns are argued to be a direct consequence of recurrent types of phonetically based sound change. Common phonological alternations like final obstruent devoicing, nasal-stop place-assimilation, intervocalic consonant lenition, and unstressed vowel deletion, to name just a few, are shown to be the result of phonologization of well documented articulatory and perceptual phonetic effects. Synchronic markedness constraints of structuralist, generativist, and optimality approaches are abandoned, and replaced, for the most part, with historical phonetic explanations which are independently necessary.

The general Evolutionary Phonology approach, detailed in Blevins (2004a), is summarized in (5) and (6).[3]

(5) Central premise of Evolutionary Phonology

> Principled diachronic explanations for sound patterns have priority over competing synchronic explanations unless independent evidence demonstrates, beyond reasonable doubt, that a synchronic account is warranted.

(6) Hypotheses of Evolutionary Phonology supported by empirical investigation

a. Common sound patterns typically result from common phonetically motivated sound change.
b. Rare sound patterns are not the result of common phonetically motivated sound change.
c. Synchronic properties of particular sound patterns are better explained in diachronic terms than in terms of synchronic phonological universals.
d. Sound change is not goal-directed.
e. Rare sound patterns may be rare as a consequence of sound change, or may reflect accidental gaps in sound pattern distribution.

Already, this framework has proven useful in identifying new phonetic explanations for well documented recurrent sound patterns and for distinguishing sound patterns with a natural history in phonetic substance from those with an unnatural history involving rule inversion, rule telescoping, analogy, or language contact (Blevins 2004b, 2004c, 2004d, 2005a, 2005b; Gessner & Hansson 2004; Hansson 2004; Mielke 2004; Yu 2004; ; Odden 2005; Shih 2005; Vaux and Samuels 2005; Garrett and Blevins To appear; Iverson and Salmons To appear). Some general results of the model are summarized in (7). Specific results of this study fall into the same categories, and are summarized in (8). In this case, the general approach undermines the empirical truths expressed by (1)-(3), revealing, instead, those in (4). At the same time, the generalizations in (4) have diachronic phonetic explanations which need not be duplicated in the synchronic grammar.

(7) Some results of the Evolutionary approach

a. New common pathways of sound change are identified.
b. New phonetic explanations are proposed for previously problematic instances of sound change and sound patterns.
c. New non-phonetic explanations are proposed for recurrent sound patterns which defy phonetic explanation.
d. Markedness constraints are excised from synchronic grammars.

(8) Some specific results of this study

a. Epenthesis at the edge of prosodic domains is identified as a common sound change, having distinct properties from intervocalic glide epenthesis, as summarized in (4).
b. An association is found between laryngeal epenthesis and prosodic domains.
c. Regular epentheses which do not appear to be phonetically natural, are, for the most part, the result of rule-telescoping or rule inversion.
d. Explanations for general patterns of C-epenthesis adjacent to vowels do not require reference to syllabic markedness (2), or segmental markedness (3). Synchronic patterns of C-epenthesis provide no evidence for markedness constraints as components of synchronic grammars.

This chapter is organized as follows. Section 2 presents the two most common natural phonetic sources for epenthetic consonants adjacent to vowels: the reinterpretation of V-to-V transitions (2.1) and marking of prosodic boundaries with laryngeal features (2.2).[4] Section 3 presents the two most common unnatural sources for epenthetic consonants in intervocalic position: rule telescoping in which a once-phonetically natural epenthetic segment undergoes fortition (3.1); and loss of weak consonants in coda position with rule inversion (3.2). Rarer cases of unnatural epentheses are illustrated in 3.3. Section 4 reviews evidence from general syllabification and prosodic morphology which also supports the elimination of syllabic and segmental markedness constraints from synchronic grammars. Section 5 presents a summary of findings as well as implications of this approach for capturing universal tendencies in sound patterns.

Before examining a range of consonant epenthesis rules, I should emphasize that by questioning the validity of ONSET (2) as a linguistic universal, I do not mean to question the important role of syllables in determining certain aspects of sound patterns. Arguments for the syllable as phonological constituent are summarized in Blevins (1995), and are not contested. What I do question is whether syllables and syllabifications are defined universally, by constraints like ONSET, or whether, as suggested by Greenberg (1978:75), Ohala and Kawasaki-Fukumori (1997), Steriade (1999), and Blevins (2003a, 2003c, 2004a, to appear), syllable structure is, to a great extent, emergent, with syllabification arising as a consequence of the acquisition of word-based phonotactics.

2. Natural history.

Synchronic sound patterns with natural histories are those which directly reflect the phonologization of earlier phonetically conditioned sound change. In this section I suggest that consonant insertion adjacent to vowels has only two common natural histories each with a distinct set of distributional and phonetic properties. The first natural history involves the reinterpretation of a V-V transition as an intervocalic glide. The second involves the spontaneous occurrence of a non-contrastive laryngeal gesture at a prosodic boundary. Since nearly all regular sound change appears to be phonetically motivated, by identifying the most common natural histories for epenthetic consonants adjacent to vowels, we predict that C-epenthesis sound patterns which directly or indirectly reflect these sound changes will be more common than ones which do not. Recognizing these two distinct natural histories and the cluster of properties surrounding them goes a long way towards explaining why many of the world's languages have synchronic C-epentheses adjacent to vowels involving the glides *w, j,* or laryngeals *ʔ, h*.

2.1 Natural history I: the evolution of intervocalic glides.

Glides often evolve spontaneously between adjacent vowels. There is little debate as to the phonetic explanation for this process. In hiatus contexts formant transitions between adjacent vowels can give rise to the percept of a medial glide. This historical process is most common when one of the vowels is /i/ or /u/, with reinterpretation of the vowel sequence as one with an intervening heterorganic glide: *ia* > *ija*, *ua* > *uwa*, etc. Examples of this phonetically natural sound change are illustrated in (9) from three different languages representing three distinct language families (Indo-European, Austronesian, and Papuan - Madang Adelbert Range subphylum).[5]

(9) Glide Insertion as sound change

Language/source	Sound change	Examples			gloss
i. Pre-Hindi	*ia > ija	*kia- >	ki**j**aa		'done'
ii. Pre-Chamorro	*ua > uwa	*buaq >	*pu**w**a	> pu**gw**aʔ	'betel nut'
	*ia > ija	*liaŋ >	*li**j**aŋ	> li**dz**aŋ	'cave'
	*au > awu	*zauq >	*tʃawuq	> tʃa**g**oʔ	'far, distant'
iii. Pre-Tauya	*ie > ije	*nie >	ni**j**e		'I/you (sg.) eat'
	*ia > ija	*nia >	ni**j**a		'they eat'
	*oe > owe	*oe >	o**w**e		'I/you (sg.) say'
	*ue > uwe	*-tue >	-tu**w**e		'I/you give to'

In languages like Chamorro the segmental status of earlier **w* is supported by the strengthening of **w* > g^w, and **j* > *dz*. This strengthening effects directly inherited **w* and **j* (e.g. g^w*alu* < **walu* 'eight'; *adzudzu* < **qajuju* 'coconut crab') as well as predictable transitional glides like those in **puwa*, **lijaŋ* etc. At some point then, the phonetic glides had the same segmental status as those which were directly inherited.

Few linguists would deny the fact that sound changes like those shown in (7) exist, and that such sound changes have phonetic motivation. What needs to be stressed regarding examples of this type is that, first, no reference need be made to the featural make-up of the historically epenthetic glide: its quality is determined by the percept arising from the transition from one vowel to the next. Since in this case, a principled phonetic diachronic explanation is evident, by (5), this historical explanation has priority over a synchronic markedness account which, at best, will only duplicate the diachronic explanation.

A second important point is that the historical evolution of transitional glides from ambiguous percepts is not altogether a chance event: the pre-existence of a glide *w* or *j* independent of the phonetic context in question appears to play a role in category acquisition in the majority of cases examined. In all languages listed in (9), contrastive *w* and *j* in other contexts pre-date the documented intervocalic sound change. This non-local effect on category acquisition is attributed to the general principle in (10). By the principle of Structural Analogy, a language learner is more likely to categorize ambiguous transitions as glides when pre-existing categories of glides exist in a language.

(10) Structural Analogy (Blevins 2004:247)

> In the course of language acquisition, the existence of a (non-ambiguous) phonological contrast between A and B will result in more instances of sound change involving shifts of ambiguous elements to A or B than if no contrast between A and B existed.

