The Emergence of Dorsal Stops after High Vowels in Huishu*

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0. Introduction

Huishu, a Tibeto-Burman language of Manipur belonging to the Tangkhul group, features an unusual sound change in which dorsal stop codas are inserted after high vowels in open syllables. Thus PTB **səy* > PTk > **kə.thi* > Huishu *kə.tik* 'to die'. This development seems both formally and functionally aberrant: epenthesis usually inserts vowels, and consonant epenthesis, when it does occur, usually inserts glides (Blevins to appear).[1]

I propose that this change and others like it were not motivated by either formal or functional factors. Rather, they result from the conjunction of aerodynamic, acoustic, and perceptual facts, which lead to a systematic misperception (and thus, misinterpretation) of the forms involved in these innovations. This model, I argue, is able to account not only for the general facts surrounding the emergence of consonants after high vowels, but is also able to account for specific facts of this phenomenon in Huishu.

1. Huishu

Huishu is spoken by a few thousand individuals in Huishu village and the surrounding area in Ukhrul District, Manipur State, India. It is a member of the closely related family of languages spoken by the Tangkhuls (also called the Tangkhul Nagas). The position of this family of languages within the larger Tibeto-Burman family has not yet been settled, but some evidence suggests that it may be close to Kuki-Chin, Zeliangrong, or both (Mortensen 2003).

Proto-Tangkhul (PTk; Mortensen 2003), in addition to nasal codas (**-m*, **-n*, and **-ŋ*) and liquid codas (**-r* and **-l*) had the stop codas **-p*, **-t*, and **-k*. In pre-

*This paper owes a debt to many individuals including James Matisoff, Larry Hyman, John Ohala, Sharon Inkelas, Juliette Blevins, Takumi Ikeda, Andrew Garrett, and Gary Holland. It is likely that none of these individuals agrees completely with the arguments presented in this paper, and none of them is responsible for its errors and shortcomings, but each of them shaped—in some way—its central ideas. I also owe a special debt to Jonathan and Rufus Zingkai, who provided the Huishu data upon which my argument depends.

[1]An important exception to this generalization is eclipsis; see Hock (1991:122–123)).

Huishu, all instances of PTk _*-t_ and _*-k_ became _**-ʔ_, as did _*-p_ after low vowels (_*a_ and _*ɐ_). This left pre-Huishu with a two-way stop-coda contrast between _**-p_ and _**-ʔ_.

Subsequently, dorsal stop codas emerged after high vowels in open syllables. Thus the pre-Huishu rhymes _**-i_ and _**-u_ (< PTk _*-i_ and _*-u_/_*-ɨ_) became /-ik/ [icʰ] and /-uk/ [ukʰ]. All instances of /k/ in modern Huishu reflect these emergent or epenthetic stops. There are now open syllables containing high vowels, but these are all the result of a (rather complicated) set of later sound changes and they seem never to reflect PTk high vowels.

The data showing the development of these stops—a process that is almost perfectly regular—are quite plentiful, since the PTk rhymes _*-i_ and _*-u_ were among the most common in the language. The following table gives the Huishu data along with cognate forms from Standard Tangkhul and Kachai (another Tangkhul language), reconstructed forms for PTk,[2] and Proto-Tibeto-Burman reconstructions (PTB; Benedict 1972; Matisoff 2003).

