Epenthetic Inheritance

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In this paper, I examine the typology of epenthetic consonants, and observe that epenthetic consonants tend to inherit quality from surrounding sounds in general phonotactics. To capture this, I argue that epenthetic consonants are made by constricting or lengthening existing gestures into new sounds. The basic mechanism of consonant epenthesis is thus transformation (following Splitting Theory, Staroverov 2014), not insertion. This proposal contrasts with markedness-based theories of epenthesis (e.g. Lombardi 2002), since epenthetic quality is thus primarily constrained by faith. These claims are supported by a novel typological survey and several in-depth case studies, which demonstrate that the typology of consonant epenthesis cannot be constrained by markedness alone.

Keywords: consonant epenthesis; gestures; segments; assimilation; typology

1 Introduction

In this paper, I examine the typology of epenthetic consonants, and observe that epenthetic consonants tend to inherit quality from surrounding sounds in general phonotactics. I propose that epenthetic consonants are modifications of existing articulatory gestures (cf. Gick 1999; Browman, Goldstein et al. 1987), where changes have been made to their gestural targets or gestural timing. Languages may differ on which of these dimensions they manipulate, but the intuition is that epenthetic consonants will minimally perturb the existing gestural dynamics. The basic mechanism of consonant epenthesis is thus transformation (following Splitting Theory, Staroverov 2014), not insertion.

My proposal contrasts with markedness-based theories of epenthesis (e.g. Lombardi 2002), since epenthetic quality is thus primarily constrained by faith. It also contrasts with segmental splitting models of epenthesis (Staroverov 2014, 2016), which share a similar analytical basis, but ultimately make different predictions due to using segments as the basic representational unit. I support this analysis through a novel typological survey and several in-depth case studies, which demonstrate that only a gestural transformation account will correctly predict the typology.

The core claim of the paper is given in (1), which I call *Epenthetic Inheritance*.

(1) **EPENTHETIC INHERITANCE:** Phonotactically general consonant epenthesis (that does not require morphological conditioning) tends to be assimilatory, where epenthetic quality at least partially matches surrounding sounds.

Epenthetic Inheritance can be broken down into five generalizations shown in (2).

(2) Generalizations for phonologically general consonant epenthesis patterns:

a. LOCAL ASSIMILATION. Epenthetic consonants tend to share quality with gesturally local sounds.

b. NOT MARKEDNESS, NOT STRUCTURE-PRESERVING. Epenthetic consonants do not minimize segmental markedness, and may be segments that are not robustly contrastive in the language.

c. INTERVOCALIC SONORANT BIAS. Epenthetic consonants in intervocalic positions tend to be sonorants (cf. Uffmann 2007).

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d. Margin Voiceless Obstruents. Epenthetic consonants are only voiceless obstruents when adjacent to another consonant or word margin, never in intervocalic positions.

e. Invisible Man. Epenthetic consonants are invisible/inert with respect to allomorph selection.

f. The typology of morphologically-restricted epenthesis is different from the phonologically general kind, and does not obey (2a.-e.). (See Section 4.2.)

Crucially, Epenthetic Inheritance only applies to epenthesis patterns that are phonologically general. In epenthesis patterns that require reference to particular lexical items or morphological contexts (which I will call morphologically restricted), the typology is different, and so separate analysis is necessary.

The paper is organized as follows. Section 2 introduces a core case study from Uab Meto, where the epenthetic consonants are [b, ɟ, l] (in the Molo dialect) and [ɡ] (in Oekabiti Amarasi). Section 3 introduces the analysis, and then Section 4 presents the typological survey and selected case studies. Sections 5-6 discuss implications for the architecture of phonology and conclude.

2 Core Puzzle: Meto (Molo dialect)

The core case study for Epenthetic Inheritance comes from Uab Meto (Austronesian; Southern Malayo-Polynesian), a dialect chain spoken in West Timor, Indonesia. Each dialect has a pattern of consonant epenthesis, which have been insightfully described in Culhane (2018) and Edwards (2016, 2020). The data reported here come from the author's fieldwork unless otherwise noted.[1] Meto epenthesis is important for establishing two baselines: (i) that the attested set of epenthetic consonants is more varied than previously claimed, and (ii) that epenthetic consonants inherit their quality from local sounds.

2.1 Data: Molo Epenthesis

In the Molo dialect, epenthetic consonant quality is conditioned by the preceding vowel. Round vowels condition [b], mid front vowels condition [l], and high front vowels condition [ɟ].

(3) Molo: Consonant epenthesis of [b, l, ɟ] before vowel-initial suffixes on CVV# roots

a.	/ʔau-e/	→ [ʔaub-e]	'the lime'	cf.	[ʔau]	'lime'
	/ʔao-e/	→ [ʔaob-e]	'the body'		[ʔao]	'body'
	/meo-e/	→ [meob-e]	'the cat'		[meo]	'cat'
b.	/fee-e/	→ [feel-e]	'the woman'		[fee]	'woman'
	/biɟae-e/	→ [biɟael-e]	'the water buffalo'		[biɟae]	'water buffalo'
	/ʔoe-e/	→ [ʔoel-e]	'the water'		[ʔoe]	'water'
c.	/ʔai-es/	→ [ʔaɟ-es]	'a fire'		[ʔai]	'fire'
	/hoi-e/	→ [hoɟ-e]	'dry it'		[hoi]	'dry'
	/fai-e/	→ [faɟ-e]	'the night'		[fai]	'night'

[1] Data was collected in elicitation from five participants (2F) in Mollo Utara, NTT, Indonesia in Summer 2019. All participants were fluent in Uab Meto, Kupang Malay, and Standard Indonesian, and used Uab Meto in their day-to-day lives. Audio recordings and additional participant metadata are available online at PARADISEC.

In words that end in a CV sequence, the conditioning vowel also disappears, shown in (4):

(4) Molo: Consonant epenthesis of [b, l, ɟ] before vowel-initial suffixes on CVCV# roots

a.	/manu-e/	→ [manb̲-e]	‘the chicken’	cf.	[manu]	‘chicken’
	/ʔasu-e/	→ [ʔasb̲-e]	‘the dog’		[ʔasu]	‘dog’
	/belo-e/	→ [belb̲-e]	‘the boat’		[belo]	‘boat’
b.	/ʔume/	→ [ʔu͡ɪml̲-e]	‘the house’		[ʔume]	‘house’
c.	/tasi-es/	→ [tasɟ̲-es]	‘a sea’		[tasi]	‘sea’
	/nafnafɪ-es/	→ [nafnafɟ̲-es]	‘a spider’		[nafnafɪ]	‘spider’

Evidence that this pattern is epenthesis, not deletion, comes from plural allomorphy. Meto plural suffixes appear in three phonologically-conditioned allomorphs: *-in* (after consonants), *-n* (after singleton vowels), and *-nu(k)* (after two vowels). If the consonants in (4) were underlying rather than epenthetic, then words like [manu] in (4a.) would have the underlying representation /manub/. We would therefore expect for them to take the allomorph *-in*, just like any other CVCVC word. However, the data in (5) demonstrates that this is not the case: Words like [manu]/[manb-e] ‘(the) chicken’ select [-n], but words like [manus] ‘betel vine’ take [-in]. The simplest explanation is to treat words like [manu] as underlyingly vowel-final.

(5) Molo: Phonologically-conditioned allomorphy in the plural

	-n after V# words			*-in* after C# words			
a.	[manu-n]	‘chickens’	g.	[ma͡ʊns-in]	‘betel vines’	cf.	[manus]
b.	[ʔasu-n]	‘dogs’	h.	[pe͡ob-in]	‘onion’		[peob]
c.	[belo-n]	‘boats’	i.	[loit-in]	‘kinds of money’		[loit]
d.	[ʔume-n]	‘houses’	j.	[keba͡elʔ-in]	‘cabinet’		[kebaleʔ]
e.	[tasi-n]	‘seas’	k.	[tais-in]	‘sarongs’		[tais]
f.	[nafnafɪ-n]	‘spiders’	l.	[ko͡iks-in]	‘bread’		[kokɪs]

As expected, when there is no stem-final vowel, as in (6), no epenthesis takes place. Note that these forms also undergo consonant-vowel metathesis or diphthongization – as this is not directly relevant to the epenthesis pattern I set them aside for now, and direct readers to Mooney (2022); Edwards (2018).

(6) Molo: No epenthesis with C# words

a.	/manus-e/	→ [ma͡ʊns-e]	‘the betel vine’	cf.	[manus]	‘betel vine’
b.	/noah-e/	→ [no͡ah-e]	‘the coconut’		[noah]	‘coconut’
c.	/loit-e/	→ [lo͡ɪt-e]	‘the money’		[loit]	‘money’
d.	/kebaleʔ-e/	→ [keba͡elʔ-e]	‘the cabinet’		[kebaleʔ]	‘cabinet’
e.	/tais-e/	→ [ta͡is-e]	‘the sarong’		[tais]	‘sarong’
f.	/kokɪs-e/	→ [ko͡iks-e]	‘the bread’		[kokɪs]	‘bread’

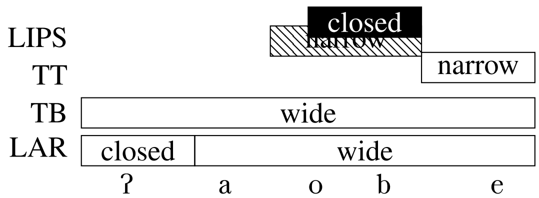
The epenthetic consonants found in Molo are typologically rare. Epenthetic [b] and [l] are attested, although all patterns bear contextual restrictions. For example, Old English epenthetic [b] must be adjacent to a labial consonant (Hogg 2011). In SE Pennsylvania English, epenthetic [l] must occur after a low vowel (Gick 1999). Epenthetic [ɟ], on the other hand, is unattested in general intervocalic contexts (de Lacy 2006: 81). These kinds of epenthetic consonants are expected to be impossible in theories that determine epenthetic quality through markedness alone (such as *STRUC constraints), because they should be ranked high in universal place or sonority hierarchies (Lombardi 2002; de Lacy 2006; de Lacy & Kingston 2013).

2.2 Analysis: Molo Epenthesis

I propose that the mechanism of epenthesis in Molo is based on faith (as in Splitting Theory, Staroverov 2014). Existing vowels are hardened into epenthetic consonants by increasing the gesture's narrowest degree of constriction. The consonants [b, ɟ, l] are selected because they require minimal changes to the articulatory targets.

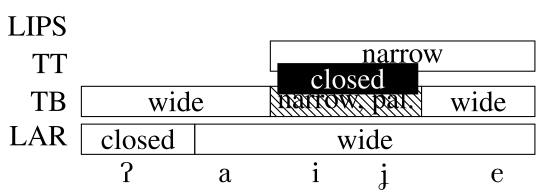
An informal sketch of the analysis is below. In /ʔao-e/ → [ʔaob̲-e] 'the body', the labial rounding gesture (LIPS: narrow) becomes more constricted (LIPS: closed), producing a [b].

(7) Molo: epenthetic [b] from strengthening [u] constriction (LIPS: narrow → closed)



Similarly, in /ʔai-es/ → [ʔaɟ-es] 'a fire', the palatal constriction for the high vowels /i, ɪ/ is strengthened from narrow to closed. No other articulators change their targets. The reason why the vowel entirely disappears in [ʔaɟ-es] (rather than *[ʔaɪɟ-es]) follows from differences in articulator stiffness (Browman & Goldstein 1984; Kelso & Tuller 1985). Palatals are less stiff than labials, meaning that the gesture is kinematically slower in [ʔaɟ-es] 'a fire' than [meob-e] 'the cat'. The palatal thus fully obscures the [i] so that no diphthongization is visible (e.g. [ʔaɟ-e], *[ʔa͡iɟ-e]).

(8) Molo: epenthetic [ɟ] from strengthening the [i] palatal constriction (TB: narrow → closed)



While other epenthetic consonants are theoretically possible, they don't occur in Molo for the following reasons. One, they would require more articulators to change targets, or two, they would require the constriction degree to change more dramatically. For example, an epenthetic [m] in /ʔao-e/ → *[ʔaom̲-e] would require NAS: closed → wide in addition to LIPS: wide → closed. Similarly, while an epenthetic glottal stop would require just one articulator to change, the degree of constriction change would be more abrupt, going from wide to closed. The observed epenthetic consonants [b, l, ɟ] minimally perturb the existing gestural dynamics, which I will argue is the most prevalent pattern in the typology of epenthesis.

2.3 Alternatives

Alternatives fall into two groups: insertion theories and splitting theories. Insertion theories are the traditional view, where epenthesis adds new material (e.g. features, segments) from nothing. Splitting theories, by contrast, treat epenthesis as a transformation of input material. Here, I demonstrate that neither theory perfectly captures the typology. My theory is a hybrid of these two types.

2.3.1 Insertion-Based Alternatives

Insertion theories share the property that epenthetic consonants have no formal relationship to input material – epenthetic consonants are inserted from nothing. Most insertion theories contend that epenthetic consonants minimize markedness in some form, such as in terms of PLACE (Lombardi 2002; Smolensky 1993; de Lacy 2006) or sonority (de Lacy 2002; Uffmann 2007). These theories all share a prediction called The Emergence of the Unmarked (TETU, McCarthy & Prince 1994): When there is no input segment to be faithful to, the grammar will select candidates based on markedness alone.

Many insertion-based theories also have developed ways of accounting for epenthetic assimilation. These again usually take the form of markedness constraints such as AGREE (de Lacy 2002, 2006), SHARE[F] (Culhane 2018), *MULT-LINK (Rubach 2000), *LINK(C,V) (Uffmann 2006), or surface correspondence (Kitto & de Lacy 1999). Again, TETU is at play. Even if there is no assimilation elsewhere in the language, we may expect to see assimilation in epenthetic consonants because input faith is not relevant. Epenthetic consonants are expected to assimilate whenever these constraints are ranked above other forms of markedness.