The interpretation of ambiguous vocalic transitions as glides [j], [w] is predicted to be more common in languages in which the phonological categories /j/ and /w/ pre-exist than in cases where they do not. For example, in Pre-Chamorro, forms like **wada, *walu* , **qawa* , **qajuju*, **daja* **lajaR*, etc. were directly inherited with initial and medial contrastive glides. By (10), the acquisition of this contrast made it more likely for language learners to categorize phonetically predictable transitional glides like those in **buaq*, **liaŋ*, etc. as instances of /w/ and /j/ than if these categories were absent. In Rennellese, a Polynesian language without /w/ and /j/, the principle in (10) suggests that despite common *ia* and *ua* sequences, glide-insertion as sound change is less likely to occur than in Pre-Chamorro since there are no pre-existing contrastive glides *w*, *j*, to serve as the basis of categorical analogy during the course of language acquisition.

A third point worth stressing for developments like those in (9), is that they do not support an ONSET constraint like that stated in (2): a requirement that syllables have onsets seems not only unnecessary, but also inaccurate. This stems from three factors: not all vowel sequences give rise to epenthetic glides; vowel-initial words may persist diachronically; and new vowel-initial words may arise as a consequence of subsequent initial C-loss and/or borrowing. Each of these points is illustrated in (11) for Lou, a Western Admiralties language with transitional glides in phonetically predictable contexts. Data in (11) is from Blust (1998). In (11i) we see that not all vowel sequences in Lou give rise to intervocalic glides; in (11ii), inherited vowel-initial words are maintained without change. And in (11iii), new vowel-initial words have evolved as a consequence of initial C-loss and borrowing, again, with no obvious constraint against vowel-initial syllables which one might expect if a constraint requiring onsets were at work.[6]

(11) Lou intervocalic glide-insertion ≠ ONSET

i. Not all vowel sequences give rise to intervocalic glides (only sequences of rising sonority do)

	/tia-n/	[tijan]	'his/her abdomen'
	/kea/	[keja]	'swim'
	/moloa-n/	[molowan]	'his/her shadow/spirit'
	/suep/	[suwep]	'digging stick'
But:	/wei-n golom/	[weiŋgolom]	'your saliva'
	/mween/	[mwɛɛn]	'man, male'
	/kapeun/	[kaβeun]	'bitter'

ii. Vowel-initial words are typically unaffected phrase-initially

/okok/	[okok]	'to float'
/ara-mu ŋata-n/	[arɔmŋaran]	'your head is bald'
/i lɪp nɔt/	[ilɪpnɔt]	'pregnant (lit. 'she is carrying a child')'

iii. New vowel-initial words may arise via initial C-loss or borrowing

a. *p > Ø / _V (Pre-Lou) **paŋan* > *aŋ* 'feed'; **pia* > *ia-n* 'good', **puka* > *uk* 'open, uncover', **apaRat* > *aa* 'south wind', **sa-ŋapuluq* > *saŋaul* 'ten'.

b. *k > Ø /_V (Pre-Lou) **ka* > *a* 'and', **keri* > *er* 'scrape out', **konso* > *os* 'husk coconuts'.

c. *aipika* 'an edible plant: *Hibiscus manihot* (loan: NG Pidgin *aipika*)

One final argument against the syllable onset as a catalyst for sound changes like those in (9) is the fact that parallel phonetic developments occur in other positions within the syllable. As shown in (12), homorganic glides can evolve from reanalysis of complex VC transitions giving rise to new complex nuclei (12a), or coda glides (12b), while the reinterpretation of complex CV transitions can yield glides as components of complex onsets (12c).

(12) Homorganic glide/vowel evolution in non-onset position (Hock 1991:119-20)

Language	Sound change	Examples	gloss	Output of sound change
a. American English	ʃ > jʃ, ʒ > jʒ	mæʃ > mæjʃ meʒɻ > mejʒɻ	'mash' 'measure'	coda, complex coda
b. Old French	ɲ > jn > in	*plaɲit > *plaint* *poɲu- > *poing*	'complains' 'fist'	complex nucleus
c. Lithuanian	p^j > pj	*p^jaut^{j}i > pyauti	'cut'	complex onset

What the examples in (9) and (12) share is the perceptual ambiguity of formant transitions between historically adjacent segments. In all examples, the formant transitions are interpretable as segmental glides and the phonetic quality of the glide is predictable. However, unlike the sound changes in (9) which may be interpreted as ameliorating syllable structure, those in (12) result in more complex syllable types.

In sum, the evolution of glides *w* and *j* as reinterpretations of formant transitions in relevant V-V, C-V and V-C strings is part of the natural history of consonant-epenthesis. In these cases, the two most important explanatory factors appear to be: (i) the occurrence of formant structure which is perceptually similar to that of a glide; (ii) the occurrence of unambiguous glides outside of the context in question for pattern-matching in the course of language acquisition in accordance with (10).

2.2 Natural history II: laryngeals at prosodic boundaries.

While segmental glides *j* and *w* often evolve spontaneously between adjacent vowels, epenthetic laryngeals *h* and *ʔ* have an arguably different natural history resulting in distinct sound patterns and system-internal relationships. Significant differences are summarized in (13). One important difference concerns distribution: where epenthetic segmental glides *w* and *j* typically originate in intervocalic contexts, regular sound change involving epenthetic laryngeals typically originates at prosodic boundaries, including the phonological phrase and phonological word. Another difference between the two types of sound change is their contrastive status. Sound changes like those in (9) are most common within sound systems in which contrastive glides are pre-existing; however, the occurrence of a laryngeal closing or spreading gesture at a prosodic boundary is typically non-contrastive at its point of origin, and may continue to be non-contrastive for many generations.

(13) Significant differences between *j/w* and *ʔ/h* epenthesis-as-sound-change

	j/w	*ʔ/h*	Languages with prosodic epenthesis:
Position of origin	V_V	$_P$[_V	English (ʔ), French(ʔ), Rennellese (ʔ), Ritwan (h), Nhanda (h/ʔ), Muna (ʔ), Anejom (ʔ)
		V_]$_P$	Chintang (ʔ), Yurok (h), Atayal, etc. (ʔ); Aklanon, etc. (h) [see (15)]
Typically contrastive	Yes	No	
Input phonetic ambiguity	Yes	not necessarily	

English presents a typical example of prosodic laryngeal distribution. In English, vowel-initial words are preceded by glottal stop at the beginning of the phonological phrase or word. Glottal stop, however, is not contrastive, and in fact, many English speakers have great difficulty perceiving glottal stop word-initially, or producing vowel-initial words not preceded by glottal closure. If this segment is not *perceptible* to the average English speaker, it is quite odd to refer to it as satisfying a constraint which requires that syllables have onsets. At the same time, within the phonology of English where contrasts are encoded, there is no contrast between syllables beginning in *ʔV…* and those beginning in *V*….

Similar facts are reported for many languages around the world. For example, in Muna, word-initial vowels are optionally preceded by a non-phonemic glottal stop, as illustrated in (14a) (van den Berg 1989:21-27). In Anejom (*aka* Aneityum, Lynch 2000), utterance-initial glottal stop precedes vowels, and again, is non-contrastive. Compare the utterance-initial vowel in (14b) with its non-utterance-initial counterpart. Another language with similar sound patterns is Rennellese (Elbert 1988:7). Although glottal stop contrasts with both zero and other consonants in word-medial position, "its distribution differs from that of other consonants in utterance-initial position" where "it occurs predictably before words that otherwise begin with vowels… This predictable glottal stop may be considered a feature of initial vowels."

(14) Non-contrastive phrase-initial [ʔ] in Muna, Anejom and Rennellese

	i. prosodic laryngeal	ii. no prosodic laryngeal; V-initial syllables
a. Muna	[ʔina]	[i.na] 'mother'
	[ʔo.e]	[o.e] 'water'
	[ʔurɛ]	[u.rɛ] 'high tide'
		[a.i.ni] 'this
		[wa.e.a] 'bat'
b. Anejom	[ʔa.ek] 'you (sg.)'	[ʔa.ba.ma.ek] 'you (sg.) come!'
c. Rennellese	[ʔe uʔu e te hokai]	'the lizard bites'
	[ʔuʔu mai]	'Bite!'

Consider the pronunciation of the verb 'bite' in the two phrases in (14c). Where the verb *uʔu* is not phrase-initial, there is a phonetic transition between vowels *e-u*, with no glottal gesture; where the same verb is utterance-initial, it is preceded by glottal stop. Though the medial glottal stop in *uʔu* 'lizard' contrasts with *u:* and other *uCu* sequences, glottal stop does not contrast with zero word-initially. There is no evidence for a general onset requirement in Muna, Anejom or Rennellese. In each language, accounting for word- or phrase-initial glottal stop by invoking ONSET will require stipulations as to why the same constraint does not apply to every medial vowel-initial syllable.