		PTB	**PTk**	**Tangkhul**	**Kachai**	**Huishu**
[1]	‘blood’	_*s-hywəy_	_*ʔa.ʃi_	_ʔà.ʃi_	_ʔā.sɐ̀_	_ʔā.sìk_
[2]	‘blow’	—	_*kə.mə.ri_	_khə̀.mə̀.ri_	—	_kə̄.mə̄.līk_
[3]	‘comb’	_*si_	_*rik-si_	_rik-si_	_rɐ́k-sɐ_	_ʔə̄.róʔ-sìk_
[4]	‘die’	_*səy_	_*kə.thi_	_kə̀.thì_	—	_kə.tìk_
[5]	‘fear’	_*kri_	_*kə.ŋə.ci_	_khə̀.ŋə̀.cì_	_khə́.ŋə̀.tsɐ̄_	_kə́.tsìk_
[6]	‘four’	_*b-ləy_	_*pə̀.lì_	_mə̀.tì_	_pə̀.tsɐ̄_	_mə.kìk_
[7]	‘horn’	—	_*ʔa.ŋə.ci_	_ʔà.ŋə̀.ci_	_ʔā.ŋə̀.tsɐ̄_	_ʔa.nə.tsìk_
[8]	‘medicine’	_*r-tsəy_	_*ʔa.ri_	_ʔà.rì_	_ʔa.rɐ̂_	_ʔa.rîk_
[9]	‘mother-in-law’	—	_*ʔa.ni_	_ʔa.ni_	_ʔa.nɐ̄_	_ʔa.nik_
[10]	‘one’	—	_*kə.si_	—	_kə̄.sɐ̄_	_kə.sík-à_
[11]	‘salt’	_*tsyi_	_*mə.ci_	_mə̀.cî_	_mə.tsɐ̄_	_ʔā.mə̄.tsīk_
[12]	‘seven’	_*s-nis_	_*ci.ni_	_ʃí.ní_	_ʃ́i.nɐ̂_	_thi.nik_
[13]	‘two’	_*g-nis_	_*khə.ni_	_khə́.nî_	_khə̄.nɐ̂_	_khə.nîk_
[14]	‘bone’	_*g-rus_	_*ʔa.ru_	_ʔa.rú-kùj_	_ʔā.rɐ́_	_ʔā.rūk_
[15]	‘breast’	_*nəw_	_*ʔa.nu_	_ʔà.nù_	_nɐ́-tɐ̂_	_ʔā.nə̄.nùk_
[16]	‘carry (on shoulders)’	—	_*kə.ŋə.wu_	_khə̀.ŋə̀.vù_	_kə̄.hɐ̄_	_kə̄.nə̀.vúk_
[17]	‘grandchild’	—	_*ru_	_ʔà.rù_	_ī-ðɐ̄_	_ʔā.rúk-rè_
[18]	‘insect’	—	_*ʔa.khu_	_ʔà.kù_	_ʔà.khɐ̀_	_ʔā.khúk-è_
[19]	‘tie’	—	_*kə.mə.su_	_khə̀.mə̀.sú_	_khə́.mə̀.sī_	_kə̄.mə́.sūk_
[20]	‘dog’	_*kʷəy_	_*hwɨ_	_fu_	_ʔā.hwì_	_ʔā.huk_
[21]	‘egg’	_*har-rəy_	_*har-rɨ_	_hɐ̀r-ru_	_hàr-ðî_	_ʔā.hó-phə̄.rùk_
[22]	‘laugh’	_*m-nwəy_	_*kə.mə.nɨ_	_khə̀.mə̀.nù_	_khə́.mə̀.nî_	_kə̀.mə̀.nùk_
[23]	‘water’	_*rəy_	_*-rɨ_	_tɐ́-ru_	_tūŋ-ðì_	_ʔā.rùk_

[2] The reconstructions given here are identical to those in Mortensen (2003), with one difference: the rhyme previously reconstructed as _*-ɐj_ (the reflex of PTB _*-əy_) is here given the more plausible reconstruction _*-ɨ_.

The above data gloss over some important phonetic facts about these non-etymological velar stops. While all of these stops have been transcribed above as /*k*/, phonetically they differ according to the preceding vowel: /*uk*/ is realized with a velar stop, but /*ik*/ is realized with a palatal stop (not unlike the velar stops in English). Furthermore, unlike Huishu /*-p*/ (and in fact, the coda obstruents of most Tibeto-Burman languages in the India-Burman borderlands region), Huishu dorsal stop codas are produced with an audible release, which—at times—is accompanied by very noticeable frication. They sound rather like the aspirated stops that occur as onsets in Huishu.

The same type of development shown here in Huishu is attested in a number of other languages and language families.