I argue that this TETU prediction is false for consonant epenthesis: in several languages, epenthetic consonants are selected even though they must be highly marked *in that language*. To illustrate, consider the Amarasi dialect of Uab Meto. In Amarasi, the epenthetic consonant is always [ɡ][2], as shown in (9):

(9) Amarasi (Oekabiti) consonant epenthesis

a.	/meo-e/	→ [meoɡ-e]	'the cat'	cf.	[meo]	'cat'
b.	/ʔao-es/	→ [ʔaoɡ-es]	'a body'		[ʔao]	'body'
c.	/noe-es/	→ [noeɡ-es]	'a river'		[noe]	'river'
d.	/tasi-e/	→ [taisɡ-e]	'the sea'		[tasi]	'sea'
e.	/roti-e/	→ [roitɡ-e]	'the bread'		[roti]	'bread'

(10) Amarasi: When there is no vowel hiatus, no consonant epenthesis occurs

a.	/noah-es/	→ [noah-es]	'a coconut'	cf.	[noah]	'coconut'
b.	/tai-s-e/	→ [tai-s-e]	'the sarong'		[tai-s]	'sarong'
c.	/roi-t-e/	→ [roi-t-e]	'the money'		[roit]	'money'
d.	/manus-es/	→ [mauns-es]	'a betel vine'		[manus]	'betel vine'

The reason why this pattern is puzzling is because [ɡ] is banned in all other contexts in Amarasi. It is not a robustly contrastive phoneme, and only occurs in this narrow set of epenthetic contexts. While all other consonant phonemes occur root-initially, as in (12), there are no roots that begin with [ɡ].

(11) Amarasi consonant inventory (loanword-only in parentheses)

	Labial	Alveolar	Palatal	Velar	Glottal
Plosive	b p	t		k	ʔ
Nasal	m	n			
Fricative	f	s			h
Affricate			(dʒ)		
Liquid		r			

[2] There is some dialectal variability on rounding and palatalization, see Section 3.4.

(12) Minimal pairs for word-initial consonants in Amarasi

[boʔ] 'ten'	[poʔon] 'orchard'	[toʔo] 'angry'	[ʔoo] 'k.o. bamboo'
[meo] 'cat'	[peo] 'onion'	[neo] 'to'	[reok] 'good (medial)'
[fai] 'night'	[hai] '1PL.NOM'	[ʔai] 'fire'	[kai] '1PL.ACC'
[roit] 'money'	[toit] 'ask'	[soiʔ] 'count'	

Additionally, there is evidence that this is not an accidental gap. In loanwords where we would expect /g/ to appear, /g/ is realized unfaithfully as [k], shown in (13).

(13) Amarasi adapts loanword /g/ as [k]

	Amarasi	Indonesian	gloss	
a.	krei	geredʒa	'church'	(via Portuguese *igreja*)
b.	kuru	guru	'teacher'	(via Sanskrit/Indonesian *guru*)

These data are consistent with [g] being highly marked in Amarasi. To rule out faithful loanword adaptation in (13), *[g] must be ranked over faith. Yet, if [g] is so highly marked, then any other consonant in the language should be preferred as the epenthetic consonant. This problem is illustrated in (14)-(15).

(14) Amarasi: *[g] must be highly marked to condition loanword adaptation of [g] as [k]

/guru/	*[g]	IDENT[VOI]	*[ʔ], *[k] ...
a. guru	*!		
☞ b. kuru		*	*

(15) Amarasi: Unexpected epenthesis of the marked

/meo-e/	*[g]	DEP	*[ʔ], *[k] ...
☹ a. meog-e	*!	*	
b. meok-e		*	*
c. meoʔ-e		*	*

Amarasi is thus epenthesis of the marked – a pattern that is explicitly predicted *against* by every markedness-based theory of epenthesis. While surprising, the Amarasi data is not entirely fatal to the OT accounts. I briefly outline two possible solutions, and then continue to contrast my proposal with Splitting Theory.

One way to derive Amarasi [g] epenthesis is to appeal to positional markedness. Albright (2004) observes several cases where marked structures appear in unexpected (but non-epenthetic) contexts. Lakhota, for example, shows a wider variety of codas in affixes than in roots. This is surprising under a theory of positional faith, since any underlying codas in the input should be preferentially *preserved* in roots as a consequence of root faith. Albright calls this Emergence of the Marked, and demonstrates that patterns of this type can be derived using positionally-sensitive markedness constraints.

In the context of Amarasi epenthesis, the Emergence of the Marked strategy would be to rank *ROOT[G] ≫ IDENT[VOI] ≫ *[G], banning root-internal [g] but allowing it elsewhere. If this were the case, we could derive the correct epenthetic consonant, but we would have to treat the absence of [g] in affixes as an accidental gap. Later on in Section 4.5, I argue that again this misses a generalization: Many languages have epenthetic consonants that are not robustly contrastive in the same way as Amarasi. We would therefore need to say that all of these languages have the same accidental gap in their affixal inventories.

A second possibility would be to say that the epenthetic [g] is somehow featurally distinct from phonemic [g], so that the epenthetic [g] is unmarked but phonemic [g] is highly marked. On this latter approach, I actually agree: the phonology treats epenthetic [ɡ] specially because there is no *segment* that has all the features of [ɡ]. We hear [ɡ] because that is what a vowel becomes when you constrict it, not because there is a [ɡ] in the atomic segmental representation. This actually marks a point of unity for all models of epenthesis – regardless of if one adopts insertion or splitting, we need some way of treating epenthetic consonants as having different representational status from underlying segments. This is precisely what the theory of Epenthetic Inheritance does, since epenthetic consonants manipulate gestures rather than segments.

To summarize, insertion-based theories all predict that epenthetic consonants minimize markedness. The problem with this prediction is that many languages have epenthetic consonants that are not robustly contrastive. Non-contrastive consonants are typically eliminated with high-ranked markedness constraints (to prevent them from arising in other contexts). Insertion-based theories are thus left at a quandary: epenthetic consonants must be minimally marked, but distributional data suggests those same consonants are marked. Markedness alone cannot be the answer; we must also make reference to faith.

2.3.2 Splitting-Based Alternatives

Splitting Theory (Staroverov 2014, 2016) treats epenthetic consonants as unfaithful correspondents of input vowels. In contexts that require consonant epenthesis, a vowel splits into two segments (violating INTEGRITY) and one of these correspondents is realized as a consonant (often violating IDENT). The core prediction is that epenthetic consonants always have a pressure to be faithful to the input vowel. Epenthetic consonants will thus be as vowel-like as possible, and other consonants will only be considered once those have been ruled out by markedness.

Epenthetic Inheritance builds on Splitting Theory's empirical and analytical core by adopting two claims: (i) epenthetic consonants are restricted by faith to surrounding sounds, and (ii) there is no universal class of epenthetic consonants. However, the predictions of Splitting Theory are different, especially as they pertain to locality and consonant-vowel asymmetries. Splitting Theory assumes that GEN can only split consonants locally. When a vowel splits into an epenthetic consonant, they must be linearly adjacent – no segments may arise between them (e.g. no hypothetical *[pai$_1$tj$_1$-e]; Staroverov 2014: 16, 46).

This locality restriction is too strong. In the Miomafo dialect of Meto, the epenthetic consonant and its conditioning vowel are not always string adjacent (e.g. /fatu-e/ → [fau$_1$tb$_1$-e] 'the stone', /tasi-e/ → [tai$_1$sɟ$_1$-e] 'the sea'; Nona Seko, p.c.). Splitting Theory's adjacency requirement would thus need to be relaxed to allow splitting across a single intervening segment, otherwise it would undergenerate the typology.

However, relaxing the locality requirement leads to an overgeneration issue that I call the No Copying Gap. The No Copying gap was first observed by Kawahara (2007), who observed that no language has general copy-epenthesis of consonants across an intervening vowel (e.g. hypothetical /pa-i/ → *[pap-i]). We are thus left a quandary: If we allow consonants to split across any intervening segment, we fail to derive the No Copying Gap. Yet, if we maintain Splitting Theory's linear adjacency requirement, we fail to derive Miomafo. We are thus forced to say that vowels can split across intervening consonants, but that consonants can only split locally.

While this consonant-vowel asymmetry on locality appears correct (see Staroverov 2014: 206 for discussion), Splitting Theory offers little explanation for its source. If consonant and vowel segments only differ in featural content, then why should GEN treat them differently with regards to splitting? Kawahara (2007) presents an intuitive source of this asymmetry in terms of lengthening. If a vowel lengthens across a consonant we will observe vowel copy epenthesis, but a consonant lengthens across a vowel we will observe only a long consonant. While Kawahara uses this to argue in favor of an Autosegmental analysis of epenthesis, the same reasoning holds for gestures. The No Copying gap suggests that consonant epenthesis makes reference to representations other than segments, which is precisely what my theory does.

2.4 Interim summary

In this section, I have argued that both insertion theories and splitting theories fall short of the observed typology. Insertion theories predict that epenthetic consonants should be less marked and less assimilatory than they often are. Splitting theories fail to predict when an epenthetic consonant is conditioned by a non-adjacent vowel – an attested pattern. My analysis is thus a hybrid between insertion and splitting theories: epenthetic consonants are extensions of existing gestures, but the details of their targets (shape, location) may be inserted.

3 Analysis

This section introduces the analysis, where epenthetic consonants are transformations of existing gestures.

3.1 Preliminaries: Defining gestural targets

Following Browman & Goldstein (1986, 1989, 1990), I treat speech sounds as gestures. Gestures are targeted movements for one of five articulators (lips, tongue tip, tongue body, nasal port, and larynx). Gestural targets are composed of three parameters: constriction degree, constriction location, and constriction shape (Browman & Goldstein 1989). Every gesture is specified with a constriction degree, but languages may differ on whether they specify any additional constriction location or constriction shape. These specifications are summarized in (16):

(16) Gestural target specifications for articulators (Browman & Goldstein 1989: 209)

ARTICULATORS	lips, tongue tip, tongue body, nasal port, larynx
CONSTRICTION DEGREE	closed, critical, narrow, wide
CONSTRICTION LOCATION	dental, postalveolar, palatal, uvular, pharyngeal
CONSTRICTION SHAPE	lateral, rhotic, spread

As a simplifying assumption, I also assume that there are default constriction locations for certain articulators. The default location for the lips is labial, the default for the tongue tip is alveolar, and the default for the tongue body is velar.[3]

I propose that constriction degree specifications are organized along a cline going from wide to closed, as in (17):

(17) Cline of gestural constriction degrees

MOST OPEN	1	2	3	4	MOST CLOSED
	wide	narrow	critical	closed	

This cline gives us a metric for evaluating how much a constriction degree has changed. For instance, changing a vowel into a fricative (wide-1 → critical-3) would be a fairly costly, as it moves up two steps on the cline. In comparison, changing a fricative into a stop (or vice versa) would be much less costly, as it would only move one step (critical-3 → closed-4). I assume that while languages may differ on which subset of these specifications they allow, they always select from this universal set of constriction specifications, and organize them along the same universal cline.

[3] One difference between my model and Browman & Goldstein (1989) is the treatment of aspiration/[h]. Browman & Goldstein treat this as a wide specification on the larynx, with voicing as unmarked. I depart from this, and treat voicing as a wide specification, whereas aspiration is a wide constriction degree with a spread vocal fold shape. While similar to Browman & Goldstein, this difference will aid in describing why some languages have epenthetic [h] whereas others have epenthetic [ʔ] – the difference comes from whether languages prefer to change constriction degree or change constriction shape.

3.2 The Theory of Epenthetic Inheritance

I cast my analysis in Optimality Theory (Prince & Smolensky 1993), and assume that the most basic phonological unit is the gesture (following Browman & Goldstein 1986, 1989, 1990). Whether there are also segments or higher-level representations will be discussed in Sections 4.8 and 5; but only gestures are relevant for deriving the typology of epenthetic consonants in phonotactically general patterns.

I adopt some strong restrictions on GEN to reflect the use of gestural representations. I assume that constriction degree can be widened or narrowed (violating IDENT), whereas constriction shape and location specifications may be inserted or removed (violating MAX and DEP). This follows from the idea that constriction degree is a necessary part of every gesture, but that location and shape are only specified as needed. Phonological GEN can thus only manipulate gestural timing or gestural targets *of existing gestures*, but cannot insert gestures outright, since this would require inserting new constriction degrees. Precedents for this kind of restriction on GEN exist in Harmonic Serialism, where GEN may only be permitted to delete (or insert) a single feature at a time (McCarthy 2008). These limits on GEN capture how the grammar of general consonant epenthesis differs from morphologically-restricted epenthesis: The GEN responsible for general phonology is restricted in ways that the GEN for morphologically-restricted phonology is not.

I define three kinds of faithfulness constraints on gestural targets. Changes to constriction degree are militated against by a gradient version of IDENT, which counts the number of steps in the cline from (17) from one constriction degree to another:

(18) **IDENT[CONDEG]**: ‘Maintain constriction degree’
Given a constriction degree specification X_i on an articulator A in the input, and
a corresponding constriction degree X_j on articulator A in the output,
assign a violation for each step between X_i and X_i.
where A = {LAB, TT, TB, NAS, LAR}, and X_n = {wide-1, narrow-2, critical-3, closed-4}.

As an example, changing a stop to a fricative would incur one violation of IDENT[CONDEG] (closed-4 → critical-3), whereas changing a stop into a vowel would incur three violations of IDENT[CONDEG] (closed-4 → wide-1).

Constriction location (19) and constriction shape (20) are handled with DEP and MAX constraints. These are a form of MAX[F]/DEP[F] constraints (following Lamontagne and Rice 1995; Lombardi 1995, 1998; Causley 1997a,b; Parker 1997; Walker 1997). I use these in place of IDENT because their specifications are privative.

(19) a. DEP[LOCATION]: ‘Don’t insert constriction locations’
b. MAX[LOCATION]: ‘Don’t remove constriction locations’

(20) a. DEP[SHAPE]: ‘Don’t insert constriction shapes’
b. MAX[SHAPE]: ‘Don’t remove constriction shapes’

For example, changing the tongue tip gesture of a [d] into an [l] would require violating the shape faithfulness constraint DEP[LAT]. The constriction degree and location would remain the same, closed at the alveolar ridge. Similarly, changing a [K] into a uvular [q] would require changing the gesture location to uvular. Constriction degree and constriction shape would remain the same.