A further argument against laryngeal epenthesis as serving a basic onset-filling function is the fact that it is not limited to the beginning of a prosodic domain. As shown in (13) edge-final prosodic laryngeals are also found, and are well described for many Austronesian languages (Blust, in prep.:25). As summarized in (15), these sound patterns include word-final non-contrastive glottal stop in Formosan languages, Bashiic languages, languages of Borneo, and Sundanese of west Java (15i) as well as final [h] insertion for a range of central Philippine languages, and for languages of northern and central Sarawak (15ii).[7]

(15) Final laryngeal epenthesis in Austronesian (Blust, in prep.)

i. Ø → ʔ / V_]$_{\text{PrWd}}$ in	Atayal, Saisiyat, Pazeh, Bunun, Kavalan, Paiwan, Puyuma, Amis; Yami, Itbayaten, Ivatan, Casiguran Dumagat; Brunei Malay, Sarawak Malay, Taboyan, Lawangan, Kapuas, Ba'aman, Katingan, Dohoi, Murung, Tunjung; Lou; Sundanese.
ii. Ø → h / V_]$_{\text{PrWd}}$ in	Aklanon (and other Bisayan dialects of C. Philippines), Tagabili, Taosug; many northern and central Sarawak lgs., including: Miri, Narum, Kiput, Berawan, Western Penan, Long Wat Kenya, Sebop, Kelabit, Dalat, Matu, and Serike Malanau.

Let us look at one example which highlights the relationship between laryngeals and prosodic boundaries. In Aceh (Durie 1985:36-37), an Achinese-Chamic language, *h*-epenthesis is described for a very particular prosodic boundary: "Clitics which have no syllable-final consonant add /h/ when they are enclitics, and occur last in the phrase." Compare the examples in (16a) and (16b): in the first set, a clitic (*neu, pi*) is phrase final and occurs with epenthetic [h]; in the second set the clitic (*ka, pi*) is not phrase-final and no [h] is inserted. Notice that in these examples, onset plays no role, since the inserted [h] is in coda position.

(16) Final [h]-epenthesis in Aceh (Durie, 1985)

Ø → h / V_]$_{\text{Cl-Pr}}$

a. droe=neu**h**	ka=neu=jak	b. ka=droe-neu-jak	
self=2	IN =2=go	IN=self-2-go	
'you have gone'		'you have gone'	
lôn=pi**h**	sakêt	peulandôk	pi=ji-beudöh
I=EMPH	sick	mousedeer	EMPH=3-rise
'I am sick too!'		'The mousedeer got up.'	

Another language which illustrates an association between laryngeal settings and prosodic boundaries is Yurok. In Yurok and Wiyot, the two Ritwan languages within the Algic family, historically vowel-initial words have acquired an initial *h*. Comparison sets are shown in (17), with the proposed sound change in (18).

(17) Word-initial *h* in Wiyot and Yurok : Proto-Algonquian vowel-initial words

a. PA **e:wa* 'he goes' < ***a:-* 'go' (Berman 1984:336); Y **ho-* in *heɣok'* 'I go' (intensive infix *-eɣ-*, 1sg *-k'*); W **ho-* in *hol-* 'go, walk'.

b. PA **ekwa* 'the other says so to him' (A294); cf. Y *h-* in *hek'* 'I say', *hiʔ* 'it is said', W *h-* 'say to', *hi-* 'be said'.

(18) Ritwan sound change: Ø > h / $_{Pr}$[_ V

Some evidence for the prosodic conditioning of this rule is the sandhi alternations which are continued in both Yurok and Wiyot (Blevins and Garrett, 2001). First, in both languages, there are *h*-initial nouns which surface without *h* under pronominal prefixation. An example from Yurok is shown in (19a). Second, in both languages, word-initial /h/ alternates with [j] after /i/, suggesting that in *i#V* sandhi contexts, where V was not initial in the prosodic word, there was no [h]. A representative example is given in (19b).

(19) Yurok initial /h/ in sandhi contexts

a. Word-internal:	haʔaaɣ	'rock'	cf.	nepuj	'salmon'
	'naʔaaɣ	'my/our rock'		'ne-nepuj	'my/our salmon'
h~ Ø	w'aʔaaɣ	'his/her/its/their rock'		'we-nepuj	'his/her/its/their salmon'
	k'a'aaɣ	'your rock'		k'e-nepuj	'your salmon'
	pelin haʔaaɣ	'big rock'		pelin nepuj	'big salmon'
b. External:	heɣo'l	'he goes'			
	ni [j]eɣo'l	'he goes there'			
h~ j	hunowoni	'growing'			
	k'i [j]unowoni	'the growing (things)'			

Note that the sound change in (18) is limited to prosodic boundaries, and therefore cannot be attributed to a general syllable onset requirement. The internal sandhi facts in (19a) suggest vowel cluster reduction, while the external sandhi facts in (19b) suggest historical Ø > j / i_ V.

The historical process in which *h* was inserted at the beginning of prosodic words in Ritwan is mirrored word-finally in Yurok where there is evidence for *h*-insertion at the *end* of prosodic domains. A striking aspect of Yurok sound patterns is that there are no nouns or verbs ending in short vowels, with the sole exception of attributives ending in *-ni*. Where a word-final short *V* is expected, final *Vh* surfaces instead. For example, where vowel shortening has occurred in the *o*-class paradigm for *new-* 'to see', we expect the first plural indicative *newoo* to shorten to *newo*, but the surface form is *newoh*. As should be clear from the words in (20), syllables ending in short vowels appear freely in non-final position.[8]

(20) Word-final syllable types in Yurok nouns and verbs

rhyme	noun	gloss	verb	gloss
VV	te.poo	'fir tree'	roo	'to be a particular time'
VC	le.wet	'salmon net'	ne.pek'	'I eat'
V'	ho'.mo.noʔ	'tan oak'	he.ɣiʔ	'it was said'
Vh	ho.mo.nah	'live oak'	ne.poh	'we eat'
	pi.ʔih	'mussel'	ne.woo, ne.woh	'we see'
VVC	ha.ʔaaɣ	'rock'	ne.wok', ne.wook'	'I see'
VV'	pe.co.looʔ	'ko sugar pine'	ske.wi.paaʔ	'he put in order'
V	-------		-------	

In order to account for the absence of word-final short *V*, and instances where expected word-final V surfaces with final *Vh*, the sound change in (21) is proposed.

(21) Yurok sound change: Ø > h / V_]$_{Pr}$

Since (21) applies at the end of prosodic words and phrases, we expect to see sandhi alternations similar to those seen for word-initial /h/. This is the case. As shown in (22), locative suffixation suggests earlier noun-forms lacking final /h/.

(22) Yurok final /h/ in sandhi contexts (*-oɬ* 'locative')

a. Word-internal:	paʔah	'water'	cf.	nepuj	'salmon'
	paʔaaɬ	'water-LOC'		nepujoɬ	'salmon- LOC'
h~ Ø					
	tektoh	'log'		looɣin	'fish-dam'
	tektooɬ	'log-LOC'		looɣinoɬ	'fish-dam- LOC'
b. Word-internal	piʔih	'mussel'			
h~ j	piʔijoɬ	'mussel-LOC'			

The association of non-contrastive laryngeals with prosodic boundaries is a recurrent sound pattern in languages across the world. But why it is natural for laryngeals [h] and [ʔ] to mark prosodic boundaries, and why are these segments typically non-contrastive at origin in these positions? A preliminary answer relates the occurrence of default laryngeals to pitch contours which characterize prosodic boundaries. Prosodic boundaries are typically marked by pitch contours initiated via laryngeal mechanisms. It is this laryngeal involvement which likely gives rise to fixed articulatory laryngeal gestures at certain prosodic boundaries.[9] While this is a preliminary hypothesis, the high frequency of such sound patterns, their regularity, and their subphonemic nature all point to natural phonetically conditioned origins.

Intervocalic glide epenthesis and prosodic laryngeal epenthesis constitute the majority of phonological epentheses where a synchronic alternation may have traceable roots to natural phonetically conditioned sound change (pace footnote 4). The segmental quality of an intervocalic glide need not be specified, since its quality follows from the phonetic characteristics of surrounding vowels. In laryngeal epenthesis, a glottal spreading or closure gesture may come to be specified as an aspect of language-specific phonetics precisely where this gesture is non-contrastive. Reference to onset in both types of epenthesis does not appear justified: in intervocalic glide-epenthesis, word- or utterance-initial vowels are typically unaffected, while under prosodic laryngeal epenthesis domain-medial vowel-initial syllables are unaffected. In particular cases like Aceh or Yurok domain-final *h*-epenthesis, there are no cases where onsets are created, and prosodic domains must be invoked. Having examined C-epenthesis sound patterns with natural histories, I now turn to unnatural histories, where rule inversion, rule telescoping, analogy, or language contact may be involved.