2. Lom (Belom)

Lom is an unclassified Austronesian language of Bangka (an island off the east coast of Sumatra, approximately 200 miles to the south of Singapore; Blust 1994).[3] In Lom, the dorsal stops /*-c*/ and /*-k*/ have intruded after word-final Proto-Austronesian (PAN) high vowels:

		PAN	**Lom**
[24]	'day'	**waRi*	*aric*
[25]	'flesh, meat'	**isi*	*isic*
[26]	'husband; male'	**laki*	*lakeik*
[27]	'to buy'	**beli*	*melic*
[28]	'excrement'	**Caqi*	*taic*
[29]	'ash'	**qabu*	*abek*
[30]	'yes'	**au*	*aok*
[31]	'dog'	**asu*	*asek*
[32]	'stone'	**batu*	*batek*
[33]	'tunnel trap'	**bubu*	*bubek*
[34]	'body hair'	**bulu*	*bulek*
[35]	'put, place'	**taRu*	*tarok*
[36]	'headwaters'	**qulu*	*ulek*

3. Singhi

Singhi, also an Austronesian language, is a Land Dyak language of Sarawak on Borneo. In Singhi, obstruents have also developed after word final high vowels, but they are fricatives rather than stops. Pre-Singhi ***-i* > Singhi /*-is*/ while Pre-Singhi ***-u* > /*-ux*/ (Blust 1994).

		PAN	**Singhi**
[37]	'yam'	**qubi*	*bis*
[38]	'iron'	**besi*	*bosis* 'small axe'
[39]	'this'	**iti*	*itis*

[3] Thanks to Juliette Blevins for directing me to Blust (1994), where Lom and Singhi are discussed.

[40]	'dig'	**kali*	*karis*
[41]	'buy'	**bili*	*miris*
[42]	'spear'	**suligi*	*sirugis*
[43]	'ash, fireplace'	**qabu*	*abux*
[44]	'stone'	**batu*	*batux*
[45]	'new'	**baqeRu*	*baux*
[46]	'louse'	**kuCu*	*gitux*
[47]	'burn'	**CuNu*	*ninux*
[48]	'sugarcane'	**CebuS*	*tobux*

4. Maru (Langsu)

Maru (known in the Chinese literature as Langsu) is a Burmish language of Northern Burma (Kachin State) and Southern China (Yunnan Province). Burling (1966) argued persuasively, on tonal evidence, that some of the stop codas of Maru (which he transcribed as /-*t*/ and /-*k*/) were a secondary development. This same argument was made earlier by Benedict (1948), and Burling's /-*t*/ and /-*k*/ developed regularly after the reflexes of Proto-Tibeto-Burman (PTB) **-əy* and **-əw* (as reconstructed by Benedict), which appear to have become the high vowels ***-i* and ***-u* in pre-Maru. See the following comparisons between Maru, the closely related language Atsi (Burling 1966), Written Burmese (WB), and PTB (Matisoff 2003):

		PTB	**WB**	**Atsi**	**Maru**
[49]	'die'	**səy*	*se*	*šî*	*šìt*
[50]	'leg/foot'	**krəy*	*khre*	*khyí*	*khyìt*
[51]	'water'	**rəy*	*re*	—	*ɣìt*
[52]	'parrot'	**gyəy*	*kyê*	*jì*	*jìt*
[53]	'dung'	**kləy*	*khyê*	*khyì*	*khyít*
[54]	'horn'	**krəw*	*khrui*	*khyúi*	*khyùk*
[55]	'cry'	**ŋəw*	*ŋui*	*ŋâu*	*ŋùk*
[56]	'sky'	**məw*	*mûi*	*màu*	*mùk*
[57]	'bone'	**rəw*	*rûi*	*vùi*	*ɣùk*
[58]	'smoke'	**kəw*	*mî-khûi*	*khàu*	*khúk*
[59]	'steal'	**r-kəw*	*khûi*	*kháu*	*khúk*
[60]	'grandfather'	**pəw*	*ʔəphûi*	*phàu*	*phúk*

It is interesting to note that the secondary stop that Burling (1966) transcribes as /-*t*/ is always transcribed as /-*k*/ by Chinese linguists (Sun 1991; Dai & Huang 1992). This may be due either to a sound change that changed all instances of **-it* to /-*ik*/, or to the conservation of the original place of articulation in Maru dialects spoken in China but not the dialects spoken in Burma (where Burling did his Maru field work). It is most plausible that both Burling's /-*t*/ and the /-*k*/ of Chinese linguists are reflexes of an original ***-c* similar to that found in Huishu and Lom.