3.3 Sample derivation: Molo epenthesis

To illustrate, let's again consider consonant epenthesis in the Molo dialect of Meto. Recall, round vowels condition [b], mid front vowels condition [l], and high front vowels condition [ɟ]. An excerpt of the pattern is repeated in (21):

(21) Molo: Consonant epenthesis in ...V-V... contexts — data partially reproduced from (3)

a.	/ʔao-e/	→ [ʔaob̲-e]	'the body'	cf. [ʔao]	'body'
b.	/ʔoe-e/	→ [ʔoel̲-e]	'the water'	[ʔoe]	'water'
c.	/ʔai-es/	→ [ʔaɟ̲-es]	'a fire'	[ʔai]	'fire'

As background, Molo has the consonants /p b f m t s n k ʔ h/. The set of constriction specifications for each articulator is given in (22).[4]

(22) Set of constriction specifications in Meto (Molo dialect)

Articulator	Constriction degrees	Addtl. Location/Shape
LIPS	closed, narrow, wide	(dental)
TONGUE TIP (TT)	closed, critical, narrow, wide	(lateral, strident)
TONGUE BODY (TB)	closed, narrow, wide	
NASAL PORT	closed, wide	
LARYNX	closed, wide	(spread)

Molo has seven vowels, whose specifications are given in (23). High vowels have a narrow tongue body gesture (Browman & Goldstein 1989: 229), front vowels have a narrow tongue tip, and round vowels have narrow lip aperture.[5]

(23) Articulator specifications for the Molo vowel inventory

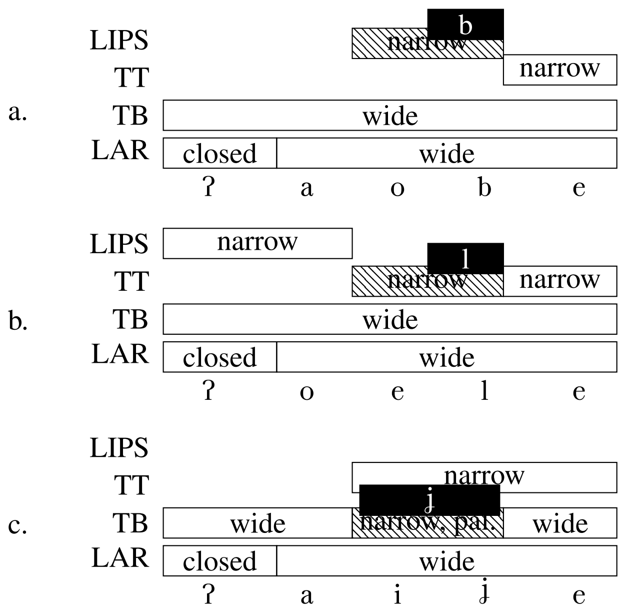
<table>
<tr><th></th><th>i</th><th>ɪ</th><th>e</th><th>ɔ</th><th>o</th><th>u</th><th>a</th></tr>
<tr><td>TONGUE BODY (TB)</td><td colspan="2">narrow, pal</td><td colspan="3">wide</td><td>narrow</td><td>wide</td></tr>
<tr><td>TONGUE TIP (TT)</td><td colspan="3">narrow</td><td colspan="4">wide</td></tr>
<tr><td>LIPS</td><td colspan="3">wide</td><td colspan="3">narrow</td><td>wide</td></tr>
</table>

As shown in Figure 1, Molo epenthetic consonants are derived by taking a vowel's narrowest constriction degree and strengthening it further into a consonantal closure. Thus, rounded vowels (with a narrow specification) become [b], high vowels (with a narrow, palatal specification) become [ɟ], and front mid vowels (with a narrow tongue tip) become [l].

The front high vowels have narrow specifications for both the tongue tip and the tongue body, and so we could also imagine inserting [l] or [g] in these cases instead. However, these candidates would require modifying constriction location (MAX[PAL]) or the constriction shape (DEP[LAT]), and so [ɟ] is preferred.

[4] Note that I treat critical as a specification only available for the tongue tip – [h] is textscLar:wide, spread and [f] is LIPS:closed, dental with LAR: wide, spread. This assumption is not crucial to the analysis – as long as [f] bears a dental location feature, it will be dispreferred over [b] because it will require featural epenthesis.

[5] For my analysis, the only crucial assumption is that whatever specification these articulators have, that it is slightly more closed than wide. Here I have chosen to give high vowels the same constriction degree as glides (narrow), which was independently proposed for English in Browman & Goldstein (1989).



/ʔao-e/	IDENT[CONDEG]
☞ a. ʔaob-e	** (narrow→closed)
b. ʔaog-e	***! (wide→closed)
c. ʔaoʔ-e	***! (wide→closed)

/ʔoe-e/	IDENT[CONDEG]
☞ a. ʔoel-e	** (narrow→closed)
b. ʔoeɟ-e	***! (wide→closed)
c. ʔoeʔ-e	***! (wide→closed)

/ʔai-e/	IDENT[CONDEG]
☞ a. ʔaɟ-e	** (narrow→closed)
b. ʔail-e	** (narrow→closed)
c. ʔaig-e	***! (wide→closed)
d. ʔaiʔ-e	***! (wide→closed)

cf. (24)

Figure 1: Molo epenthetic consonants [b, l, ɟ] are formed by increasing the narrow constriction degree of a preceding vowel (shaded). The closed constriction (black) is labeled with the resulting epenthetic consonant.

(24)

/ʔai-e/	MAX[PALATAL]	DEP[LAT]	IDENT[CONDEG]
a. ʔail-e		*!	** (narrow→closed)
☞ b. ʔaiɟ-e			** (narrow→closed)
c. ʔaig-e	*!		** (narrow→closed)

By contrast, the front mid vowel lacks the narrow tongue body gesture (and the palatal location), and so [l] is produced even though this requires modifying the constriction shape.

(25)

/ʔoe-e/	DEP[PALATAL]	DEP[LAT]	IDENT[CONDEG]
☞ a. ʔoel-e		*	** (narrow→closed)
b. ʔoeɟ-e	*!		*** (wide→closed)
c. ʔoeg-e			***! (wide→closed)

Similar reasoning also rules out insertion of [b] over [f] in [ʔaob-e] 'the lime'.

(26)

/ʔao-e/	DEP[DENTAL]	IDENT[CONDEG]
☞ a. ʔaob-e		** (narrow→closed)
b. ʔaof-e	*!	* (narrow→critical)

The final ranking obtained Molo epenthetic consonants is given in (27). Constriction degree and lateral shape may be manipulated to produce epenthetic consonants, but constriction location (i.e. DEP[DENTAL], DEP[PALATAL]) is never changed.

(27) Constraint ranking for Molo consonant epenthesis

*V-V   Dep[dental, palatal]

Ident[ConDeg]   Dep[lat]

3.4 Deriving fixed place in Oekabiti Amarasi

In the Amarasi (Oekabiti) dialect of Meto, consonant epenthesis occurs in similar contexts to Molo, but where the epenthetic consonant is always [g], reproduced in (28).

(28) Oekabiti Amarasi: Consonant epenthesis in ...V-V... contexts see data in (9)

a.	/ʔau-e/	→ [ʔaug-e]	'the lime'	cf.	[ʔau]	'lime'
b.	/ʔoe-e/	→ [ʔoeg-e]	'the water'		[ʔoe]	'water'
c.	/ʔai-es/	→ [ʔaig-es]	'a fire'		[ʔai]	'fire'

We can capture this pattern by asserting that some places of articulation are easier to manipulate than others. Smolensky (1993) and Lombardi (2002) both make arguments along this line, proposing that coronals are ideal epenthetic consonants because they are less marked than labials or dorsals. Place features are organized along a universal hierarchy so that coronals are the least marked (Rice & Avery 1993, Paradis & Prunet 1991, Prince & Smolensky 1993: 198, Lombardi 2002).

I adopt the hierarchy in (29), following Lombardi (2002). I draw the reader's attention to two changes where I depart from Lombardi's place hierarchy: (i) *Lips ≫ *Dor (whereas in Lombardi (2002) they are unranked), and (ii) that there are two possible positions for *Lar, and I assume languages differ parametrically on which position they adopt.

(29) Markedness hierarchy for articulators

(*Lar) ≫ *Lab ≫ *Dor ≫ *Cor ≫ (*Lar)

If we conjoin this hierarchy with Ident[ConstrictionDegree] (Id[ConDeg]), we then produce the hierarchy in (30). The intuition here is that it is easiest to manipulate the targets of articulators low in the hierarchy – usually laryngeals, then coronals, then dorsals.

(30) (*Lar-Id[ConDeg]) ≫ *Lab-Id[ConDeg] ≫ *Dor-Id[ConDeg] ≫ *Cor-Id[ConDeg] ≫ (*Lar-Id[ConDeg])

Amarasi treats laryngeals as marked, and so epenthetic [g] is produced because Dor-Id[ConDeg] is ranked lower than Lab-Id[ConDeg] and Lar-Id[ConDeg].

(31)

/ʔau-e/	Lar-Id[ConDeg]	Lab-Id[ConDeg]	Dor-Id[ConDeg]
a. ʔaub-e		*!* (narrow→closed)	
☞ b. ʔaug-e			** (narrow→closed)
c. ʔauʔ-e	*!** (wide→closed)		

Additionally, no manipulation of constriction shape or location is permitted. Thus, the coronal liquid [ɾ] is not produced (which occurs in place of [l] in Amarasi).

(32)

/ʔau-e/	DEP[RHOTIC]	DOR-ID[CONDEG]	COR-ID[CONDEG]
a. ʔaur-e	*!		
☞ b. ʔaug-e		** (narrow→closed)	

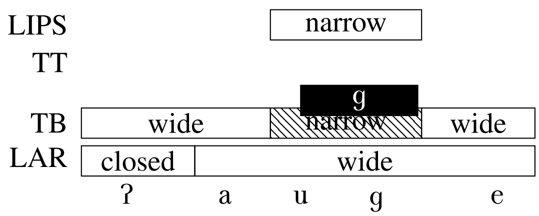
Similarly, epenthetic [z] is not produced because this would require inserting a strident constriction shape.

(33)

/ʔau-e/	DEP[STRIDENT]	DOR-ID[CONDEG]	COR-ID[CONDEG]
a. ʔauz-e	*!		* (narrow→critical)
☞ b. ʔaug-e		** (narrow→closed)	

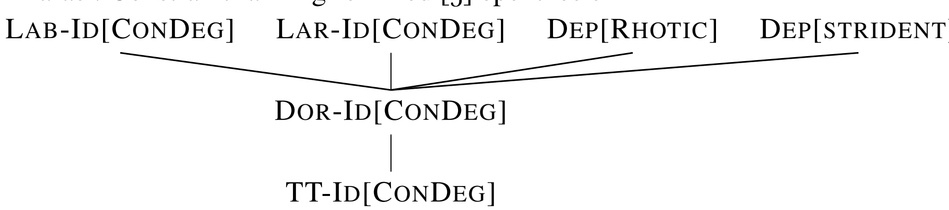
Amarasi thus prefers to manipulate the dorsal gesture alone, since this is the only articulator that would not also require changes to constriction location or constriction shape.

(34) Only dorsal gestures constrict in Amarasi



The constraint ranking is summarized in (35):

(35) Amarasi: Constraint ranking for fixed [g] epenthesis



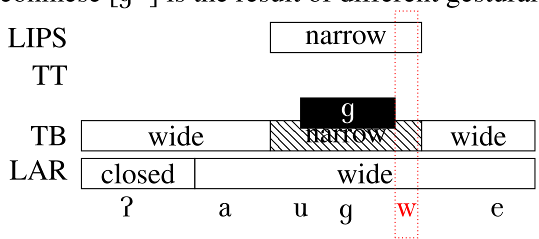
As an aside, I briefly mentioned in Section 2.3.1 that some speakers of Amarasi vary in their rounding and palatalization of their epenthetic consonant. In Neonmese Amarasi (Edwards 2020), speakers vary between epenthetic [g^w] and [dʒ] (rather than having a fixed epenthetic [g] as in Oekabiti Amarasi). Back vowels condition [g^w] and front vowels condition [dʒ].

(36) Neonmese epenthesizes [g^w] after front vowels and [dʒ] after back (Edwards 2020: 220)

a.	/kreni/	kreni	kreendʒ=ee	'the ring'
	/ʔoni/	ʔoni	ʔoondʒ=ee	'the bee/sugar'
	/ʔuki/	ʔuki	ʔuukdʒ=ee	'the banana'
	/fafi/	fafi	faafdʒ=ee	'the pig'
	/nope/	nope	noopdʒ=ee	'the cloud'
b.	/biku/	biku	biikg^w=ee	'the curse'
	/tefu/	tefu	teefg^w=ee	'the sugar-cane'
	/nopu/	nopu	noopg^w=ee	'the grave'
	/nefo/	nefo	neefg^w=ee	'the lake'
	/koro/	koro	koorg^w=ee	'the bird'

The difference beween Neonmese [g^w] and Oekabiti [g] comes from a difference in gestural timing. When making an epenthetic [g], the tongue body constriction changes from wide to closed – all targets on other articulators remain unchanged. Oekabiti phases the tongue body and lip gestures together, and so no rounding can be heard. In Neonmese, the lip gesture lags after the tongue body release, producing [g^w].

(37) Neonmese [g^w] is the result of different gestural timing



The primary difference between Neonmese and Oekabiti is the fine gestural timing, not the gestural targets. Exactly how gestural timing is encoded (and if it can be inferred from phonological representation or must be learned separately) is beyond the scope of this paper, and so I set it aside for later work.

3.5 Interim summary

In this section, I presented the analysis for Epenthetic Inheritance. Epenthetic consonant quality is determined by faith, where existing sounds are made into consonants by changing their constriction degree, location, or shape. Languages may weigh these aspects of targets differently, but the core intuition is that epenthetic consonants minimally perturb the existing gestural dynamics. I now turn to the typology of consonant epenthesis at large, and demonstrate that my gesture-based theory allows us to unify several observations about the typology that have previously been at odds.

4 Typology and Case Studies

This section discusses the typology of consonant epenthesis, building on a novel typological survey. I first discuss complications with previous surveys, and then introduce my results.

4.1 Previous surveys

Previous surveys of consonant epenthesis have generally agreed that glottal stops and glides are well-attested, but beyond that they have differed. For instance, Smolensky (1993) and McCarthy & Prince (1993) argue that coronal place is least marked, and thus [t] makes an optimal epenthetic consonant. Lombardi (2002) argues that glottals are even less marked than coronals, and so [t] will only occur when [h, ʔ] are otherwise ruled out. de Lacy (2006) concurs, and argues that default epenthetic consonants can only be glottals, coronals, and glides, but never dorsals. Staroverov (2014) asserts the opposite typology, where coronals are ruled out and dorsals are permitted. Uffmann (2007) argues that sonority, not place, is responsible for determining ideal epenthetic consonants, and that in intervocalic positions more sonorant consonants (glides, liquids) are preferred. Lastly, Vaux (2002) argues that there are no synchronic limitations at all, allowing epenthetic consonants such as [t ʃ s k g b] – diachrony is the only limitation.