3. Unnatural history.

Synchronic sound patterns with unnatural histories are those which do not directly reflect the phonologization of earlier phonetically conditioned sound change. In this section I suggest that intervocalic consonant insertion has two fairly common unnatural histories each with a distinct set of distributional and phonetic properties. The first unnatural history involves two sound changes in sequence: a natural sound change involving intervocalic glide insertion or insertion of a laryngeal, followed by subsequent strengthening of the glide or laryngeal. As a consequence of this sequence of sound changes, phonetically unnatural rules of intervocalic obstruent epenthesis may be in evidence in synchronic grammars. The second common unnatural history involves the inversion of an earlier rule of consonant loss. Recognizing these two distinct unnatural histories and the cluster of properties surrounding them goes a long way towards explaining why many of the world's languages have synchronic C-epentheses involving segments other than the glides *w, j,* or laryngeals *ʔ, h*, and accounts for many of the distributional properties of these segments.

3.1 Unnatural history I: epenthesis + strengthening

Intervocalic glides in many languages are susceptible to further sound changes. As illustrated earlier in (9ii), Chamorro glides underwent context-free strengthening, with **w* > *gw* and **j* > *dz*. The combination of phonetic glide epenthesis with subsequent glide strengthening constitutes a common instance of rule telescoping. If the epenthesis alternations are maintained synchronically, an unnatural sound pattern is in evidence as a consequence of sequential natural sound changes. The alternations in (23) from Chamorro illustrate a case in point, where (23b) shows intervocalic insertion of [dz] between a vowel-final verb stem, and /-i/ the referential focus suffix. These alternations are the result of the sequence of sound changes in (23i,ii) (Blust 2000).

(23) Chamorro obstruent/zero alternations from glide-epenthesis + strengthening

Sound change i. Vi > Vji
Sound change ii. j > dz

a.	a.mo.ti	'take away for'	cf. amot 'take away'
b.	ha.tsa.dzi	'lift for'	cf. ha.tsa 'lift'
c.	ha.na.gwi	'go for'	cf. ha.naw 'go'

Epenthetic laryngeals like those illustrated in 2.2 may also become phonologized, and are also susceptible to further sound changes. In Singhi (*aka* Land Dayak), as illustrated in (24ii), insertion of a word-final laryngeal is followed by context-sensitive strengthening conditioned by vowel context: coarticulation of *h* with a high back vowel yields *x*, while coarticulation with a high front vowel yields *s*.

(24) Singhi obstruent/zero developments from laryngeal epenthesis + strengthening (Blust, in prep.)

Sound change i. Ø > h / V_]$_{Pr}$
Sound change ii. h > x/ u__
s/ i__

a. PMP *Raja > aju**x** 'great, large'
b. PMP *batu > batu**x** 'stone'
c. PMP *qubi > bi**s** 'yam'
d. PMP *kali > kari**s** 'dig'

In Singhi, no synchronic alternations are involved, since reflexes of word-final **h* remain word-final.

However, in cases where a laryngeal/zero alternation exists, as seen in (19) for Yurok, subsequent changes to the laryngeal can give rise to unusual alternations. In Yurok, intervocalic /h/ is realized as ɣ, a voiced velar fricative. As a consequence, historically vowel-initial stems are ɣ-initial when preceded by vowel-final particles within the phonological word. Since the *h*/ɣ alternation remains transparent in Yurok, there is synchronic evidence for both *h*-insertion/deletion and *h*-strengthening, as illustrated in (25). However, the general point is that seemingly unnatural surface Ø/ɣ alternations exist as a consequence of an intermediate stage of *h*- strengthening.[10]

(25) Yurok initial /h/ in sandhi (Robins 1958)

	haʔaaɣ	'rock'	cf.	nepuj	'salmon'
	'naʔaaɣ	'my/our rock'		'ne-nepuj	'my/our salmon'
h~ Ø	w'aʔaaɣ	'his/her/its/their rock'		'we-nepuj	'his/her/its/their salmon'
	k'aʔaaɣ	'your rock'		k'e-nepuj	'your salmon'
h~ ɣ	ku ɣaʔaaɣ	'the rock'		ku nepuj	'the salmon'
	ku//haʔaaɣ	'the rock'			

3.2 Unnatural history II: coda loss + rule inversion.

One of the most striking observations regarding regular consonant epenthesis is that once one leaves the domain of phonetically predictable glides and prosodically conditioned laryngeals, the range of epenthetic consonants is, for the most part, co-extensive with consonants which are most commonly subject to weakening and loss in syllable-coda position. While this collection of segments includes glides *w/j* and laryngeals *h/ʔ,* it also includes, liquids and nasals which are unattested as direct outputs of the phonetically natural processes examined in section 2. A further difference relates to contexts of consonant-insertion. Where natural epentheses allow statement of the conditioning environment in terms of positive intervocalic contexts, some unnatural epenthesis occur in intervocalic contexts which appear to be the complement to specific post-vocalic coda environments. In (26), differences between the natural epentheses illustrated in section 2, and common consonant-zero alternations which do not directly reflect such sound changes are summarized.

(26) Significant differences between synchronic epentheses with natural and unnatural histories

	natural history	unnatural history
Position	V_V $_P$[_V , V_]$_P$	complement of C > Ø /V_i _...
Segment quality	w/j, h/ʔ	w/j, h/ʔ, **nasal, liquids**

The differences just noted are clearly not accidental: numerous instances of phonological C-epenthesis between vowels are clearly instances of historical rule inversion of earlier post-vocalic consonant-loss (Vennemann 1972, Blevins 1997, Vaux 2002). As a consequence, inserted consonants are precisely those which have been subject to historical weakening and loss, and the position of epenthesis is typically the complement environment to that of original loss. Rule inversion, as illustrated in (27) is the consequence of an analytic problem in the course of language acquisition. Having established a systematic pattern of alternation, the learner is faced with the question of which alternate is basic and which is derived. If the non-historical alternate is taken as basic, rule inversion may occur.

(27) Rule inversion resulting in C-epenthesis, where W = weak consonant

i. Sound change:	W > Ø / V_i_ {#, C}		
ii. Resulting surface patterns	V_i{#, C}	~	V_iWV
iii. Synchronic reanalysis:	Ø → W / V_i_ V		

A general prediction of the current model is that a consonant which undergoes natural phonetic weakening/loss in post-vocalic or intervocalic position can be reanalyzed as epenthetic in precisely the contexts where it was *not* lost, since surface patterns of consonant/zero alternations typically give rise to phonological ambiguity: is the predictable consonant underlying, or inserted by rule? If a language learner chooses to derive predictable consonants by rule (27iii), rule inversion can occur, resulting in a wider range of surface epenthetic consonants than those resulting from phonetically natural processes.

In (28) I list a range of languages where coda-loss of a weak consonant has been inverted, giving rise to epenthesis of the consonant which was historically lost.[11] Blevins (1997) illustrates the extent to which C-epentheses of the sort illustrated in (28) are problematic for segmental and syllabic markedness accounts. While these accounts can handle the facts, they are forced to treat laterals, uvular fricatives, or labialized pharyngealized rhotic glides as unmarked segment types.

(28) Examples of inverted C-loss giving rise to C-epenthesis

Language	Consonant	epenthesis context	
Uradhi	ŋ	V#_V	(Hale 1976)
English, RP, Boston, etc.	ɻ	V_i#_V (V_i= lax)	(refs. in Blevins 1997,
Bristol, Mid.At. etc.	l	V_i#_V (V_i=lax; V_i= ɔ)	and Gick 1999)
Yupik	ʁ	V_i _-V (V_i≠ ə)	(Jacobson, 1984)
Anejom	ɾ	V _ ## V	(Lynch 2000:29)

Furthermore, like the instances of intervocalic glide-epenthesis reviewed earlier, accounts making reference to ONSET fail to explain why C-epenthesis is limited to intervocalic contexts, and does not insert the same unmarked consonant before vowels in phrase-initial position.[12]

Synchronic consonant/zero alternations are also attested in cases where a variety of consonant types underwent loss in a particular position. Perhaps the most well studied case of this type is the loss of final consonants in the history of the Oceanic languages. Proto-Oceanic had many intransitive verbs and nouns which were consonant final. However, several daughters of Proto-Oceanic regularly lost consonants in word-final position. As a consequence of the historical sound change in (29), an extreme case of (27i), many Oceanic languages have C/zero alternations, where a consonant of unpredictable quality surfaces in suffixed forms, and is absent in unsuffixed forms.