5. Momo and Fomopea

The Momo group of Grassfields Bantu languages display an innovation similar to the others discussed here (Stallcup 1978:124–132).[4] Epenthetic /*k*/s appear after

[4]Thanks to Larry Hyman for alerting me to the existence of this case and that of Fomopea.

what must have been high vowels historically. The same development occurred (apparently independently) in Fomopea, a language from the core of the Bamileke group. Take the following examples from Proto-Grassfield Bantu (PGB) (Hyman 1979/1993), Fomopea,[5] and Moghamo (Stallcup 1978):

		PGB	Bafut	Fomopea	Moghamo
[61]	‘head’	*tú`	àtú`	àtúk	á-tók`
[62]	‘mouth’	*cùl`	n̄cù	n̄cūk	í-côk
[63]	‘dog’	*bú̯à	m̀bú`	m̀bʉ́k	bók`
[64]	‘fall’	*gù̯a	—	—	gòk
[65]	‘eat’	*lí̯a	—	—	jə́k
[66]	‘moon’	*mu-V	—	—	í-mə́k`
[67]	‘knife’	*bé	—	—	fí-bék
[68]	‘stone’	*tí´	—	—	aték`
[69]	‘tree’	*tí´	àtì	àtɨ́k	—

It is not immediately evident that these data parallel the data from Huishu, Maru, Singhi, and Lom, since the “high-vowel” conditioning environment is not evident in either the Proto-Grassfields Bantu reconstructions or the Moghamo forms. However, there is external evidence, from languages like Bafut which reflect these vowels as /*i*/, /*ɨ*/, and /*u*/ and from the aspiration of stops in Bamileke languages, that high vowels were the environment for /*k*/ epenthesis (Hyman 1972:23–24; Stallcup 1978). Applying the inductive hypothesis (without taking the reconstructed phonetics too seriously), we might suppose that there were three contrasting high vowels in Pre-Momo: a high front vowel that became Moghamo /-*ek*/, a high back vowel that became Moghamo /-*ok*/, and a high mid vowel that became Moghamo /-*ək*/.

6. Competing Accounts

There are four things that an account of dorsal stop epenthesis in Huishu and other languages should explain:

1. **Mechanism** How the change took place.
2. **Environment** Why high vowels seem robustly to form the environment for this type of epenthesis.
3. **Motivation** Why this sound change converts a “less marked” structure into a “more marked” structure.
4. **Substance** Why the epenthetic obstruents have the place and manner features that they do.

An account which explains these four factors would be additionally attractive if it could explain the odd release of Huishu dorsal stops.

[5] The Fomopea data are taken from Larry Hyman’s unpublished field notes. The data from Bafut, a Grassfields language from the Ngemba group, are taken from a Grassfields Working Group notebook, also graciously provided by Larry Hyman.

6.1. Diphthongization Plus Glide Fortition

One possible account for the type of phenomena described here was given by Blust (1994)—that the emergence of these stops was a two-part process[6]: First the vowels diphthongized; then the off-glide was fortified to become an obstruent. Blust notes that there are clear cases of glide fortition word-initially and word-medially in Austronesian languages (Blust 1994:112–113). This seems a plausible explanation for the case of Lom, where the quality of the reflexes of word-final PAN **u* has changed to become /*e*/ (in exactly those cases where it is followed by the intrusive /*k*/). But in the Tangkhul family, there is no independent evidence for diphthongization in the affected rhymes. Rather, evidence suggests that PTB diphthongs had become PTk monophthongs in these words before the epenthesis took place. There are many diphthongs in PTk, and yet only the rhymes which we would reconstruct on independent grounds as monophthongal high vowels are affected by the epenthesis.

6.1.1. Buccalization of Glottal Stop ("*nope*-Epenthesis")

Glottal stops sometimes occur at prosodic boundaries and in positions of prominence (see, for example, Dagbani as described in Hyman 1988). For related reasons, English *no!* is sometimes realized as [noʔ] or [nowʔ]. Acoustically, this is similar to [nop], accounting for English *nope* < [noʔ] < *no!*[7]. Likewise, earlier English *oh!* > English [ow] ∼ [owʔ] ∼ [owp]. This, we may call *nope*-epenthesis, after its best-known exemplar.