(38) Schematic summary of previous typologies

	Possible epenthetic consonants	Never epenthetic
McCarthy & Prince (1993)	[t], glides, glottals	
Lombardi (2002)	glottals, glides, coronals	
Uffmann (2007)	glides, glottals, liquids	
de Lacy (2006, 2013)	glides, glottals, liquids, [t]	*[k]
Staroverov (2014)	glides, glottals, liquids, dorsals	*[t]
Vaux (2002)	[j w ʔ h r l n ŋ N v b t d s ʃ z ʒ g x k]	–

The source of much of this uncertainty comes from what constitutes a valid epenthesis pattern. Consonant-zero alternations often provide the critical evidence in favor of epenthesis. For example, a hypothetical form like [pataka] becomes [pataka-ji] or [pataka-jon] upon suffixation, but on forms like [katap] there is no glide (e.g. [katap-i], [katap-on]). Since the glide predictably occurs between putatively vowel-final stems and vowel-initial suffixes, we treat it as epenthetic. The complication is that many patterns of epenthesis are partially conditioned by morphology. For example, we may see a glide in [pataka-ji], [pataka-jon], but not with other suffixes like [pataka-ot]. There thus doesn't appear to be a purely phonological generalization on where we see [j] and where we see nothing at all – part of the conditioning environment is morphological.

These kinds of consonant-zero alternations are analytically ambiguous. While we could consider such patterns to be epenthesis, we could just as easily treat it as morphologically-restricted deletion. For instance, it could simply be that the hypothetical suffixes [-ji] and [-jon] underlyingly have a glide, but that these suffixes delete their glide following consonants (e.g. /katap-jon/ → [katap-on]). The outcome would be the same: [-ji] and [-jon] would only surface after vowel-final stems, but [-ot] would have no glide in any context.

A standard approach to this ambiguity has been to exclude morphologically-restricted consonant-zero alternations from epenthesis surveys. de Lacy & Kingston (2013), for example, argue against treating several instances of [k]-∅ alternations as epenthesis on the grounds that the environment is morphologically defined. Staroverov (2014) also excludes a different set of consonant-zero alternations on similar grounds, this time eliminating several [t]-∅ alternations. Morley (2015) correctly observes that exclusion is not a satisfactory solution to this problem – if some consonant-zero alternations are morphologically-restricted and others are general, then where is the cutoff between them? Is it enough that we only find alternations in certain morphological contexts, or do we also need clear-cut exceptions (as in hypothetical [pataka-ot] above)? Ultimately, we do not know if there is a difference between the typology of consonant epenthesis and the typology of consonant deletion. If a difference does exist, we also do not know what evidence speakers need to analyze consonant-zero alternations as epenthesis versus deletion, and if the evidence needed varies depending on the generality of the pattern.

It's unlikely that another typological survey of epenthesis can resolve this issue. Either excluding or including morphologically-restricted patterns may introduce problems, depending on whether those cases turn out to share the same mechanism as more general patterns. I therefore proceed with caution, and survey both general and morphologically-restricted C-∅ alternations. If the typologies are the same, then there is nothing lost by separating them. If the typologies are different, then we have evidence that we may need a distinct set of mechanisms for morphologically-restricted consonant-zero alternations, which could be either epenthesis, deletion, or a mixture of the two. I use two heuristics for separating phonotactically-general versus morphologically-restricted patterns, given in (39).

(39) Two heuristics for defining phonotactically-general versus morphologically-restricted alternations

a. If the pattern has a clearly-defined phonotactic context *with no surface exceptions*, then it is phonologically general.

b. If the pattern is attested with fewer than three morphemes but there is a clear conditioning context, then there is insufficient data. I group these patterns with the morphologically-restricted type.

4.2 Primary source survey

The primary source survey consisted of a broad search of 2562 individually-collected digitized grammars (1348 unique languages) for consonant epenthesis patterns. Grammars were searched for terms *consonant epenthesis*, *epenthetic consonant*, *consonant insertion*, *consonant gemination*, along with related stems.[6] The grammars were then examined by hand for any possible epenthesis patterns. Each consonant epenthesis pattern was then marked for segmental quality, its conditioning context, and any interactions with other phonology such as stress or allomorphy. This yielded 54 consonant epenthesis patterns, 36/54 of which were language-general according to the heuristics from (39).

The attested epenthetic consonants are summarized in Table 1.

	Labial	(Post-)Alveolar	Palatal	Velar	Uvular	Glottal
Plosive	p b	t d	ɟ	k g	(q)	ʔ
Nasal	m	n		ŋ		
Liquid		r ɹ l				
Affricate		dʒ				
Fricative	(v)	(s)		x ɣ		h
Approximant	w		j			

Table 1: Attested epenthetic consonant qualities from the primary source survey. (Segments that are *only* found in morphologically-restricted patterns are circled.)

The full survey results are given in Tables 2 and 3. Patterns with asterisks only apply to loanwords, and thus present a grey area for determining whether or not they are morphologically restricted. On one hand, loanwords often bear exceptional sequences of sound not found in native words, and so loanwords may be the only place in the language where the context for epenthesis arises. On the other hand, speakers may recognize this, and partition the lexicon so that loanwords form their own morphological class.

[6] This procedure is expected to under-count the number of epenthesis patterns in these grammars – some grammars used different terminology, such as *glide formation*, */t/ insertion*, and so on, which would not be selected by the search terms above. (Searching for just “insertion” was attempted, but this returned almost the entire 2600 grammar sample, because “insertion” is frequently used when discussing morphology like case.)

Family	Language	Segment	Source
Algic	Ojibwe	j	Rhodes 1976: 13-14
Austronesian	Ida'an	j, w	Goudswaard 2005: 31-32
	Ilocano	t, b; ʔ	Rubino 1997: 28, 109
	Meto (Amarasi)	g, dʒ	Edwards 2016; Mooney 2022
	Meto (Molo)	b, l, ɟ	Mooney 2022
	Mato	k, g	Stober 2013: 20-21
	Neverver	b, d, g	Barbour 2012: 63
Benue-Congo	Kisi	j, w	Childs 1988: 65-66
Cangin	Noon	n	Soukka 1999: 52
Cariban	Carib	j	Courtz 2008: 40-41
Caucasian	Khwarshi	j	Khalilova 2009: 37
Chadic	Goemai	g, ɣ	Hellwig 2011: 36
	Wandala	h	Frajzyngier 2012: 61
Creoles	Nigerian Pidgin	j, w, r	Faraclas 2005: 258
	*Sri Lankan Malay	ŋ	Nordhoff 2009: 136
Cushitic	Somali	j, ʔ	Saeed 1999: 26
Indo-European	Old English	p, b, t, d	Hogg 2011: 292
(isolate)	Huave	j	Kim 2008: 75-77
	Xincan	ʔ	Rogers 2010: 125
Khoisan	Sandawe	g	Steeman 2012: 96
Macro-Je	Apinajé	m	de Oliveira 2005: 76-77
Mayan	*Mocho'	x	Palosaari 2011: 109-110
Muskogean	Choctaw	ʔ	Broadwell 2006: 27-28
Omotic	Bambassi (Mao)	ʔ	Ahland 2012: 58
Papuan	Doromu-Koki	j	Bradshaw 2012: 39
	Motuna	j, w	Onishi et al. 1994: 21
	Teiwa	ʔ	Klamer 2010: 49
	Urim	p, t, tʃ, k; w, j	Hemmilä & Luoma 1987: 12
Penutian	Mutsun	ʔ	Okrand 1977: 25-27
Quechuan	*Quechua (Huallaga)	g	Weber 1989: 476
Sino-Tibetan	Tibetan (Dongwang)	m, n, ŋ	Bartee 2007: 41
Totonac-Tepehua	Totonac	j, ʔ	McFarland 2009: 37-39
Tucanoan	Wanano	ʔ	Stenzel 2004: 60-65
Tupian	*Tapiete	ʔ	González 2005: 272
Turkic	Turkish	j	Hieber 2007: 18
Volta-Niger	Oko	j, w	Atoyebi 2009: 65
Languages sampled: 36			
Language families:	23 (2 isolates, 2 creoles)		

Table 2: Primary source survey: Languages with **language-general** consonant epenthesis. Asterisks mark loanword-only patterns.

Family	Language	Segment	Source
Algic	Arapaho	t; n	Moss & Cowell 2008: 61, 277-278
	Blackfoot	t	Taylor 1969: 146-147
	Ojibwe	d	Rhodes 1976: 13-14
Australian	Gooniyandi	b, w, dʒ, j	McGregor 1990: 205
Austronesian	Lote	x	Pearson & van den Berg 2008: 22-23
	Maori	m, t, r, k, ŋ, h	Harlow 2007: 118
	Siar	r, l	Frowein 2011: 320-321
Bantu	Kpwe	h	Henson 2007: 193-194
Cariban	Carib	l, n	Atindogbe 2013: 17, 99-100
Caucasian	Ingush	v, n	Nichols 2011: 128
Cushitic	Afar	copy	Bliese 1981: 177
Eskimo-Aleut	Yupik (C. Alaskan)	ɣ	Miyaoka 2012: 223-224
Hibito-Cholon	Cholon	n	Alexander-Bakkerus 2005: 123
Indo-European	Polish	t, d, k	Bielec 2004: 45
(isolate)	Basque	r	Laka Mugarza 1996: 67-68
Macro-Je	Bororo	t, d, n, k, g	Crowell 1979: 14-15, 208-209
Mayan	Chol	j, w	Vázquez Álvarez 2011: 51-54
Nambikwaran	Sabanê	l, t	De Araujo 2004: 69
Nilo-Saharan	Lango	r	Noonan 1992: 22
Omotic	Dime	j	Seyoum 2008: 39
Sino-Tibetan	Rabha	homorganic N	Joseph 2007: 124
Tungusic	Udihe	w	Nikolaeva & Tolskaya 2011: 79
Turkic	Turkish	n, s	Hieber 2007: 28
Uto-Aztecan	Ute	j	Givón 2011: 99
Volta-Niger	Oko	n	Atoyebi 2009: 65
Wakashan	Nuu-chah-nutlh	q	Davidson 2002: 173-174
Yeniseian	Ket	ɣ	Georg 2007: 87
Yuki-Wappo	Wappo	ʔ, t	Thompson, Park & Li 2006: 123-129
Languages sampled: 28			
Language families: 23 (and 1 isolate)			
Total languages in sample: 54			
Language families represented: 34 (and 3 isolates, 2 creoles)			

Table 3: Primary source survey: Languages with **morphologically-restricted** consonant epenthesis.

4.3 Summary of Generalizations

I draw five generalizations from the typological survey, reproduced from (2) in (40).

(40) Generalizations for phonologically general epenthesis patterns

a. LOCAL ASSIMILATION. Epenthetic consonants tend to share quality with gesturally local sounds.

b. NOT MARKEDNESS, NOT STRUCTURE-PRESERVING. Epenthetic consonants do not minimize segmental markedness, nor are they structure preserving. Epenthetic consonants may be segments that are not robustly contrastive in a language.

c. INTERVOCALIC SONORANT BIAS. Epenthetic consonants in intervocalic positions tend to be sonorants.

d. MARGIN VOICELESS OBSTRUENTS. Epenthetic consonants can only be voiceless obstruents when adjacent to another consonant or at word margins, never in intervocalic positions.

e. INVISIBLE MAN. Epenthetic consonants are invisible/inert with respect to allomorph selection.

f. The typology of morphologically-restricted epenthesis is different from the phonologically general kind, and does not obey (a.-f.).

The rest of this section is dedicated to going through each of these generalizations in depth.

4.4 Local Assimilation

We have already seen some evidence for (40.a) from Meto, where epenthetic consonants share place with a preceding vowel. The Molo dialect shows this most transparently, with [b] after round vowels, [l] after mid front vowels, and [j̥] after high front vowels. (See (3) in Section 2.)

It turns out that this kind of assimilation is actually common in the typology at large. In Table 4, we see that general patterns of consonant epenthesis have a strong tendency to share PLACE with nearby sounds. Glides account for 11/36 patterns, and even if we restrict to non-glides, PLACE-assimilating epenthesis accounts for 16/36 patterns.[7] Of the 9 patterns remaining, 8 of those are glottals, and so their oral place is obscured (if present at all). There is therefore only one case where general consonant epenthesis does *not* share oral place with surrounding sounds, which is Noon [n] epenthesis (see Section 4.6.3). By comparison, the morphologically-restricted patterns did not have the same assimilatory bias.

	General	**Morph.-restricted**
Glides only	9	4
Glottals only	8	0
Glides and glottals only	2	0
Non-glides that share PLACE with local C	8	2
Non-glides that share PLACE with local V (dorsal only)	5	3
Non-glides that share PLACE with local V	3 *1/3 rhotic.	2 *2/2 rhotics.
Non-glides/glottals that do not share PLACE	1	17
Total	36	28

Table 4: Summary of assimilation within epenthetic consonants. Language-general patterns had a strong bias in favor of sharing place with nearby sounds. Morphologically-restricted patterns had no such bias.

Assimilatory behavior is expected under my theory, because all epenthetic consonants are mutations of existing gestures. Constriction degree will minimally change, which will push epenthetic consonants to use the articulator that has the maximal degree of constriction at that point in time. Note that differs slightly from analyses where two segments (i.e. host and epenthetic) directly share place (Uffmann 2006; Culhane 2018;

[7] There were several ambiguous cases in this sample that involved rhotics. For instance, Nigerian Pidgin allows epenthesis of [r], but only after back vowels (Faraclas 2005: 258). Whether or not the rhotic shares PLACE depends heavily on its phonetic quality – a level of detail that is not often given in grammars. For this reason, I mark how many rhotics are present, as it remains possible they are not PLACE-sharing patterns.

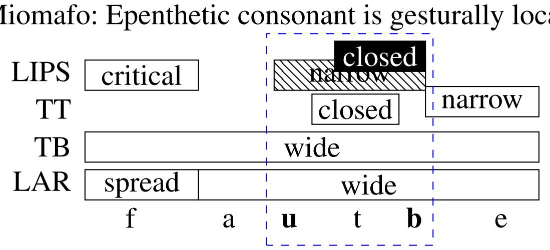
Edwards 2016). The only segments are those that are present in the input – epenthetic material is parasitic on those segments, but is purely gestural.

One prediction from Epenthetic Inheritance thus concerns locality. If epenthetic consonants always emerge from existing gestures, then epenthetic consonants must always be gesturally local to their host. That is, assimilatory consonant epenthesis is always local. This appears to be true. In languages where an epenthetic consonant is not *linearly* adjacent to its conditioning host, the two sounds are still gesturally local.