(29) Final C-loss in Oceanic (Ross 1998)

Proto-Oceanic *C > Ø / _]Wd in, e.g.: Central Pacific (Fijian, Rotuman, Polynesian)
Western Oceanic (Manam, etc.)
South-East Solomonic (Toqabaqita, etc.)

The consonants which surface only under suffixation are traditionally known as 'thematic consonants'. Since, historically, they constitute the set of inherited final consonants, they cover a range of obstruents and sonorants, and include consonants at multiple points of articulation. In (30) I give a list of Oceanic languages which show C/Ø alternations under suffixation, and the range of attested thematic consonants.[13]

(30) C/Ø alternations in some Austronesian languages (Hale 1973, Lichtenberk 2001; Pawley 2001)

Language	thematic Cs	extension of thematic C?
Toqabaqita	t, f, s, m, n, ŋ, l, r, w, ʔ	no
Manam	t, m, n, ŋ, l, r, w, ʔ	yes, semantic (see 31iii)
Maori	t, k, m, n, ŋ, r, wh, h	default (see 31ii)
Samoan	t, s, f, m, n, ŋ, l, ʔ	no
Tongan	t(s), k, f, m, n, ŋ, h, ʔ	no
Niuean	t, k, m, n, h	no
Hawaiian	k, m, n, l, h, ʔ	yes, -ʔ*ia*

If segmental or syllabic markedness constraints played a role in synchrony or diachrony, we might expect: (i) a general shift from marked to unmarked consonants in these contexts; (ii) unmarked consonant-insertion in cases where the lexical thematic consonant is not retrievable; (iii) extension of C-insertion to other V_V contexts. However, there is little evidence for any of these predictions, as summarized in (31).

(31) Some observations regarding C/Ø alternations in Oceanic

i. /f/, /m/ are maintained in many Oceanic languages in this context

ii. Maori default passives are sensitive to prosodic structure of the base, and there are different 'default' consonants in different dialects (Hale 1973; Blevins 1994)

a. *-ia* , *-a* when base is bimoraic

b. elsewhere, *-Cia*	dialect I:	*-tia*
	dialect II:	*-hia*
	dialect III:	- *ŋia*

iii. Where leveling does occur within subparadigms, it is inconsistent with phonological markedness predictions.

Manam (Lichtenberk 2001), transitive verbs based on kinship all take *-m-*, where this pattern is arguably an innovation.

tama-m-i	'regard s.o. as one's father'
tina-m-i	'regard s.o. as one's mother'
toqa-m-i	'regard s.o. as one's older ss sibling'
tari-m-i	'regard s.o. as one's younger ss sibling'
natu-m-i	'adopt s.o. as one's child'
taua-m-i	'have s.o. as one's trading partner'
ruaŋa-m-i	'have s.o. as one's friend'

iv. V-initial allomorphs are maintained without change.
In Maori, 41.09 % of passives in Biggs (1966) take *-a*.

First, consider the suggestion that segmental markedness constraints might shape the nature of these alternations over time, leveling them to less marked consonants. In cases where alternations are productive or semi-productive, alternations between /f/ and /m/ are maintained in most Oceanic languages (31i). Under markedness accounts, this might be unexpected. In cases where the lexical consonant is not retrievable, there are at least three different strategies reported for Maori dialects alone. First, the vowel-initial suffix is used when a base is bimoraic; when bigger than a minimal word, forms take a C-initial suffix, with C variable across dialects (31ii). One dialect may reflect type frequency, since *-tia* (31.1% of passives from Biggs 1966) has the highest frequency of any *-Cia* suffix. However, other dialects may reflect token frequency, since many common verbs occur with *-hia* and *-ŋia*. In careful studies where leveling within subparadigms has been studied, consonants appear to take on semantic domains, rather than undergoing phonological bleaching. For example, as shown in (31iii), *-m-* has been extended in Manam within a subclass of semantically related transitive verbs. Since many will agree that a phonological approach to these alternations is not warranted, it is worth pointing out that the hiatus occurring between vowel-final stems and the historical transitive suffix has not been altered by regular epenthesis in the majority of languages (31iv).

Clearly the most general observation one can make with respect to alternations arising from Oceanic final consonant loss, or similarly general processes of final C-loss like that which occurred in the history of French, is that phonological rule inversion of the sort schematized in (27) simply does not take place: since consonant quality is not predictable, no phonological generalization is made, and alternations are gradually lexicalized, with emergent developments or generalizations for the most part governed by morphological or semantic analogy.[14]

In sum, as with the natural epentheses investigated in 2.2, there is no need to invoke segmental or syllabic markedness constraints to account for regular consonant-epenthesis originating in historical rule inversion. The schema in (27) suggests that any consonant which can be lost through natural phonetic processes in the syllable coda can give rise to regular epenthetic alternations, independent of its purported segmental markedness. Furthermore, the historical approach maintains that, in general, such alternations will not be extended to initial vowels. This is the case for the alternations listed in (28), as well as others documented in Vaux (2002).

3.3 Other unnatural histories.

In this section two instances of historical consonant epenthesis are presented which reflect uncommon developments due to the unlikely convergence of phonetic, phonological, morphological and syntactic properties. Each case has as its point of origin a type of sound change already discussed. Oceanic *y*-accretion, in 3.3.1, may originate from high frequency *ija* (< *i#a*) strings in these languages. Ritwan *l*-sandhi in 3.3.2, on the other hand, has its source in rule-inversion of earlier **l*-loss, combined with phonetic glide-insertion.

3.3.1. What is Oceanic *j*-accretion? Blust (1990) describes a recurrent development in Oceanic languages which involves the word-initial insertion of a palatal glide *j* before /a/. In (32) I summarize the sound changes in question.

(32) Glide-accretion in Oceanic (Blust 1990)

<u>Language</u>	<u>sound change</u>	<u>remarks</u>
Fijian	* Ø > j / $_{Wd}$[_a	Not in Waya, Nakoroboya (West); Not in Labasa, Dogotuki (NE Vanua Levu); In Bua, optional or lexically determined. Lexically gradual change (*j > θ intervenes) /j/ has low functional load. (Geraghty, 1983)
Gedaged	* Ø > j / $_{Wd}$[_a	Milke (1968) suggests this sound change is widespread in the AN languages of New Guinea.
Motu	* Ø > j / $_{Wd}$[_a	Followed by *j > l
Cristobal-Malaitan	* Ø > j / $_{Wd}$[_a	Followed by *j > θ; lexically gradual change.
Trukic	* Ø > j / $_{Wd}$[_a * Ø > j / $_{Wd}$[_ {i,e} * Ø > w / $_{Wd}$[_{o,u}	Homorganic glides not reported before /i/ in all languages; glide before /a/ is not homorganic; evidence for long-term diffusion across dialect chain.

(33) Glide-accretion outside of Oceanic

Buli, Numfor	* Ø > j / $_{Wd}$[_a	(Blust 1978)
Bonfia	* Ø > j / $_{Wd}$[_a	And other languages of Central Moluccas (Stresemann 1927:114ff.)
Sepa, Tehoru	* Ø > j / $_{Wd}$[_a, * Ø > h / $_{Wd}$[_a	Collins (1982); limited to nouns, but verbs typically take proclitic subject markers, eliminating /a/-initial verb stems (Blust 1990:17).

Blust (1990) notes that similar sound changes appear to have occurred independently in other Austronesian language, including Buli and Numfor, two South Halmahera-West New Guinea languages (SHWNG), and in three Central Malayo-Polynesian language of Seram in the Central Moluccas: Bonfia (*aka* Masiwang), Sepa and Tehoru. These proposed sound changes are summarized in (33).

What is of particular interest in the data summarized in (32) and (33) is the asymmetry between reflexes of **a*-initial words, which show epenthetic initial glides, and reflexes of **u*- and **i*-initial words, which, with the exception of some of the Trukic languages, do not show epenthetic glides. In other words, in word-initial position, a range of Austronesian languages show the general pattern in (34).