We might posit that PTk **-u* and **-i* became /*-uk*/ and /*-ik*/ via *nope*-epenthesis: **-u* > ***-uʔ* > /*-uk*/ and **-i* > ***-iʔ* > /*-ik*/. This explanation is problematic for several reasons: other cases of *nope*-epenthesis occur in interjections or other words that are largely confined to special prosodic environments (Hock 1991:124); in Huishu, the epenthesis is a regular sound change. *Nope*-epenthesis should not target one class of vowels preferentially; in Huishu and related cases, high vowels seem to be an essential conditioning environment for the sound change. Furthermore, an epenthesized glottal stop produced by this process would collide with other segments in the Huishu or Pre-Huishu segment inventory, no matter what order of events one proposed.

6.1.2. Constraint against Open Syllables

If sound changes occur in order to enhance the phonotactic well-formedness of the words that contain them, then it would follow that adding coda consonants improves the syllables to which they are added in some way. It makes little sense, however, to say that these developments are motivated by a constraint against open syllables. Indeed, the opposite constraint is widely believed to be a universal tendency. Fur-

[6] It should be noted that Blust (1994) argues both for and against epenthetic stops resulting from glide fortition, depending on the details of the specific case.

[7] For an alternative analysis of this phenomenon, see Hock (1991:124).

thermore, the fact that the process targets high vowels differentially complicates such an appeal. The constraint would have to be against open syllables with high vowel nuclei. But even given such a constraint, it seems odd that the epenthetic segment would not be some “minimally marked” segment such as /ʔ/ (which was already a legal coda in Huishu). And, of course, positing a universal constraint against syllable-final high vowels seems to simply and arbitrarily restate part of the generalization without explaining the phenomenon. Nevertheless, I will argue that there is a (perverse) sense in which this account is true: that open syllables with a high vowel nucleus are a “marked” structure.

6.2. Maintenance of Contrasts (Push Chain)

One might conceive of this type of epenthesis as part of a push chain. This explanation has the virtue of explaining the fact that it is high vowels (and perhaps other peripheral vowels) that are the targets of these epenthetic processes. Peripheral vowels are the most likely to be crowded uncomfortably by encroaching vowels because they have, as it were, no place to run. The distinctions made by such vowels can only be maintained, we might argue, by something drastic like epenthesis. We may also note, referring to the other languages in which the process has been observed, that it never seems to result in mergers.[8]

The impression that this was a kind of chain shift grows if we look at the changes that occurred in the monophthongal rhymes between PTk and Huishu, schematized in Figure 1. Considering only this data, it might seem plausible that

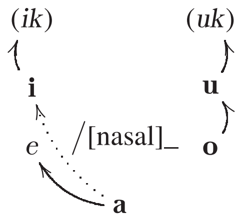

Figure 1: The development of Huishu monophthongs.

Huishu developed velar stops in order to keep the high-vowel rhymes from merging with the reflexes of PTk **-a*, and **-o*, which were creeping up from below.

This illusion is shattered quite decisively, however, if we look at a larger subset of the sound changes that occurred in rhymes between PTk and Huishu (Figure 2). If the motivation for the development of dorsal stop codas in Huishu was to preserve lexical contrasts, it is odd that so many mergers seem to have occurred in the language at about the same time. Huishu /*u*/ reflects no less than four PTk rhymes, including two very common diphthongs (PTk **-ej* and **-uj*). In light of this evidence, the push chain hypothesis seems contrived.

[8]This observation is due to Larry Hyman, p.c.

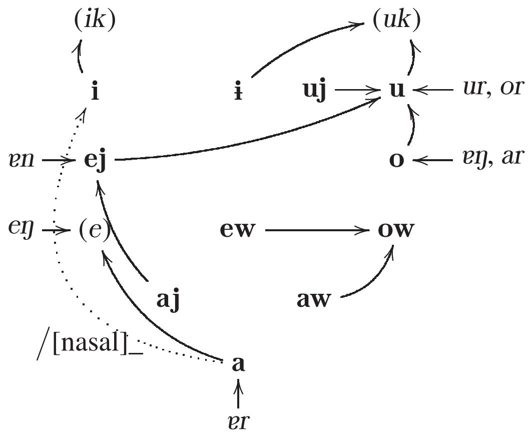

Figure 2: The development of Huishu monophthongal and diphthongal rhymes from PTk rhymes.