As briefly discussed in Section 2.3.2, an example of one such case comes from Miomafo, another dialect of Meto. Miomafo epenthetic consonants are also conditioned by the preceding vowel (as in Molo dialect), but a separate metathesis pattern displaces the vowel so that they are not string adjacent on the surface, producing /fatu-e/ → [fau$_1$tb$_1$-e] 'the stone' (Nona Seko, p.c.). The Miomafo data is thus problematic for theories that constrain locality with string adjacency alone.

If we constrain locality in terms of gestures, this problem disappears. Mooney (2022) argues that Meto metathesis does not fully reorder segments, but instead is a kind of overlap where the vowel gesture slides leftwards in the word, but fails to move fully beyond the consonant. If this is true, then Miomafo epenthetic consonants are still gesturally local to their conditioning vowel. This is illustrated in (41), where the narrow lip gesture is contiguous with the closed lip gesture.

(41) Miomafo: Epenthetic consonant is gesturally local to its conditioning vowel, but not string adjacent



Gestural score for Miomafo dialect /fatu-e/ → [fau$_1$tb$_1$-e] 'the stone'

Defining locality in terms of gestures solves two problems from Section 2.3.1. It allows us to adopt a single locality constraint for both vowels and consonants, whereas Splitting Theory had to state them independently (permitting non-adjacent splitting for vowels, but not consonants). It also allows us to predict the No Copying Gap from Kawahara (2007): No language has general consonant epenthesis that copies a consonant across an intervening vowel, because such a pattern would be gesturally non-local.[8]

4.5 Not Markedness, Not Structure-Preserving

We have also already seen some evidence that epenthetic consonants do not always minimize markedness, nor are they always structure preserving. Recall, Amarasi epenthesizes [g] even though it appears to be marked in the language. There are two reasons to think this is so: First, [g] is not robustly contrastive in the language, and no morphemes have underlying [g]. Second, loanwords with [g] are uniformly adapted with [k]. Amarasi [g] is thus avoided in every context except for epenthesis, precisely the opposite of what markedness-based theories would predict.

In the typology, there are many other cases like Amarasi. In Koryak (Kenstowicz 1976; Lombardi 2002) and German (Steriade 2001; Alber 2001), glottal stops are used as the epenthetic consonant even though the languages lack them as an allophone of any phoneme. Similarly, glides in Faroese (Lockwood 1955; Staroverov 2014) and Tamil (Christdas 1988) are epenthetic despite not being robustly contrastive in these languages. While the epenthetic consonants in these languages are less unusual than Amarasi's, they also present interactions with theories of markedness. If inventory gaps are generated by high-ranked markedness

[8] For a case of morphologically-restricted epenthesis that is gesturally non-local, see Afar (Cushitic, Bliese 1981: 177), which fully copies a consonant across an intervening vowel.

	More similar to vowels (more likely epenthetic)								Less similar to vowels (less likely epenthetic)
Oral Constriction Degree	NARROW		CRIT	CLOSED		WIDE		CRIT	CLOSED
Shape		RHOTIC/LAT.					SPREAD		
Non-oral articulators					NAS$_{\text{OPEN}}$	LAR$_{\text{CLOSED}}$	LAR$_{\text{WIDE}}$		
LIPS			v, β	b	m			f	p
TT		r, ɾ, l	z, ð	d	n			s, θ	t
TT & TB	j		ʑ, ʒ	ɟ	ɲ			ʂ, ʃ	ç
TB		ʀ, ʎ	ɣ	ɡ	ŋ			x	k
LIPS & TB	w								
none						ʔ	h		
Δ CON. DEG (all articulators)	*	*	**	***	****	*	-	***	****
Δ SHAPE		*					*	*	*
Overall Δ (from vowels)	1	2	2	3	4	1	1	4	5

Table 5: The predicted typology of epenthetic consonants in intervocalic positions. Consonants whose targets minimally differ from vowels are expected to be common (e.g. glides, liquids, and glottals). Other consonants will only be chosen when markedness or articulator-specific faithfulness are in play.

constraints and epenthetic consonants occupy those gaps, then we need a theory that does not rely solely on segmental markedness to explain epenthetic quality.

The markedness issue is not problematic for all frameworks. In Lexical Phonology, for example, these kinds of patterns are expected for post-lexical rules, which need not obey the same set of limitations imposed on lexical items (Structure Preservation, Kaisse & Shaw 1985; Kiparsky 1982, 1985). My theory of Epenthetic Inheritance is also consistent with how epenthetic consonants occupy phonemic gaps. Following Hall (2003, 2006), let us assume that phonological representations come in two main flavors, segments and gestures. Epenthetic consonants are extensions of surface gestures, but do not have independent segmental status. As long as phonemic inventories are exclusively the domain of segments, then epenthetic consonants should be free of those restrictions.

4.6 Intervocalic Sonorant Bias

Epenthetic consonants tend to match surrounding sounds in PLACE, but they also tend to match surrounding sounds in sonority. This leads to the Intervocalic Sonorant Bias (first observed by Uffmann 2007): between two vowels, epenthetic consonants are sonorants. Following Splitting Theory, Epenthetic Inheritance derives the Intervocalic Sonorant Bias through faith. In intervocalic contexts, the only possible source of epenthetic material are vowels. Thus, epenthetic consonants in these contexts will be as similar to vowels as possible.

Table 5 illustrates the predicted cline: glides and liquids are at the left, since they require minimal changes to oral constriction degree. Fricatives, stops, and nasals will all require greater changes, and so are only expected when glides and liquids are otherwise ruled out. In languages that prefer to modify laryngeal constriction degree before oral constrictions (e.g. when LAR-IDENT[CONDEG] is ranked low), then we may expect to see glottals as epenthetic consonants. These both keep oral constriction degree wide, but change the laryngeal target to closed or spread. Voiceless obstruents are not predicted, because voiced stops and glottals will harmonically bound these candidates.

Previous work has also analyzed the Intervocalic Sonorant Bias, though in different terms. Uffmann (2007) captures the same sonorant bias through applying Prince & Smolensky (1993)'s theory of prominence scales. Sonorous segments are preferred at syllable peaks, but less sonorous sounds are preferred at syllable margins. Uffmann argues that epenthetic consonant quality can be determined by either the margin constraint hierarchy or the peak constraint hierarchy depending on context. At word edges, the margin hierarchy is used, favoring low-sonority sounds. In intervocalic contexts, the peak hierarchy is used, favoring high-sonority sounds.

The empirical problem with Uffmann's analysis stems from this last assumption: that intervocalic positions globally favor high-sonority sounds. Uffmann defends this position on grounds of lenition, since intervocalic stops often weaken into fricatives or other continuants. However, we should expect stronger distributional asymmetries if low-sonority sounds are universally more marked in intervocalic positions than high sonority sounds. For instance, it should be possible for languages to only allow obstruents at word margins, with only sonorants word-medially. This doesn't appear to be the case – while word-final devoicing is common, word-medial sonorization (such as to an approximant, nasal or liquid) is not. We can avoid this prediction by saying that intervocalic onsets are still treated as syllable margins on some level, but this in turn would also weaken Uffmann's typology.

There are other ways of deriving the Intervocalic Sonorant Bias. For example, theories of consonant epenthesis based on diachrony predict that intervocalic sonorants are more likely to arise due to errors in perception or production (Blevins 2008). Synchronic analyses, such as one based on Steriade (2001)'s P-Map, could also predict that perceptual ambiguity is the source of the sonorant bias in the typology. Sonorants between two vowels are not very perceptually salient, and so listeners may face ambiguity when hearing putative VV sequences, eventually positing a sonorant where there was none before.

I now demonstrate how Epenthetic Inheritance generates the Intervocalic Sonorant Bias, proceeding first through glides and glottals (Section 4.6.1), liquids (Section 4.6.2) and then nasals (Section 4.6.3). The most important case study comes from Noon in Section 4.6.3, which illustrates general intervocalic nasal epenthesis — a previously unattested pattern.

4.6.1 Glide and glottal stop epenthesis

Glide and glottal epenthesis are the most straightfoward case, as they can be generated by manipulating constriction degree alone. Glide epenthesis narrows the dorsal gesture of a vowel, as in (42b.), whereas glottal stop epenthesis narrows the larynx, as in (42c.). Both involve a minimal change to the constriction degree on the given articulator.

(42) Glide and glottal stop epenthesis both minimally change constriction (hypothetical example)

/pai/	ONSET	IDENT[CONDEG]
a. [pai]	*!	
☞ b. [paji]		* (DOR: wide → narrow)
☞ c. [pahi]		* (LAR: wide → narrow)
d. [paʔi]		**! (LAR: wide → closed)
e. [paɣi]		**! (DOR: wide → critical)
f. [pagi]		**!* (DOR: wide → closed)
g. [paŋi]		**!** (DOR: wide → closed, NAS: wide → closed)

A recurrent problem is that many languages use both glide and glottal epenthesis depending on context. For example, many languages use glide epenthesis word-medially, but glottal stop epenthesis at word margins (e.g. Washo, Staroverov 2016; Czech, Rubach 2000; German, Alber 2001; Faroese, Lockwood 1955; Staroverov 2014; see discussion in Blevins 2008). In my theory, the source of this positional asymmetry is not expected to be specific to epenthesis. Epenthesis should always favor minimal changes to existing sounds, and so the preference for glottals over glides (or vice versa) must be determined by markedness.

There are many possible answers to what kind of markedness conditions this epenthetic asymmetry. Word-margin glottals could be preferred by the same markedness constraints that condition laryngeal neutralization. Laryngeal distinctions are often neutralized at word or syllable boundaries (Lombardi 1995), and so in any language where laryngeal markedness outranks faith, we may expect to see laryngeal alternations or laryngeal epenthetic consonants, since both are governed by faith. In Section 4.7, I demonstrate that this is the correct prediction: Epenthetic consonants spawned from vowels are only ever voiceless in margin positions.

4.6.2 Liquid epenthesis

Liquid epenthesis will occur whenever (i) glides and glottals are dispreferred as syllable onsets, or (ii) if inserting a liquid would involve *less* change to constriction degree than a glide. A classic case of liquid epenthesis is intrusive [ɹ] in Boston English (Uffmann 2007: 463). High vowels condition the insertion of glides (e.g. /kiː ɪz/ → [kiːj̲ ɪz] 'key is'), but mid and low vowels condition insertion of [ɹ] (e.g. /spɑ ɪz/ → [spɑɹ̲ ɪz] 'spa is').

In my theory, these results are expected as long as we assume English glides require two narrow constrictions (one dorsal, and the other labial or coronal). High vowels form glides because they already have a narrow constriction degree at the tongue tip/lips, and so all that remains is to narrow the dorsal gesture. In mid and low vowels, the lip/tongue tip constrictions are absent, and so constriction degree is preserved better by epenthesizing a rhotic instead of a glide. However, rhotic epenthesis comes at the expense of inserting a rhotic constriction shape (violating DEP[RHOTIC]), which rules out rhotic epenthesis after high vowels. The core ranking is *ONS/GLOTTAL ≫ IDENT[CONDEG] ≫ DEP[RHOTIC], shown in (43) below.

(43) Boston English: Analysis in Epenthetic Inheritance

a. Glides after high vowels: /kiː ɪz/ → [kiːj ɪz] 'key is'

/kiː ɪz/	ONSET	*ONS/GLOTTAL	IDENT[CONDEG]	DEP[RHOTIC]
a. [kiː ɪz]	*!			
b. [kiːʔ ɪz]		*!	* (LAR: wide → narrow)	
c. [kiːɹ ɪz]			* (TT: wide → narrow)	*!
☞ d. [kiːj ɪz]			* (DOR: wide → narrow)	

b. Rhotics after mid/low vowels: /spɑː ɪz/ → [spɑːɹ ɪz] 'spa is'

/spɑː ɪz/	ONSET	*ONS/GLOTTAL	IDENT[CONDEG]	DEP[RHOTIC]
a. [spɑː ɪz]	*!			
b. [spɑːʔ ɪz]		*!	* (LAR: wide → narrow)	
c. [spɑːɹ ɪz]			* (TT: wide → narrow)	*
d. [spɑːj ɪz]			**! (DOR & TT: wide → narrow)	

To compare, Uffmann (2007) analyzes Bostonian ɹ-epenthesis in terms of prominence scales. The hypothesis is that high-sonority consonants are preferred in intervocalic contexts, which Uffmann formalizes as the sonority-based markedness hierarchies of the form *V_V/obs ≫ *V_V/liq ≫ *V_V/glide. These markedness constraints will favor sonorant epenthetic consonants between two vowels. Rhotics are chosen over glides to minimize violations of DEP[F]. As in Splitting Theory and Epenthetic Inheritance, Uffmann treats the vowels as supplying the core featural content for the epenthetic consonants.

The main difference between Uffmann's account and my own is the role of prominence scales. Uffmann's analysis hinges on the assumption that high-sonority consonants are preferred in intervocalic contexts. While is some cross-linguistic evidence this may be true (e.g. lenition, see Uffmann 2007: 462 for discussion), the predictions of the theory remain muddy because of the markedness hierarchies independently needed for onsets. Onsets have been previously argued to have a cross-linguistic bias in favor of low-sonority consonants (Prince & Smolensky 1993: 183-187), with the markedness scale of *Ons/glide ≫ *Ons/liq ≫ *Ons/obs. We thus have two markedness hierarchies that create opposite typologies: intervocalic consonants should be maximally sonorous, but onset consonants should be minimally sonorous. The theory of prominence scales suggest that these two typologies should be equally possible, but my survey data only provides evidence in favor of the former. The only explanation for why high-sonority consonants are preferred over low-sonority ones is violations of DEP[F]. This is precisely what my theory does: epenthetic consonants minimize perturbations to existing material.

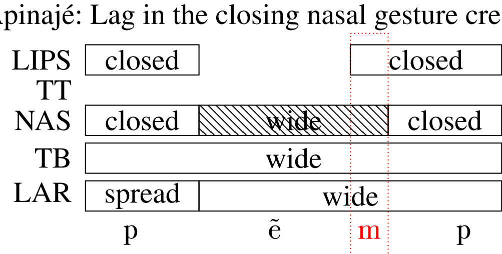
To summarize, liquid epenthesis is rarer than glide and glottal epenthesis, but there are other attested cases. Lateral epenthesis, for example, is also found in Bristol and SE Pennsylvania English (Gick 1999, 2002), and Molo (Section 2). These languages prefer to insert lateral constriction shape over a rhotic constriction shape, but their violations of IDENT[CONDEG] should be the same.