(34) General pattern of C-insertion under *j*-accretion

i. $_{\text{Wd}}$[a > $_{\text{Wd}}$[ja

ii. $_{\text{Wd}}$[i > $_{\text{Wd}}$[i
iii. $_{\text{Wd}}$[u > $_{\text{Wd}}$[u
iv. $_{\text{Wd}}$[e > $_{\text{Wd}}$[e, Ø
ii. $_{\text{Wd}}$[o > $_{\text{Wd}}$[o (Oceanic only)

If the function of [j] in these cases is to provide an onset for the syllable in question, then why is the sound change limited to the context in (34i)? And why is the segment [j] , instead of [w] or a laryngeal? I suggest that glide-accretion has both a phonetic and analogical component, as sketched in (35). On the phonetic side, glide-accretion can be viewed as the phonologization of a very common sound sequence in Oceanic, /…i#a…/, realized phonetically as [ija].[15] A range of pre-nominal particles end in /i/. These include: generic locatives **i, *di*, directional **ki*; personal article **i*/**si*; genitive marker *qi/*ni; deictics **qani, *ini, *idi*. When pronounced as proclitics, these particles will give rise to glide-like percepts before following /a/-initial nouns.[16] The excrescent glide is analyzed as part of the following word, with *a/ja* as non-contrastive variants. The non-contrastiveness of these variants is due to an inherited property from Proto-Austronesian, where /j/ was contrastive word-medially and finally, but not word-initially. The system stabilizes as *ja*-forms gradually replace *a*-forms.

(35) Hypothesis regarding the origins of *y*-accretion

i. Common sound sequence: /…i#a…/ realized as […ija….]

ii. […ija….] analysed as […i#ja…]

iii. […ija….] analysed as /…i#ja…/ ; [a….] analysed as /ja…/

iv. /ja…/ variant chosen as basic for words beginning in [a…]

As with other examples of C-epenthesis, no direct reference is necessary to the onset-filling function of these developments. In fact, as illustrated in (34), the majority of V-initial words are inherited without change. And no direct reference is made to segmental markedness: the fact that the epenthetic glide is [j] is attributed to the high frequency of phonetic *ija* in sandhi contexts.

3.3.2. What is Ritwan *l*-sandhi?

Sound changes similar to *j*-accretion occur where phonetic glides are just one variant in sandhi contexts. Recall the evidence from Ritwan languages Wiyot and Yurok for original V-initial words, with *j*-insertion in sandhi (19b), and [h] inserted at the beginning of a prosodic word. In this case, an additional sandhi process involves surface [l]. Following Blevins and Garrett (2001), certain *l*-final particles, including the locative **tol*, were subject to *l*-devoicing and loss before consonants, with [l] surfacing only before vowel-initial words. This *l*-sandhi, has given rise to distinct sound patterns in Yurok and Wiyot.

The Wiyot pattern is illustrated in (36): in Wiyot, a stem with an initial /h/ appears with [j] instead after preverbs ending in front vowels, and with [l] after all other preverbs (Teeter 1964:24; Reichard 1925:19). These sources are abbreviated T and R respectively below, with page numbers following.[17]

(36) Wiyot *h*-sandhi

a. h → j / {i, e} # ___

hak^{W}t-	"build fire"	bas hi ják^{W}tad	"then one builds a fire"	(T 114)
haʔlab-	"dance"	ki jaʔlabìɬ	"they never danced"	(T 119)
hil-	"say"	hi jíliɬ	"then he says"	(T 109)

b. h → l / {a, o, u} # ___

hap-	"be cooked"	kitko kowa láp	"they are almost cooked"	(T 117)
haʔlab-	"dance"	pitabaláʔlabiɬ	"he only dances"	(T 119)
halok-	"go along"	to lalókiɬ	"he goes along"	(T 120)

c. h → l / C # ___

hoɬb-	"feel so"	kuc kóbaɬ loɬbiɬ	"he felt bad about that"	(T 111)
hanelis-	"arrange"	ku-cap-la:nelis-oiʔ	"were arranged same way again"	(R 63)
hil-	"say"	kwis-le:l-iɬ	"suddenly he said"	(R 52)

In Yurok until the mid-20th century, /h/-initial words were pronounced with initial [l] only after particles which contained historical final laterals; elsewhere we find [j] after /i/, [ɣ] between other vowels, and [h] elsewhere. Examples of the general Yurok pattern are given in (37).

(37) Yurok general *h*-sandhi (Robins 1958:9)

a. h → j / i # ___

heɣo'l	"he goes"	ni jeɣo'l	"he goes there"
hunowoni	"growing"	k'i junowoni	"things that grow"

b. h → g / V # ___ (V≠i)

hohkumek'	"I work"	me ɣohkumek'	"I worked"
hoole'meɬ	"they go"	wonu ɣoole'meɬ	"they went up"

Yurok examples of post-particle [l] are given in (38).

(38) Yurok *h*-sandhi: [l] after ʔ*o* 'locative', *ma/me,* ʔ*ema/*ʔ*eme* 'past', *tem(a)* 'in vain'

a. Sample place names (Waterman 1920)

haʔaaɣ	"rock"	ʔo laʔaaɣ	"LOC rock"
heɣ-	"go, travel"	ʔo leɣ	"where one goes"
ho'monoʔ	"tan-oak"	ʔo lo'monoʔ	"LOC tan-oak"

b.

tuʔ witu meɬ	mi	woʔ	ʔo	leɣohku	niiɣem
and for that reason	not	they	LOC	make-INT	obsidian

"That is why they do not make obsidians there." ([ALK 75.8]; tr. *YM* 436)

c.

ʔo	le'm	kwilek	nek	ki	nepaane'm	ko	ʔo	lewoloce'm
LOC	say-3SG	well	me	FUT	eat-2SG	TEMP	LOC	get.well-2SG

"It said, 'If you eat me, you will recover.' " ([ALK 75.25-26]; tr. *YM* 313)

d.

tuʔ	hii,	toʔ	kwilek	me	lego'l	mewimor
and	*hii*	and	well	PAST	go-3SG	old man

"*Hī*, the old man is the one who was there then." ([ALK 75.8]; tr. *YM* 436)

A summary of the analysis detailed in Blevins and Garrett (2001) is given in (39).

(39) Ritwan sandhi before *V

<u>Stage I.</u> merger of laterals **l* and **ɬ* in final position led to phrasal alternations.

a. Before a vowel-initial word in the same phonological word:
   *-V**l**#V-, i.e. [-V.**l**V-] with syllabification into the following onset
b. Elsewhere: *-Vɬ. (e.g. [Vɬ.CV])

<u>Stage II</u>. The automatic *h*- in vowel-initial words transformed these phrasal alternations as follows:

a.	Before a vowel-initial word:	*-V.lV-
b.	Before a consonant-initial word:	*-Vɬ.CV-
c.	An *h*-initial word with no lateral sandhi:	*hV- phrase-initially, *ɣV- medially

<u>Stage III</u>. Final *l* was reinterpreted as part of a following, originally vowel-initial word.

<u>Yurok</u>: Within the phonological word, initial *h* → *l* after certain words.
<u>Wiyot</u>: Within the phonological word, initial *h*, non-initial *l*.

The purpose of this somewhat long excursus on Ritwan sound change is to highlight two points. First, reanalyses where word boundaries are aligned with syllable boundaries are not uncommon, and seem particularly likely where the particle + N combination is of very high frequency. Second, where such restructuring occurs, the segment in question may be a result of phonetic conditioning (Oceanic *j*-accretion), phonologically conditioned allomorphy (e.g. English *a/an*), or a combination of phonetic, phonological and morphological conditioning, as in the Ritwan developments just discussed.

In the analyses of Oceanic *j*-accretion and Ritwan *l*-sandhi, there is no reference to segmental or syllabic markedness constraints. As (34) illustrates, *j*-accretion did not fulfill this general function, nor is there evidence for the majority of Oceanic languages that any other consonant did. In Wiyot, prior to general *l*-sandhi, all syllables already had onsets. The shift of **h* > *l* under sandhi appears to constitute a change from a less marked to more marked consonant in this environment. However, this is precisely the pattern of other cases of rule inversion seen in 3.2 where consonant/zero alternations may involve segments other than glides and laryngeals. Under the current analysis, shifts like **h* > *l* in Wiyot are expected where high-frequency surface sound patterns are involved.

4. Other places where segmental and syllabic markedness fail.

The markedness constraints in (2) and (3) have been claimed to play a role not only in consonant epenthesis, but also in sound change, affix positioning, and reduplication. In this section I briefly summarize evidence against these constraints in each area.