6.3. Maximal Use of Phonological Space (Drag Chain)

But what if, instead of a push chain, the development of dorsal consonants was part of a drag chain? The **-t*, **-k* > /*-ʔ*/ sound change left a gap in the coda inventory of Huishu. Perhaps the epenthesis of dorsal codas helped fill this gap. Other rhymes then shifted in the vowel space to fill the place of the high-vowel rhymes. Still other rhymes shifted to fill these gaps, thus accounting for the apparent counter-feeding interactions between pre-Huishu sound changes.

If these sound changes were part of a scheme to give Huishu a more balanced segment inventory that makes better use of the available phonological space, they have failed bitterly. Huishu is left not only with a somewhat odd inventory of rhymes (see Table 1) but with a situation where a disproportionately small number of words contain low vowels. In fact, what seems to have happened is that a

-a	(*-ɐ*)	*-e*	*-ej*	*-i*	*-o*	*-ow*	*-u*
-am	*-ɐm*	*-em*					
	-ɐn			*-in*			*-un*
-aŋ	*-ɐŋ*						*-uŋ*
	-ɐr						
	-ɐp	*-ep*					
				-ik [-ic]			*-uk*
-aʔ		*-eʔ*	*-ejʔ*		*-oʔ*	(*-ow*)	*-uʔ*

Table 1: Huishu rhyme inventory.

language with a rather symmetrical vowel and rhyme inventory (PTk) has suffered a dramatic reduction in this symmetry. This hypothesis has the further disadvantage of providing no good explanation for the fact that the high-vowel rhymes are the target of the stop epenthesis.

6.4. Syllable Isochrony

The insertion of dorsal stops after high vowels could help bring about syllable isochrony (ensuring that all syllables are about the same length). High vowels are typically shorter than non-high vowels, so something extra (i.e., codas) would have to be added to syllables with high-vowel nuclei in order to bring them into synchrony with the rest of the system. This would explain why the process targets high vowels as opposed to other vowels—it is a matter of duration. It would also explain the aspiration of the dorsal stops (as opposed to /-*p*/, which only appears after mid vowels), since the aspiration prolongs the duration of the syllable. However, this account does not explain why plosives are such a common outcome for this type of process (though their velarity could be explained by the proposal of Carvalho 2004 that velars have the feature [high]). Furthermore, this hypothesis would not predict the raising of **-o* to /-*u*/ subsequent to dorsal stop epenthesis.

7. Proposal

Let us start with the principle that language change is the result of mistaken inferences. We may then say, as a corollary, that sound change is the result of misperception. By *misperception*, I mean the state of affairs in which a listener incorrectly attributes some intent to a speaker (for related views, see Ohala 1993, Blevins 2004, and others).

High vowels are particularly susceptible to devoicing for aerodynamic reasons, and a devoiced high vowel is (phonetically) a weak fricative. In Huishu and other languages that have developed intrusive obstruents after high vowels, the accidental fricatives resulting from HVD (high vowel devoicing) have been misparsed by perceivers as intentional fricatives or stops.[9]

Initial state	> **Automatic devoicing**	> **Phonetic implementation**	> **Phonologization**
*/u/ [u]	> */u/ [u̥] ∼ [u]	> */u/ [ux] ∼ [u̥]	> */ux/ [ux] */uk/ [uk]
*/i/ [i]	> */i/ [i̥] ∼ [i]	> */i/ [iç] ∼ [i̥]	> */iç/ [iç] */ik/ [ic]

HVD phenomena are widely known and fairly easy to explain from a phonetic standpoint. Since high vowels involve a relatively tight oral constriction (compared to other vowels) and are correlated with a small oral cavity, the superglottal pressure is likely to be higher for high vowels than for non-high vowels. It follows that the pressure drop across the glottis should be relatively lower for these vowels than for other vowels. Thus, the aerodynamic conditions coincident with the articulation of high vowels are less favorable for voicing than those for non-high vowels, and we would predict that unintentional devoicing should occur more frequently in

[9] I must thank John Ohala for informal discussion of these points, which inspired part of the analysis given here.

high vowels than in low vowels. When devoiced, high vowels become weak dorsal (palatal to velar) fricatives.