4.6.3 Nasal epenthesis

While rarer than epenthesis of liquids, glides, and glottals, nasal epenthesis is also attested in the typology. The most common cases of nasal epenthesis occur between a nasalized vowel and voiced plosive. Dongwang Tibetan has nasal epenthesis of this type, where a nasal inserted in in ṼC sequences and is homorganic with the following stop (e.g. [ɦjõ^{353}] 'valley' vs. [ɦjõm̲^{353}ba^{55}] 'valley floor', Bartee 2007: 41). Apinajé (Brazil; Macro-Jê) shows a similar pattern, where an epenthetic nasal appears between a nasal vowel and a following plosive (e.g. /pẽp/ → [ˈpẽ^{m}p] 'warrior', de de Oliveira 2005: 76-77). Ohala & Ohala (1991) observe similar cases in Hindi and French, and analyze these patterns as a kind of nasal intrusion.

Epenthetic Inheritance can handle nasal epenthesis of this kind quite easily. When a nasal gesture lags behind the oral closure, a nasal consonant appears. This is illustrated in (44) for Apinajé [ˈpẽ^{m}p] 'warrior' (data from de Oliveira 2005: 76).

(44) Apinajé: Lag in the closing nasal gesture creates epenthetic [m] in [ˈpẽ^{m}p] 'warrior'



However, there are also cases of nasal epenthesis that have no obvious nasal source, such as nasal epenthesis between two oral vowels. Noon (Cangin; Soukka 1999) exemplifies this pattern, where [n] appears whenever two oral vowels would occur across a morpheme boundary, as in (45).

(45) Noon: [n] epenthesis to avoid hiatus at morpheme boundaries (Soukka 1999: 52)

	suffixed	gloss	bare
a. /oːmaː-iː/ child-DEF	oːmaː-n̲iː	'the child'	oːmaː
b. /mati-o/ Mati-VOC	mati-n̲o	'Mati!'	mati
c. /fu hot-in mati-e/ you see-PERF Mati-PQ	fu hotin mati-n̲e	'Have you seen Mati?'	mati
d. /fu an músú-aː/ you drink water-SUBJ	fu an músú-n̲aː	'If you drink water'	músú

The [n] only occurs after vowel-final stems. In consonant-final words, as in (46), no [n] is present.

(46) Noon: No [n] on suffixes after consonant-final words (Soukka 1999)

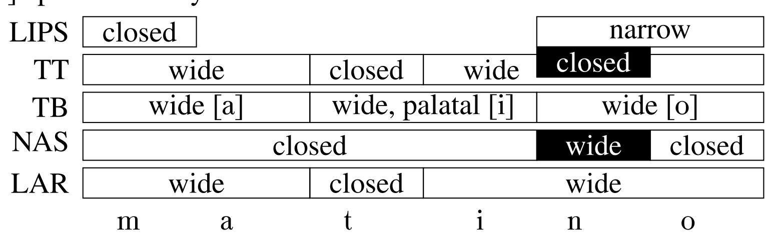
		suffixed	gloss	bare	
a.	/hal-iː/	hal-iː	'the door'	hal	'door'
b.	/kilóok-óo/	kilóok-óo	'fiance-VOC'	kilóok	'fiance'
c.	/fu jii lom-e/	fu jii lom-e	'2SG PROG buy-PQ'	lom	'buy'
d.	/kuwis-aː, mi jii jah/	kuwis-aː…	'tomorrow-SUBJ'	kuwis	'tomorrow'

Noon [n] is likely to be epenthesis, and not deletion, because Noon generally permits word-medial [Cn] clusters. For example, [Cn] clusters are permitted in [lom-neː] 'go and buy', but [n] is absent in [lom-e], 'buy-PQ' from (46c.), *[lom-ne]). A deletion analysis would thus need to contend that [n] only deletes for a certain class of suffixes – precisely those that appear to be vowel-initial. Noon thus has intervocalic nasal epenthesis that is fully general, a pattern that was unattested in previous typologies (Lombardi 2002: 235).

Under the theory of Epenthetic Inheritance, Noon [n] epenthesis arises from two pressures: (i) avoiding changes to laryngeal and tongue body constrictions, and (ii) avoiding any new constriction shapes (i.e. lateral, rhotic, etc.). Noon therefore does the next-best thing – changing tongue tip constriction degree and nasal constriction degree, shown in (47):

(47) Noon [n] epenthesis only modifies TT and NAS constrictions

a.



b.

/mati-o/	DEP[SHAPE]	DOR-IDENT[CONDEG]	COR-IDENT[CONDEG]
a. matij-o		* (wide→narrow)	
b. matil-o	* (lateral)		* (wide→closed)
c. matid-o			* (wide→closed)
☞ d. matin-o			* (wide→closed)

Note that it is surprising that Noon inserts [n] instead of [d]. In terms of faithfulness alone, [d] should be easier to epenthesize than [n], since it requires the same modification to the tongue tip constriction (wide→closed), but no modification to the nasal port. However, there is evidence that voiced stops in Noon are highly marked and often avoided entirely. In coda positions, Noon nasalizes its voiced stop series:

(48) Noon: Voiced plosives nasalize in coda position (Soukka 1999: 49)

	underlying form		…C#	…C-in (-PERF)	…C-C$_{\text{RED}}$iː (-NEG.PERF)
a.	/ab/	'hold'	[ʔam]	[ʔabin]	[ʔambiː]
b.	/sod/	'be tired'	[son]	[sodin]	[sondiː]
c.	/paɟ/	'marry'	[paɲ]	[paɟin]	[paɲɟiː]
d.	/lag/	'shut'	[laŋ]	[lagin]	[laŋgiː]

By comparison, voiceless stops and continuants do not alternate, as in (49):

(49) Noon: Voiceless stops and continuants do not alternate (Soukka 1999: 48)

	underlying form		. . . C#	. . . C-in (-PERF)	. . . C-C_{RED}iː (-NEG.PERF)
a.	/ap/	‘kill’	[ʔap]	[ʔapin]	[ʔappiː]
	/hot/	‘see’	[hot]	[hotin]	[hottiː]
	/ʔac/	‘dig’	[ʔac]	[ʔacin]	[ʔacciː]
	/feːk/	‘hit’	[feːk]	[feːkin]	[feːkkiː]
b.	/ɓas/	‘insult’	[ɓas]	[ɓasin]	[ɓassiː]
	/ʔal/	‘forget’	[ʔal]	[ʔalin]	[ʔalliː]
	/jah/	‘crush’	[jah]	[jahin]	[jahhiː]
	/gaːw/	‘hurry’	[gaːw]	[gaːwin]	[gaːwwiː]
	/haj/	‘come’	[haj]	[hajin]	[hajjiː]

Noon therefore avoids voiced stops unless they are onsets. I define the constraint *CODA[+VOI,-NAS,-CONT], which militates against coda voiced stops.

(50) *CODA[+VOI,-NAS,-CONT]: Assign a violation for any voiced oral closure that does not coincide with a wide nasal gesture unless it is syllabified in the input as an onset.

Voiced stops neutralize to nasals in coda position, as in (51), but otherwise remain faithful, as in (52).

(51) Noon: Voiced stops nasalize in coda position

/ab./	*CODA[+VOI,-NAS,-CONT]	NAS-IDENT[CONDEG]
a. ab.	*!	
☞ b. am.		* (closed→wide)

(52) Noon: Voiced stops remain faithful as onsets

/a.b-in/	*CODA[+VOI,-NAS,-CONT]	NAS-IDENT[CONDEG]
☞ a. a.bin	*	
b. a.min		* (closed→wide)

Dominated NAS-IDENT[CONDEG] is responsible for nasalization in Noon, suggesting that nasal constriction degree is not important to preserve. If so, denasalization could also be possible. This prediction is also borne out: When roots with final nasals reduplicate, the second nasal *denasalizes* to avoid a homorganic nasal sequence:

(53) Noon: Nasals denasalize to avoid homorganic nasal sequences (Soukka 1999: 49)

	underlying form		. . . C#	. . . C-in (-PERF)	. . . C-C_{RED}iː (-NEG.PERF)
a.	/ɲam/	‘eat’	[ɲam]	[ɲamin]	[ɲamb̲iː]
b.	/ʔan/	‘drink’	[ʔan]	[ʔanin]	[ʔand̲iː]
c.	/maɲ/	‘linger’	[maɲ]	[maɲin]	[maɲɟ̲iː]

To derive this, I first introduce *NAS-GEM, which assigns a violation for any sequence of identical nasals ([+NAS, αPLACE][+NAS, αPLACE]). Since *NAS-GEM dominates NAS-IDENT[CONDEG], denasalization is obtained for /ɲam.-miː/ → [ɲam-biː]] ‘eat-NEG.PERF’ in (54):

(54) Noon: Homorganic nasal sequences avoided by denasalization

/ɲam.-miː/	*NAS-GEM	*CODA[+VOI,-NAS,-CONT]	NAS-IDENT[CONDEG]
a. ɲam.miː	*!		
b. ɲab.miː		*!	* (closed→wide)
☞ c. ɲam.biː			* (closed→wide)
d. ɲab.biː		*!	** (closed→wide)

The conclusion from this section is that nasal epenthesis is possible, but should only occur (i) adjacent to nasal segments (such as nasalized vowels) or (ii) in languages where nasal constriction degree is malleable. Noon provides an example of this second type: nasals and voiced stops in the language often change their nasality based on context, and so we can conclude that nasal constriction degree is not important to preserve in the language. Other languages of this second type may include Japanese, which has been reported to have epenthesis of a homorganic nasal preceding verbal strong form suffixes like [-de] (Ohala & Ohala 1991). Tokyo dialects of Japanese have also been reported to nasalize /ɡ/ in intervocalic positions (Itô & Mester 1996), which suggests that like Noon, NAS-IDENT[CONDEG] is dominated.

4.6.4 Interim summary

To summarize, consonant epenthesis tends to insert sonorant consonants in intervocalic contexts. While this observation has been made before for glides, liquids, and glottals (Uffmann 2007), here I showed that epenthetic coronal nasals also exist – a previously unattested pattern. I also observe that epenthetic nasals only occur in languages that have other nasal alternations. Epenthetic Inheritance predicts this because all manipulations to nasality are handled by the constraint that preserves nasal constriction degree, NAS-IDENT[CONDEG]. By comparison, insertion-based models of epenthesis do not predict these things do be linked, since nasal epenthesis would be governed by DEP[NASAL] and other oral-nasal alternations would be governed by IDENT[NASAL].

4.7 Margin Voiceless Obstruents

Voiceless obstruents also occur in the typology of general consonant epenthesis, but only in restricted contexts. They may occur next to a consonant or after a syllable/word boundary, but never intervocalically.

4.7.1 Voiceless obstruents at syllable and word margins

Epenthetic voiceless obstruents are found at syllable and word margins, albeit rarely. One example of the syllable margin variety comes from Urim (Papuan, shown in (55) below), where a voiceless stop appears between a nasal and a non-nasal sonorant at word-internal morpheme boundaries (Hemmilä & Luoma 1987: 12). The place of the voiceless stop is determined by the place of the nasal, as expected under the Local Assimilation generalization. Epenthesis occurs upon suffixation (55a.), compounding (55b.) and reduplication (55c.).[9]

(55) Urim: Epenthetic [p, t, tʃ, k] occur between a nasal and non-nasal sonorant (Hemmilä & Luoma 1987: 12)

[9] Urim also has epenthesis of glides to avoid vowel hiatus across morpheme boundaries (Hemmilä & Luoma 1987: 14). The glide [w] appears to be the default, and [j] only appears after [i]. We expect this kind of behavior whenever languages avoid inserting constriction location over changing constriction degree (i.e. DEP[PALATAL] ≫ IDENT[CONDEG]).

a. /nam-o^{p}m/	nam-po^{p}m	'bit me'	cf. al-o^{p}m, 'eat me'
/antin-o^{p}m/	antin-to^{p}m	'measured me'	
/iŋkliɲ-o^{p}m/	iŋˈkliɲ-tʃo^{p}m	'help me'	
/talpulŋ-el/	ˈtalpulŋ-kel	'drive him away'	ˈal-el, 'eat him'
/ar^{p}men-el/	ˈar^{p}men-tel	'watch him'	
/tawoŋ-et/	ˈtawoŋ-ket	'having holes'	ˈmaur-et, 'spirit-dwelling'
/num-et/	ˈnum-pet	'sick'	
b. /alm-wroŋ/	alm-pwroŋ	'shoot enemies (shoot-crowd)'	wrɔŋ, crowd
/wroŋ-wɑil/	wroŋ-kwɑil	'crowd, people (crowd-big)'	wɑil, big
/num-ja/	num-pja	'vagina (body-road)'	ja, road
/won-rakol-e/	won-trakol-e	'remember (inside-break-TR)'	ˈrakol, to tear
c. /alm-alm/	alm-palm	'shot and shot (RED-shot)'	alm, shoot
/wam-wam/	wam-pwam	'ten (lit. hand-hand)'	wam, hand

By comparison, no epenthesis occurs within roots, shown in (56).[10]

(56) Urim: No epenthesis within roots (Hemmilä & Luoma 1987: 12)

a. /ˈmamam/	ˈmamam	'mom'	*ˈmampam
b. /ˈnamuŋ/	ˈnamuŋ	'banana'	*ˈnampuŋ
c. /ˈamo/	ˈamo	'to die'	*ˈampo
d. /ˈanoŋ/	ˈanoŋ	'village'	*ˈantoŋ
e. /ˈaɲen/	ˈaɲen	'to win'	*ˈaŋken

In my theory, Urim epenthetic plosives are the result of a timing mismatch between the opening of the nasal port and the closure in the oral cavity. The vowel's closed nasal gesture lags behind, and so there is a brief moment when there is no airflow through either the oral cavity or nasal passageway, creating a stop. Urim is essentially the mirror image of Apinajé from Section 4.6.3, but where a nasal forms a plosive instead of the other way around.

Other languages create voiceless stops from vowels, rather than consonants. In Mato (Austronesian, Western Oceanic; Stober 2013: 20-21), back vowels [a, u] condition epenthesis of [k, g] on a preceding consonant-final stem.[11] No epenthetic consonant appears when there is no preceding consonant, or when the suffix vowel is not [-FRONT].