4.1 General syllabification and initial C-loss.

If markedness constraints like those suggested in (2) and (3) play an active role in sound change, as argued, for example in Kiparsky (1988, 1995, this volume), then we should see evidence of this in the historical record. I have argued above that once synchronic consonant-epenthesis alternations are deconstructed, the independent components which give rise to them can be stated without reference to segmental or syllabic markedness. Another argument against the role of ONSET as a constraint on sound change, however, is the existence of recurrent sound changes leading to onsetless syllables, and their apparent consequences.

In Blevins (2001) I summarize data on initial consonant-loss in dozens of Australian languages, and argue for independent parallel developments in at least four distinct subgroups. The general sound change, stated in (40), involves loss of an initial consonant. While in some cases, the quality of the consonant arguably plays a role, in Arandic and Northern Paman languages, loss is prosodically conditioned with all initial consonants succumbing.

(40) Initial C-loss in Northern Paman and Arandic (Hale 1962, 1964, Koch 1997, Blevins 2001)

$$* C > Ø / {}_{Wd}[\_$$

Since this sound change in its numerous instantiations appears to be eliminating precisely the preferred syllable types which constraints like (2) attempt to enforce, something more clearly needs to be said. But once we admit that consonants can be phonetically weak in initial position, and perhaps not accurately perceived under destressing, while at the same time admitting that hiatus contexts can result in the percept of an intervening glide in cases of historical glide epenthesis, what arguments remain for ONSET as a component of universal grammar?

One might argue, following Jakobson (1929/1962) and Kiparsky (1995, this volume), that there are simply certain universals which are never violated. Onset in (2), however is not one of them. One of the most interesting aspects of the Northern Paman and Arandic languages which have undergone the sound change in (40) (as well as final vowel loss) is the extent to which their syllabification algorithms are highly aberrant from a cross-linguistic perspective. Sommer (1969, 1970) argues that Oykangand, which has only vowel-initial words, syllabifies all medial consonants in the coda, as schematized in (41). A similar argument is made by Breen and Pensalfini (1999) for Arrernte.

(41) Syllabification in Oykangand and Eastern Arrernte

VCV	→	V.CV
VCCV	→	VCC.V
VCCCV	→	VCCC.V

In word-based syllabification models like that advocated by Steriade (1999) and Blevins (2003a, 2003c), the syllabifications in (41) are precisely those expected when word forms happen to converge on being vowel-initial and consonant-final.

4.2 The non-emergence of the unmarked I: infixation.[18]

Theory-internal arguments have been made within Optimality Theory that both the position of infixation and aspects of reduplicative phonology follow from syllabic and segmental markedness constraints, which may be invisible in other processes due to over-riding faithfulness constraints (Prince and Smolensky 1993; Kager 1999; McCarthy 2002). Predicting the position of infixation seems a non-issue. As argued by Blevins (1999) for Leti, and more generally by Yu (2003), there are cases of infixation which defy syllable markedness accounts, as well as languages with minimal prefix/infix or suffix/infix pairs. Data from Leti illustrating the inutility of an ONSET constraint is shown in (42).

(42) The eight allomorphs of the Leti nominalizing (NOM) morpheme

	NOM	VERB STEM	GLOSS	DERIVED NOMINAL	GLOSS	AFFIX TYPE
a.	-ni-	kaati	to carve	k-ni-aati	carving	infix
b.	-n-	kini	to kiss	k-n-ini	kissing	infix
c.	-i-	mai	to come	m-i-ai	arrival	infix
di.	i-	atu	to know	i-atu	knowledge	prefix
dii.	ni-	atu	to know	ni-atu	knowledge	prefix
e.	ø	ruru	to tremble	ruru	trembling	null
f.	nia-	ltieri	to speak	nia-ltieri	speech	prefix
g.	i-, -i-	natu	to send	i-n-i-atu	sending	prefix + infix

Since /n/ is a potential allomorph of the nominalizing infix, we expect it before vowel-initial stems like /atu/ since precisely in this position, /n/ will result in an onset for the vowel-initial syllable without resulting in hiatus. However, as shown by the forms in (42di), (42dii), the two attested forms are inconsistent with ONSET as a driving force in infix-placement.

A minimal prefix/infix pair from Atayal (Egerod 1965, Yu 2003) is shown in (43). Clearly, the position of infixation cannot be accounted for in terms of prosodic constraints, unless these constraints are specific to the morphological construction involved. This is equivalent, however, to specifying whether the morpheme is a prefix or infix, greatly weakening the general claims of the phonologically-based account.

(43) Actor focus and reciprocal/reflexive /m/ in Atayal

Reciprocal/ Reflexive	Actor focus	Root	Gloss
mkaial	kmaial	kaial	'talk'
mqul	qmul	qul	'snatch'
msbil	smbil	sbil	'leave behind'
mspuŋ	smpuŋ	spuŋ	'measure'
msuliŋ	smuliŋ	suliŋ	'burn'
mhkaŋiʔ	hmkaŋiʔ	hkaŋiʔ	'search'

It is also worth mentioning in this context that a strong prediction of the syllabic markedness account of infixation is unattested. Consider a language with an affix /m-/ which is generally aligned with the beginning of the word (i.e. is a prefix). Now imagine that in this same language, the only relevant constraint is ONSET. The hypothetical pattern is illustrated in (44). If an onsetless syllable occurs anywhere in the stem, the affix fills the empty onset slot (44a-d), and if there is more than one onsetless syllable (44e), the affix occupies the onset position which is closest to the beginning of the word. The advance of the /m-/ affix within the word in (44) subject to the neediness of onsetless syllables might seem an absurd sound pattern to students of historical linguistics, since it is unclear how such a pattern could arise. However, this is precisely the pattern predicted by displacement models where the actual position of an affix can be underdetermined (left edge vs. right edge), with syllable markedness constraints, among others leading to its correct positioning. In fact, the pattern in (44) is expected to be quite common, since, the only constraint which is violated is affixal alignment, precisely the constraint which is violable in other analyses where infixes are analysed as displaced prefixes or suffixes. To my knowledge, however, there is no natural language which instantiates the general pattern illustrated in (44). This is unsurprising within the Evolutionary model, where no universal onset constraint is posited, and where no natural sound change, sequence of sound changes, of inversion of sound changes, or analogical change, is known which could produce the affix distribution in (44).

(44) Hypothetical /m-/ (Align left, with ONSET undominated)

a. m + /alu/	**m**alu	
b. m+ /talua/	talu**m**a	
c. m + /talukia/	talkuki**m**a	
d. m + /taukia/	ta**m**ukia	
e. m + /talu/	**m**talu, t**m**alu or ta**m**lu	(depending on ranking of *COMPLEX, NOCODA, etc.)

4.3 The non-emergence of the unmarked II: reduplication.

The other phonology/morphology interaction where unmarked structures have been claimed to be emergent is in reduplication (McCarthy and Prince 1994, 1995). Theory-internally, of course, it is possible to analyse nearly any sound pattern as the output of appropriately ranked markedness and faithfulness constraints within Optimality Theory. The reduplicative patterns in this section are offered as examples where, whatever technical fixes one chooses to make, unexpected or 'marked' sound patterns arise *only* under reduplication. These patterns, like the sound change in (40), the emergent syllabifications in (41), and the infixation patterns in (42) and (43) arguably constitute examples of marked structures emerging precisely where Optimality Theory predicts unmarked structures.[19]

In (45) Southern Oromo (Stroomer 1987) reduplication is illustrated. The general pattern is to take the first CV of the base, followed by an epenthetic *m*.

(45) Southern Oromo reduplication in frequentative verbs: CVm- (Stroomer 1987)

Base	Reduplication	gloss
eege	**em**eege	'he waited long'
harkifte	**ham**harkifte	'he pulled frequently
teece	**tem**teece	'she sat down a long time'
fuugite	**fum**fuugite	'she raised some children'
dubbane	**dun**dubbanne	'we talked a long time'
bak'atani	**bam**bak'atani	'they ran and ran'
deemee	**dem**deemee	'he went and went'
tataanii	**tam**tataanii	'they stayed and stayed'
guddisani	**gum**guddisani	'they made bigger and bigger (educated)'

In terms of syllable and segmental structure, the appearance of *m* is problematic. At the level of syllable structure, closed syllables are marked in comparison with open syllables. Open syllables than should be emergent, all else being equal. And, as discussed in 3.2, epenthetic segments like *m* pose difficulties for segmental markedness accounts: there is no sense in which *m* is natural or predictable in this context, nor is there any sense in which it is, in general a natural or predictable default coda or onset segment.[20]

In (46) Trukese verbal reduplication is illustrated. Like the Oromo examples in (45), an unexpected segment and syllable type occurs in a context where unmarked structures are predicted to emerge. In (46b) and (46d), where vowel-initial stems are involved, a geminate [kk] surfaces under reduplication. As with the Oromo example, this pattern is marked in both syllabic and segmental terms. Syllabically, initial geminates are marked in comparison with non-geminates. Segmentally, epenthesis of *k* is uncommon, and lacks phonetic motivation.