This tendency for high vowels to become partially devoiced has been phonologized (or, at least, made part of the language-specific phonetic implementation of high vowels) in some cases. A particularly well know example of this is Parisian French, where word-final high vowels devoice to become weak fricatives (Fónagy 1989:247).[10] The fricative codas of Singhi represent a further development of the same type of pattern as is found in French. Speakers reinterpreted devoiced vowels as vowels followed by homorganic fricatives. Speakers may have subsequently attributed the palatality of the fricative after /*i*/ to the vowel, and thus posited /*s*/ rather than /*ç*/ as the correct form for this coda.

Explaining the emergence of stop codas from these fricative codas is somewhat more challenging. It is clear that the fricative was "fortified" to become a stop, but this is a label for the process, not an explanation. The clues for one explanation lie in the phonetics of Huishu: the etymological obstruent codas of Tangkhul (and related languages) are unreleased, but the emergent stop codas of Huishu have a strong audible release—even aspiration. Suppose a pre-Huishu speaker hears the

p	*t*		*k*	*ʔ*
ph	*th*		**kh**	
	ts [tɕ, ts]			
	s [ʃ, s]	(**ç*)	(**x*)	*h*
v	*r*	*j*		
	l			
m	*n*		*ŋ*	

Table 2: Huishu onset inventory.

phonetic implementation that has been assigned to high vowels—a voiceless vowel or a vowel with a fricative coda. She notices the friction at the end of the word and mistakenly parses this friction as an attempt to produce another segment rather than as an aspect of the implementation of the vowel. What segment could it be? She is biased against labelling it a velar or palatal fricative, since these do not occur in her consonant inventory. Coronal and glottal fricatives do occur in her inventory, but fricatives never occur in coda position and so they too are disfavored. Dorsal stops, however, do occur in her consonant inventory. Aspirated velar stops occur word-initially, and other stops occur in codas. So, she assumes that the noise in the vowel was a defective attempt to produce /*k*/, which she then "restores" in her own speech (phonetically implemented as released or aspirated). Repeated enough times, this results in the observed sound change.

[10]Other (non-high) vowels devoice in similar contexts, but with less frequency (Fagyal & Moisset 1999; Smith 2003).

8. Discussion and Conclusions

The seeds of obstruent epenthesis after high vowels are aerodynamic and articulatory. These phonetic seeds take root and grow in the soil of language-specific perception. The emergence of dorsal obstruents after high vowels does not require a grammar-internal or otherwise teleological explanation: the fundamental facts about epenthetic segments of this type fall out cleanly from a perceptual-articulatory model of sound change. The change occurred because of a set of mistaken inferences. Aerodynamically and articulatorily induced variation was mistakenly attributed to speaker intent. It occurred in high vowels because they are more prone to devoicing than low vowels. The existing phonological inventory of pre-Huishu gave the new form the upper hand in a lop-sided perceptual battle. Open syllables with only high vowels are relatively more "marked" than open syllables with low vowels to the extent that processes like this one are more likely to close them. As for the articulatory properties of emergent obstruents, they proceed directly from the articulatory properties of the source vowel.

My account of dorsal stop epenthesis has the added benefit of explaining the fact that, in Grassfields Bantu languages, stop epenthesis and spontaneous aspiration have the same conditioning factor—vowel height. The devoicing of extra-high vowels could be misattributed to a preceding aspirated stop as easily as it could be misperceived as a trailing obstruent. Thus, this aspiration process can be seen as an assimilation to the same environment implicated in the epenthesis process.

This paper has identified an under-studied cluster of empirical phenomena—the emergence of non-etymological dorsal obstruents after high vowels—and in accounting for this set of phenomena, has added an (apparently novel) explanation to the repertoire of perceptual-articulatory accounts of sound change. In doing so, it has also argued that grammatical competence (specifically phonotactic knowledge) plays a significant role in the (mis)perception of speech sounds, but has argued against teleological accounts of sound change.

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