(57) Mato: Epenthesis of [k, g] after consonant-final stems (Stober 2013: 21)

a. /dV-xɑp-aŋ/	dɑ.xɑp.-kaŋ	'they got you (pl)'
b. /∅-xɑŋ baxup=uba/	ˈɣɑŋ ˌba.ɣup.-ˈku.ba	'he is going to eat a banana now'
c. /dV-hɑiŋ=uju/	dɑ.hɑiŋ.-ˈgu.ju	'they are still ascending'
d. /u-rɑxɑp-uti/	u.rɑ.ˈɣɑp.-ku.ti	'you (sg) shorten it'
e. /lipux siɑŋ-ɑm/	li.ˈpu ˌsi.ɑŋ.-ˈgɑm	'money person (businessman)'

[10] Hemmilä & Luoma also report that no epenthesis occurs when the preceding syllable is unstressed (e.g. /ˈampen-et/ → [ˈampen=et] 'slowly', *[ˈampen-tet]). This claim is difficult to interpret – stress is not consistently marked in the grammar, but based on their description, Urim stress appears to be sonority-sensitive, landing on the most sonorous vowel (a > e, o > u, i). In the case of a tie, stress lands on the final vowel (Hemmilä & Luoma 1987: 10). However, if this is true, then several examples in (55a.) show epenthesis following unstressed syllables (based on my analysis, not the grammar's transcription). Either the generalization regarding stress-epenthesis interactions is incorrect, or my analysis of Urim stress is incorrect. More data is needed to tell us which of these is the case, and so I table this issue for now.

[11] Mato has five vowels, /a i u e o/, but there are no suffixes that begin with /o, e/. The only relevant vowels for this pattern are therefore /a, u, i/.

(58) Mato: No epenthesis after vowel-final stems (Stober 2013: 20)

a. /dV-tɑhɑ-ɑŋ/	dɑ.tɑ.ˈhɑŋ	‘they hit you all’
b. /dV-hɑli=uba/	dɑ.-ˌhɑ.li.ˈu.ba	‘they are going to play now’
c. /∅-haxa=uju/	ha.ˈɣau.ju	‘he is still walking’
/dV-hɑli=uju/	dɑ.ˌhɑ.li.ˈu.ju	‘they are still playing’
d. /dV-ɡaxu-uti/	dɑ.ɡɑ.ˈɣu.ti	‘they chewed it’
e. /lipux kɑbɑli-ɑm/	li.ˈpu ˌkɑ.bɑ.li.ˈɑm	‘bush person’

One complication in Mato comes in the form of an interaction with definiteness. In nominal phrases, epenthesis does *not* occur between a stem and the specificity suffix [-ɑ] unless a demonstrative is present.

(59) Mato: No epenthesis in nominals unless demonstrative is present (Stober 2013: 40-41)

		bare	-SPEC	-SPEC + DEM (PROX *li*, MID *ba*, DIST *lo*)
a.	‘woman’	hɑiŋ	hɑiŋ-ɑ	hɑiŋ-ɡɑ ba
	‘bird’	mɑŋ	mɑŋ-ɑ	mɑŋ-ɡɑ lo
	‘area’	loŋ	loŋ-ɑ	loŋ-ɡɑ ba
	‘ladder’	tahak	tahaɡ-ɑ	tahak-kɑ li
	‘tree kangaroo’	xanam	xanam-ɑ	xanam-ɡɑ ba
b.	‘land’	titi	titi-ɑ	titi-ɑ li
	‘pig’	buxu	buxu-ɑ	buxu-ɑ lo
	‘person’	lipu	lipu-ɑ	lipu-ɑ ba

There are two possible analyses for these data. The first is that this alternation is prosodically conditioned: definite noun phrases could have a particular prosodic profile, and that profile conditions epenthesis. Related Oceanic languages have similar interactions between prosody and definiteness that suggest this may be on the right track. In Rotuman for instance, definite noun phrases undergo phonological alternations like metathesis, umlaut, and deletion (Churchward 1940; den Dikken 2003), which have independently been analyzed as prosodically-driven (McCarthy 2000). A second possibility is that we were wrong to consider Mato epenthesis as a general pattern – it could be directly conditioned by the suffixes or a demonstrative. In that case, Mato epenthesis would be morphologically-restricted, and therefore outside the scope of Epenthetic Inheritance. The choice between these two possibilities cannot be adjudicated with the data available, and so I let these possibilities rest. In either case, my theory is compatible with the Mato data.

Voiceless stop epenthesis also occurs at word boundaries. The only example in my survey comes from Mocho’ (Mayan, Palosaari 2011), which adapts vowel-final Spanish loanwords by epenthesizing [x], as in (60).

(60) Mocho’: Epenthesis of word-final /x/ in Spanish loans (Palosaari 2011: 111-112)

	Spanish loan	UR	surface form	gloss
a.	*mesa*	/mesa/	meʃax	‘table’
b.	*jarro*	/xaro/	ʃaːrux	‘jug’
c.	*burro*	/buro/	buːrux	‘burro’

Mocho’ epenthesis occurs by narrowing the the vowel’s dorsal constriction to make [x/ɣ] (DOR: wide → critical). Voiced obstruents are never permitted word-finally in Mocho’ (Palosaari 2011: 17), and so markedness favors [x] over [ɣ]. I predict that voiceless epenthetic obstruents as in Mocho’ should only occur in languages that prohibit voiced obstruents at margins.

While both of these kinds of voiceless stop epenthesis are rare in my survey, similar cases have been observed in the diachronic typology. Maru (also called Lhaovo; Tibeto-Burman) is one such case, which inserts [k] in checked-tone syllables ending with high back vowels, and [t] in checked-tone syllables ending with high front vowels (Burling 1966). Maru high back vowels have a dorsal constriction, which narrows further to create a [k]; front vowels have a coronal constriction, which narrows further to make a [t]. This is reminiscent of what we saw in Amarasi – [g] after back vowels, [dʒ] after front – and so while the Maru case is diachronic, it is also derivable in Epenthetic Inheritance.

To summarize, epenthetic voiceless stops are only attested at margins: adjacent to another consonant (as in Urim and Mato) or at word margins (as in Mocho'). The source of voicelessness differs between these two patterns. In the first type, voiceless obstruents are selected because the epenthetic consonant originates from an adjacent voiceless consonant, and voiceless obstruents are more similar to the source material. In the second type, the epenthetic quality is inherited from a vowel at a word edge, but general markedness constraints prefer voiceless codas in word-final positions. The first type is predicted in any language where consonant timing can be sloppy, whereas the second type is only predicted in languages that have a restricted distribution of voiced obstruents (e.g. languages with final devoicing).

4.7.2 Voiceless "intrusive" stops between consonants

Another common context for epenthetic voiceless obstruents is within consonant clusters. For example, in Old English nasal-liquid and strident-liquid sequences vary in the presence of a homorganic stop between the two consonants, shown in (61):

(61) Consonant epenthesis in Old English (Hogg 2011: 292)

	Variety A	Variety B	gloss
a.	*gandra*	*ganra*	'gander'
b.	*morgendlic*	*morgenlic*	'morning'
c.	*brambel*	*bremel*	'bramble'
d.	*symbel*	*symle*	'always'
e.	*ondrystlic*	*ondryslic*	'terrible'
f.	*æmptig*	*æmtig*	'empty'

These stops are often termed intrusive (or "excrescent"). Similar patterns have been found in Ilocano (Rubino 1997), Modern English (Barnitz 1974; Gick 1999; Fourakis & Port 1986), and Icelandic (Árnason 2011). Unlike other epenthetic consonants, intrusive stops have much shorter duration, disappear in careful, slow speech, and share with their preceding consonant (Fourakis & Port 1986; Ohala 1997). An open question is whether intrusive stops are a kind of epenthesis at all, or if they should be analyzed as a purely phonetic coarticulatory effect.

The theory of Epenthetic Inheritance does not require us to make this distinction. Intrusive stops are transformations of existing gestures, just like any other case of general consonant epenthesis. Differences in duration between intrusive stops and epenthetic stops will need to be handled by a richer theory of timing. This is largely beyond the scope of the present paper – a complete theory of timing will also need to explain the difference between complex segments and clusters, for instance. For existing work on this topic, see Sagey (1986), Zsiga (2000),Gouskova & Stanton (2021), Shaw, Oh, Durvasula & Kochetov (2021), and citations therein.

4.7.3 Axininca Campa

Axininca Campa (Apurucayali) has /t/-∅ alternations before certain vowel-initial suffixes (Payne 1981; McCarthy & Prince 1993; Lombardi 2002), as shown in (62). Axininca Campa poses a problem for Epenthetic Inheritance because it appears to be a counterexample to the Margin Voiceless Obstruents generalization, which states that epenthetic voiceless obstruents are never intervocalic.

(62) Axininca Campa: /t/ occurs between vowel-final root and vowel-initial suffix (Payne 1981: 108)

a.	/i-ŋ-koma-i/	→ i-ŋ-koma-t̲i	‘he will paddle’
b.	/i-ŋ-koma-aa-i/	→ i-ŋ-koma-t̲aa-t̲i	‘he will paddle again’
c.	/i-ŋ-koma-ako-i/	→ i-ŋ-koma-t̲ako-t̲i	‘he will paddle for’
d.	/i-ŋ-koma-ako-aa-i-ro/	→ i-ŋ-koma-t̲ako-t̲aa-t̲i-ro	‘he will paddle for it again’
		3SG-FUT-paddle-APPL-FUT-REP-3F	

(63) Axininca Campa: In consonant-final roots, only outer suffixes occur with /t/ (Payne 1981: 108)

a.	/i-ɲ-c^{h}ik-i/	→ i-ɲ-c^{h}ik-i	‘he will cut’
b.	/i-ɲ-c^{h}ik-aa-i/	→ i-ɲ-c^{h}ik-aa-t̲i	‘he will cut again’
c.	/i-ɲ-c^{h}ik-ako-i/	→ i-ɲ-c^{h}ik-ako-t̲i	‘he will cut for’
d.	/i-ɲ-c^{h}ik-ako-aa-i-ro/	→ i-ɲ-c^{h}ik-ako-t̲aa-t̲i-ro	‘he will cut for it again’
		3SG-FUT-cut-APPL-FUT-REP-3F	

The traditional analysis is to treat this alternation as epenthesis: /t/ is inserted to provide an onset to the suffix syllable (McCarthy & Prince 1993; Lombardi 2002). If this pattern were fully general, then we would expect for /t/ to appear whenever there would be vowel hiatus across a morpheme boundary. This prediction turns out to be too strong. Hiatus is avoided in other contexts through deletion, not epenthesis. To illustrate, at prefix-stem boundaries, a prefix vowel deletes before vowel initial stems (64) but not before consonant initial stems (65).

(64) Axininca Campa: Prefix vowel deletes to avoid hiatus before vowel-initial stems (Payne 1981: 77)

a.	/no-iŋki-ni/	→ n-iŋki-ni	‘my peanut’	*not̲-iŋki-ni
b.	/no-ana-ni/	→ n-ana-ni	‘my black dye’	*not̲-ana-ni
c.	/no-oŋko-ni/	→ n-oŋko-ni	‘my edible plant’	*not̲-oŋko-ni
d.	/no-airi-ti/	→ n-airi-ti	‘my bee’	*not̲-airi-ti
e.	/no-iirisi-ti/	→ n-iirisi-ti	‘my new leaf’	*not̲-iirisi-ti

(65) Axininca Campa: No prefix vowel deletion before consonant-initial words (Payne 1981: 77)

a.	/no-mapi-ni/	→ no-mapi-ni	‘my rock’
b.	/no-saŋko-ni/	→ no-saŋko-ni	‘my sugar cane’
c.	/no-t^{h}oŋki-ni/	→ no-t^{h}oŋki-ni	‘my small ant’

Vowel deletion also occurs at certain suffix boundaries, shown in (66). The affix vowel deletes, but no /t/ epenthesis occurs (e.g. (66a.), *[i-pijo-t̲ic^{h}i-takawo]).

(66) Axininca Campa: Vowels delete to avoid hiatus at distributive suffix boundary (Payne 1981: 45)

a.	/i-pijo-i̲c̲^{h}i̲-takawo/	→ i-pijo-c̲^{h}i̲-takawo	‘he has gathered it, in addition’
b.	/i-pina-i̲c̲^{h}i̲-takawo/	→ i-pina-c̲^{h}i̲-takawo	‘he has paid her, in addition’
c.	/i-tasi-i̲c̲^{h}i̲-takawo/	→ i-tasi-c̲^{h}i̲-takawo	‘he has roasted it, in addition’

(67) Axininca Campa: Suffix vowel does n̲o̲t̲ delete after consonant-final stems (Payne 1981: 45)

a.	/i-č^{h}ik-i̲c̲^{h}i̲-takawo/	→ i-č^{h}ik-i̲c̲^{h}i̲-takawo	‘he has cut it, in addition’
b.	/i-t^{h}oŋk-i̲c̲^{h}i̲-takawo/	→ /i-t^{h}oŋk-i̲c̲^{h}i̲-takawo/	‘he has finished it, in addition’

Both /t/ epenthesis and vowel deletion have morphological exceptions. With the diminutive suffix in (68), vowel hiatus is tolerated – neither deletion nor epenthesis occurs. Vowel deletion only resumes to avoid sequences of three vowels, as in (69).

(68) Axininca Campa: Hiatus is tolerated with diminutive suffix (no epenthesis!) (Payne 1981: 110)

a.	/hito-iriki/	→ hito-iriki	'little spiders'	*hito-t̲iriki
b.	/mapi-iriki/	→ mapi-iriki	'little rock'	*mapi-t̲iriki
c.	/ana-iriki/	→ ana-iriki	'little black dye plant'	*ana-t̲iriki

(69) Axininca Campa: Root vowels delete to avoid VVV (no epenthesis!) (Payne 1981: 141)

a.	/sampaa-iriki/	→ sampa-iriki	'little balsa'	*sampaa-t̲iriki
b.	/c^{h}iwoo-iriki/	→ c^{h}iwo-iriki	'little cane boxes'	*c^{h}iwoo-t̲iriki
c.	/manii-iriki/	→ mani-iriki	'little ants'	*manii-t̲iriki
d.	/no-pai-iriki/	→ no-pa-iriki	'my little grey hairs'	*no-pa-t̲iriki

I am not the first one to notice these restrictions. On the basis of similar data, Staroverov (2014: 154) and Morley (2015: 7) argue that Axininca Campa is best analyzed as deletion, not epenthesis. These analyses, however, rely on arguments of theoretical parsimony. Additional behavioral data is needed to adjudicate between these two possible analyses. I therefore do not attempt to answer the question of whether Axininca Campa has /t/ deletion or /t/ epenthesis. It is enough to say that Axininca Campa /t/-∅ alternations are not language-general, and are therefore not expected to obey Epenthetic Inheritance.