(46) Trukese reduplication (Goodenough and Sugita, 1980) HAB = HABITUAL

	Non-red. Base (N or V)	Single C- RED (derivational)	Double CV-C- RED. (productive, inflectional)	gloss
a.	fótuki	ffót		plant it/be planted
	posuuw	ppos		stab him/be stabbed
	tuuna-	ttuun		twirl/be twirled
b.	áápi	kkááp		transport it/transporting
	éréétí	kkérééť		scrape, sand/be sanded
	amaat	kkamaat		be ground/grinding
c.	suku-	ssuk	sussuk	knock/knock (rep.)/HAB
	fene-	ffen	feffen	peck/peck (rep.)/ HAB
	tuu-	ttu	tuttu	stab, pierce/be sewn/ HAB
	pwúnúwa-	pwúppwúnú		spouse/treat as a spouse/ HAB
d.	wún		wúkkún	drink/HAB (POC **inum*)
	ósómwoonu		ókkósómwoonu	pay chiefly respects to/HAB
	eesa		ekkees	son-in-law/treat as s-i-l HAB

For Oromo, we can only guess at the sequence of historical developments. But the historical phonology giving rise to the Trukese patterns in (46) is well documented. The single C-reduplication pattern reflects earlier CV- with loss of the pre-tonic unstressed vowel (Goodenough and Sugita, 1980; Blust 1990). What complicates the sound patterns is the loss of word-initial **k*, but maintenance of word-initial **kk*. Reduplicative paradigms after **k*-loss show V-initial forms in the base, and geminate *kk* under reduplication. Of particular interest in this case is the extension of the geminate *kk* pattern to vowel-initial words which did not have an etymological initial **k*. In this class is the verb *wún* 'drink', from Proto Oceanic **inum*, as well as many others.

4. Summary and implications.

In this chapter, I have suggested that there are clear natural and unnatural histories for patterns of consonant-insertion which make no reference to syllable onset or segmental markedness. At the same time, I have offered new ways of understanding the typology of C-epenthesis. Within the realm of natural history, glide-epenthesis and laryngeal epenthesis are two distinct subtypes with different phonetic and phonological profiles. In the domain of unnatural histories, significant correlations are observed between consonants subject to coda-weakening, and those involved in epenthesis. This finding follows from our understanding of rule-inversion as part of phonological acquisition. Finally, a mix of natural and unnatural history characterizes the analysis of Oceanic *j*-accretion and Ritwan *l*-sandhi.

What are the implications of this study for phonological modeling? Within the phonological realm, there appear to be few, if any, substantive universals.[21] Universal tendencies emerge from recurrent instances of phonetically natural sound change, and from common events like rule-inversion which have no phonetic basis. Natural and unnatural histories are intrinsic aspects of language change and give rise to synchronic systems in which the contributions of each are superficially indistinguishable. Synchronic consonant epenthesis is not a monolithic entity, and we are no closer to understanding it by simply listing and formalizing every case which occurs. However, by shifting our focus from synchronic universals to common and recurrent trajectories in sound change, the distinct histories which characterize superficially indistinguishable sound patterns may be disentangled, with explanations for universal tendencies embedded within them.

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[1] Here and elsewhere, I use the term ‘consonant’ in a non-technical sense to refer to non-vocalic non-syllabic segments including consonants, glides, and laryngeals. Phonetic symbols are those of the IPA.

[2] Other models, like Natural Phonology (Stampe 1973) simply ignore sound patterns with unnatural histories.

[3] For similar approaches to morphosyntactic regularities and rarities respectively, see Garrett (this volume) and Harris (this volume).

[4] Epenthetic consonants which result from C-to-C transitions (e.g. ns > nts), or strengthening of release features (e.g. k^h > kx) are not discussed, since these give rise to new CC clusters, not CV syllables.

[5] Pre-Hindi is from Hock (1991:128). Pre-Chamorro is from Blust (2000). Tauya data is from MacDonald (1990), though in this case, the historical reconstructions are my own, based on internal reconstruction.

[6] Since the changes in (11iiia,b) arguably precede glide-insertion historically, they only show that no glide has been accreted word-initially.

Another sound change which directly eliminates onsets is glide-vocalization. Such a change appears to have occurred in Muna, an Austronesian language of Muna island: PAN **walu* ‘eight’, Muna *oalu*, PCMP **waiR*, Muna *oe* (van den Berg, 1989).

[7] Given the number of independent instances of final glottal-stop epenthesis, Blust (in prep.:25) suggests the possibility that “final glottal stop was a feature of word endings in PAN.” The symmetry of laryngeal epenthesis at opposite ends of the prosodic domain, along with the cross-linguistic frequency of such patterns in non-Austronesian languages, and the variability within Austronesian of final [h] vs. [ʔ] are all consistent with phonetic multigenesis.

[8] See Berman (1981) for a discussion of laryngeal increments before voiceless stops and Blevins (2003b) for more on Yurok syllable structure.

[9] In at least one case where pitch accent is involved, in the Okinawa dialect of Japanese, the loss of distinctive pitch has given rise to a final glottal stop (John Whitman p.c., 2003).

[10] Notice the similarity in the Yurok change and that in Singhi. In both languages a strengthened **h* is realized as a velar fricative. In Yurok, regular strengthening is limited to intervocalic position where voicing also occurs.

[11] For other potential examples and some implications for synchronic grammars, see Vaux (2002).

[12] See Bermúdez-Otero and Börjars (2006) for a defense of markedness in the case of English intrusive [l] in one dialect. Their general claim, as I understand it, is that contexts of rule inversion are determined, not by the original phonetic context of the C-loss in question, but by markedness constraints which set limits on grammatical restructuring.

[13] Thematic consonants before long and short suffixes are collapsed, and *-ina* < **-nia* is treated as *n*-initial. For further discussion of these alternations, see Hale (1973), Lichtenberk (2001), Pawley (2001), and Blevins (2004b).

[14] For discussion of constraints on analogical change, see Garrett (this volume).

[15] Final C-loss in many Oceanic languages (29) will make hiatus across word boundaries much more common than in other Austronesian languages which maintain final consonants.

[16] Notice that in some languages, like Sepa and Tehoru *j*-accretion is limited to nouns.

The proposal sketched in (35) is not meant to account for homorganic glides in Trukic, which have a natural history similar to that outlined in 2.1. It will also not account for the * Ø > *w* / $_{Wd}$[_V in Chamorro, which, occurred at some stage after **h* loss. Since Chamorro did undergo the unconditioned sound change of **e* > *u*, it is tempting to relate *w*-epenthesis to the greater frequency of final *u*'s in hiatus contexts.

[17] Since Wiyot *i* and *e* both correspond to Yurok *i* (Yurok *e* = Wiyot *a*), *h* → *j* sandhi can be said to be regular before the reflexes of Ritwan nonlow front vowels.

[18] The non-emergence of the unmarked (TNETU) effects are generally unremarkable within Evolutionary Phonology, since there are no markedness constraints. The points raised here are meant to highlight just some of the empirical difficulties of claimed TETU effects.

[19] For additional problematic cases of reduplication where marked structures emerge and for alternative explanations of these patterns, see Blevins (2003d, 2005b).

[20] Since coda nasals can be potentially weakened and lost, a preliminary hypothesis is that an original *CVm-CVm.C… pattern of reduplication was realized as *CVm-CV:.C… by a prosodically conditioned change of this type. The *CVm- pattern was then extended to all CV:-initial stems, and later to other stems as well. While this suggestion is purely hypothetical, it illustrates the usefulness of Evolutionary Phonology in limiting the choice space for historical development. One cannot simply assume that in Southern Oromo, *m* is the unmarked consonant, and one cannot motivate the occurrence of /m/ by claiming that the prefix must be a closed syllable, since in the *emeege* example, it is not. On the other hand, one cannot motivate the insertion of *m* through ONSET, since this constraint plays no role in reduplication of C-initial forms.

[21] Though, see Kiparsky (this volume) for a different view.

The widely held view that distinctive features are substantive phonological universals is undermined by Mielke (2004), where features are argued to be language-specific emergent properties of grammars, defining both phonetically natural and unnatural classes.