To sum up, /t/-∅ alternations in Axininca Campa are not fully general. Hiatus across morpheme boundaries is often avoided by inserting /t/, but in certain contexts, vowel hiatus is tolerated. In other contexts, vowels are deleted instead. Whether one sees deletion or epenthesis is not phonologically predictable – one must know the identity of the morphemes at hand. Other languages with /t/-zero alternations also require morphological conditioning (Lombardi 2002), including Amharic (Broselow 1984), Odawa (Piggott 1980; Lombardi 2002) and Plains Cree (Wolfart 1973). The Margin Voiceless Obstruents generalization holds: in phonologically general patterns, voiceless epenthetic obstruents are never intervocalic.

4.8 Invisible Man

The last generalization, Invisible Man, states that general patterns of consonant epenthesis are never phonologically visible – when epenthesis could change the outcome of allomorph selection, for instance, no interaction occurs. Epenthetic consonants are thus consistently phonologically inert.

To illustrate, consider Haitian Kreyol (Klein 2003), which epenthesizes a glide in tense-lax vowel sequences, (70a.), but not in lax-lax ones (70b.).

(70) Haitian Kreyol epenthesizes a glide in tense-lax vowel sequences (Valdman 1978: 75, Klein 2003: 2)

a.	/ru-a/	→ [ruwa]	'the wheel'
	/po-a/	→ [powa]	'the skin'
	/diri-a/	→ [dirija]	'the rice'
	/pje-a/	→ [pjeja]	'the foot'
b.	/papa-a/	→ [papa]	'the father'
	/bɔkɔ-a/	→ [bɔkɔa]	'the sorcerer'
	/vɛ-a/	→ [vɛa]	'the glass'

Crucially, allomorphy is not affected by epenthesis. Klein (2003) observes that the definite suffix has two allomorphs: [-a] after vowel-final roots, [-la] after consonant-final roots. Roots with epenthetic glides in (71h.-j.) have the same behavior as other vowel-final roots, taking [-a].

(71) **Invisible Man:** Haitian Kreyol glide epenthesis is invisible to allomorphy (Klein 2003)

	Consonant-final words select *-la*				Vowel-final words select *-a*		
a.	/malad/	[malad-la]	'the sick (person)'	f.	/papa/	[papa-a]	'the father'
b.	/ʃat/	[ʃat-la]	'the cat'	g.	/bujwa/	[bujwa-a]	'the kettle'
c.	/liv/	[liv-la]	'the book'	h.	/papje/	[papje-ja]	'the paper'
d.	/bagaj/	[bagaj-la]	'the thing'	i.	/lapli/	[lapli-ja]	'the rain'
e.	/kaw/	[kaw-la]	'the crow'	j.	/bato/	[bato-wa]	'the boat'

If consonant epenthesis were visible to allomorph selection, we would expect to see forms like *[batow-la] 'the boat'. Instead, the epenthetic consonant is invisible, producing [bato-wa].

The invisibility of Haitian Kreyol epenthesis may be unsurprising, because allomorphy is often treated as an implicit diagnostic for epenthesis (see Section 2 on Molo, for example). However, many theories do not predict this. In any theory that interleaves allomorph selection with cycles of phonology, epenthesis-allomorph feeding should be possible (in contradiction of Invisible Man). Theories of this type include Cophonology Theory (Orgun 1996; Inkelas, Orgun & Zoll 1996) and Optimal Interleaving (Wolf 2008). We therefore need some way of explaining why general epenthesis patterns never feed allomorph selection.

My theory accounts for the invisibility of general epenthetic consonants using representations. Following Hall (2003), I assume that allomorphy can only reference segments. Since general consonant epenthesis is gestural, its outcome is never interpretable to allomorph selection. Morphologically-restricted epenthesis, on the other hand, uses segments (which is also why its quality is much less restricted, Section 4.4), and so epenthesis-allomorph feeding relationships should be possible.

This prediction is borne out: Morphologically-restricted epenthesis can be visible to allomorph selection. In Wangkajunga (Pama-Nyungan, Jones 2011: 38-39), epenthetic [pa] is inserted after consonant-final stems shown in (72).

(72) Wangkajunga: Epenthetic [-pa] after consonant-final words (Jones 2011: 40, 77)

a.	kuɲar-pa	'dog'
b.	mapaɳ-pa	'Aboriginal doctor'
c.	hantiŋ-pa	'hunting (Engl. loan)'
d.	lɪzəd-pa	'lizard (Engl. loan)'
e.	barbara-ŋurun-pa	'Barbara's group'

This epenthesis pattern is morphologically restricted. As in other Western Desert languages[12], consonant-final vocative nouns never bear [-pa], nor do words ending in the second person clitic [=n] (Jones 2011: 40).

If Wangkajunga epenthesis were like Haitian Kreyol, then we would expect for these words to still behave as if they were consonant-final for the purposes of suffixal allomorphy. Yet, this is not the case. In (73)-(74), we see that epenthetic [pa] *does* count for the purposes of ergative and locative allomorphy. The ergative takes [-dʒu] after consonants and [-lu] after vowels in (73a.-b.); the locative takes [-dʒa] after consonants and [-ŋga] after vowels in (74a.-b.). Forms with epenthetic [-pa] always take vowel-final allomorphs, as in (73c.) and (74c.), and so the epenthetic consonants must be visible.

[12] See Pitjantjatjara (Hale 1973) and Warlpiri (Nash 1980: 27).

(73) Wangkajunga [-pa] epenthesis counts for ergative allomorphy (Jones 2011: 80, 160)

	isolation	ergative	gloss	
a.	kuɲar(pa)	kuɲar-dʒu	‘dog-ERG (Wal.)’	(cf. kuɲarr-kuɭu-lu)
	mapaɳ(pa)	mapaɳ-dʒu	‘Aboriginal doctor-ERG’	
	kuʈal(pa)	kuʈal-dʒu	‘waterhole.name-ERG’	
b.	wiʈa	wiʈa-lu	‘dog-ERG’	
	jiɳa	jiɳa-lu	‘man-ERG’	
c.	dʒaɾam(pa)	dʒaɾam-pa-lu	‘prawn-EPEN-ERG’	*dʒaɾam-pa-dʒu

(74) Wangkajunga [-pa] epenthesis counts for locative allomorphy (Jones 2011: 89, 140)

	isolation	locative	gloss	
a.	kiʎir(pa)	kiʎir-dʒa	‘hot.coals-LOC’	
	paɳpaɳ(pa)	paɳpaɳ-dʒa	‘warm.spot-LOC’	
	kaʈal(pa)	kaʈal-dʒa	‘burrow-LOC’	
b.	waʈa	waʈa-ŋga	‘tree-LOC’	
	larku	larku-ŋga	‘valley-LOC’	
c.	liɲari-ŋuɾun(pa)	liɲari-ŋuɾun-pa-ŋga	‘Linyarri-GRP-EPEN-LOC’	*liɲari-ŋuɾun-pa-dʒa

Epenthesis-allomorph interactions are only attested in morphologically-restricted patterns. I interpret this in the strongest possible terms: general patterns of epenthesis are uniformly invisible to allomorph selection.

The Invisible Man generalization is likely to extend to more areas than just allomorphy. For example, I know of no language with weight-sensitive stress where epenthetic consonants count towards weight. The closest we seem get to this is verbal templates in Sierra Miwok, where there are four verbal templates conditioned by aspect and mood (Freeland 1951). These templates can induce consonant gemination, which is arguably a form of consonant epenthesis (e.g. /hut̪el/ ‘to roll’ → [huˈt̪elː] (2nd stem), or [ˈhut̪ː.el] (4th stem); Freeland 1951: 94-95). This consonant gemination is visible for the purposes of stress assignment. Stress falls on the leftmost heavy syllable, without exception (e.g. 4th stem [ˈhut̪ː.el], not *[hu.ˈt̪ːel]). If the Miwok pattern were fully general (rather than morphologically restricted), then it could be a counterexample to the stress-assignment generalization of Invisible Man.

Similarly, I know of no language where general patterns of epenthesis count towards minimal word requirements. Hall (2003: 84-85) discusses a pattern of vowel epenthesis in Mono (Volta-Congo), which is invisible to minimality-driven reduplication. Even though the presence of an epenthetic vowel should satisfy the word minimality requirement, reduplication still applies. Michelson (1989) reports a similar pattern in Mohawk, where epenthesis between CC clusters is also invisible to minimality-driven stem augmentation. Both Mono and Mohawk thus both exemplify Invisible Man for vowel epenthesis, and I predict that the same behavior should apply to epenthetic consonants.

5 Discussion

To summarize, Epenthetic Inheritance is the idea that epenthetic consonants are not inserted per se, but transformed from existing material. The reason why epenthetic consonants tend to be glottals, glides, and other sonorants is because most cases of epenthesis are between vowels, and these are the most vowel-like consonants (building on Staroverov 2014). Voiceless obstruents are only attested at margins or between consonants, because there are other sources of voicelessness in those positions.

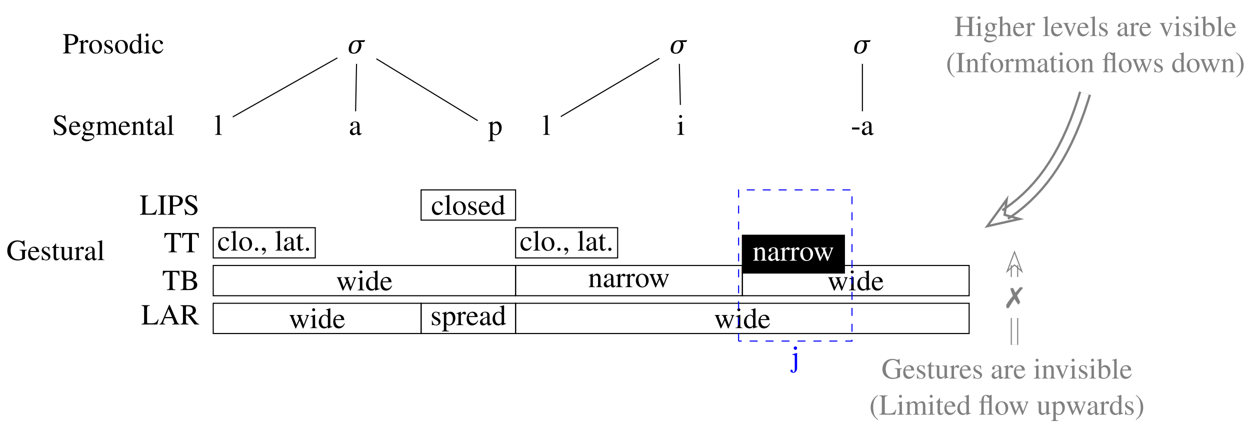
In terms of architectural assumptions, the theory of Epenthetic Inheritance makes several strong claims. Epenthetic consonants are computed by a module of grammar that can only manipulate gestures – anything less would weaken the predictions of the theory, especially those surrounding non-structure preserving patterns like Amarasi (Section 2.3.1). However, that is not to say that there are only gestural representations in phonology. Higher levels of representation are compatible with this theory; the crucial fact is that the grammar responsible for consonant epenthesis cannot change them.

This leads to a matter that I have yet to discuss at length: the conditioning contexts for epenthesis. Some common contexts include phrase-initially, word-initially, phrase-finally, word-finally, between vowels, between vowels at morpheme boundaries, or between VVV clusters. Each of these contexts requires reference to abstract levels of phonological structure, including words, syllables, and segments. Phonological gramamr must be able to reference these entities, otherwise the contexts for epenthesis would not be the ones we observe.

A gestural analysis of epenthesis is compatible with these facts. As long as both gestural and higher-level representations exist, all we need to say is that the grammar for consonant epenthesis can only manipulate gestures. On the flipside, generalizations like Invisible Man suggest that the grammar of higher-level representations has parallel limitations. While these high-level structures can reference each other (such as in allomorph selection, Section 4.8), they are unable to reference or manipulate gestures. Consonant epenthesis thus exemplifies a grammatical asymmetry grounded in representational type. Gestural grammars can reference higher levels of structure, but they can only manipulate gestural targets. Segmental (or other high-level representation) grammars cannot reference or manipulate gestures, but their outcome is visible to other abstract phonology.

The phonological architecture that emerges is one where all representational information flows in a fixed direction, going from segments to gestures. As one goes lower in the representational structure, one's ability to manipulate that structure decreases. General patterns of consonant epenthesis are low, shown in (75), but allomorphy, stress assignment, and morphologically-restricted epenthesis are all computed in higher representational layers.

(75) Lamination diagram for Haitian Kreyol [lapli-j̲a] 'the rain' from (71i.)



For consonant epenthesis, this asymmetric architecture allows us to explain why epenthetic consonants (i) often occupy phonemic gaps in a language's inventory and (ii) are always invisible to allomorphy. Epenthetic consonants are gestural, and gestural information cannot flow upwards.

An alternative to the representational account is to appeal to derivational order, such as in Lexical Phonology (Mohanan 1982; Kiparsky 1982; Kaisse & Shaw 1985:et seq.), Stratal OT (Bermúdez-Otero 1999, 2003; Kiparsky 2000), Cophonology Theory (Anttila 2002; Inkelas & Zoll 2007; Orgun 1996), or certain models of the phonetics-phonology interface (Cohn 1993, 2007; Zsiga 1997). In these derivational models, epenthetic consonants could be computed late, and so their outcome cannot affect earlier cycles. While a derivational approach could explain Invisible Man, it does not explain why epenthetic consonant quality is so different between general and morphologically-restricted patterns (Section 4.4). In a representational approach, differences in quality and visibility both follow from their representational origin.

6 Conclusion

In this paper, I argue that consonant epenthesis exhibits a split typology. In the most general patterns, epenthetic consonants tend to inherit their quality from surrounding sounds. Sonorants tend to occur between vowels, but voiceless obstruents are possible when flanked by a word edge or another consonant. The resulting epenthetic consonants also appear to be representationally weak in some way: They are not bound by the same markedness constraints are ordinary segments (and so can appear to fill gaps in a language's phonemic inventory), and they are always invisible to phonologically conditioned allomorphy. In comparison, morphologically-restricted patterns of consonant epenthesis do not have the same distributional restrictions nor the same representational weakness.

I develop a theory I call Epenthetic Inheritance, which claims that the general patterns of consonant epenthesis are gestural. Epenthetic consonants are transformations of existing articulatory movements, and so their quality will always be partially inherited from a neighboring vowel or consonant. Their representational weakness follows from their status as a purely gestural phenomenon: They cannot be changed by phonology that references segments (e.g. morpheme structure constraints, allomorphy), because epenthetic consonants lack segmental representations. Morphologically-restricted epenthesis does insert true segments, and thus exhibits a different typology. Consonant epenthesis thus exhibits an asymmetry between general phonology and morphophonology. General phonology can only use the gestural material it already has, whereas morphophonology alone can truly insert and remove segments.

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