

The Emergence of Dorsal Stops after High Vowels in Huishu*

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Credibile prorsus est, quia ineptum
est . . . certum est, quia impossibile.
—Tertullian, *De Carne Christi*

1 Introduction

- (1) a. **Problem:** In Huishu, a Tibeto-Burman language of Manipur (India) belonging to the Tangkhul group, a sound change occurred which inserted dorsal stop codas after high vowels in open syllables.
 - b. PTB **səy* > PTK > **kə.thi* > Huishu *kə.tik* 'to die'.
 - c. This same type of development has occurred independently in a number of different languages and language families.
 - d. This type of epenthesis seems odd from both a formal and functional standpoint.
 - Epenthesis usually inserts vowels.
 - Consonant epenthesis usually inserts glides (Blevins to appear a), except for eclipsis (Hock 1991:122-123).
- (2) a. **The Proposal:** This change (and the other changes like it) were not motivated by either formal or function factors.

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- b. Instead, they result from the conjunction of aerodynamic, acoustic, and perceptual facts, which lead to systematic misperception.
- c. Such a model is able to account not only for the general facts of emergent consonants after high vowels, but for specific facts of this phenomenon in Huishu.

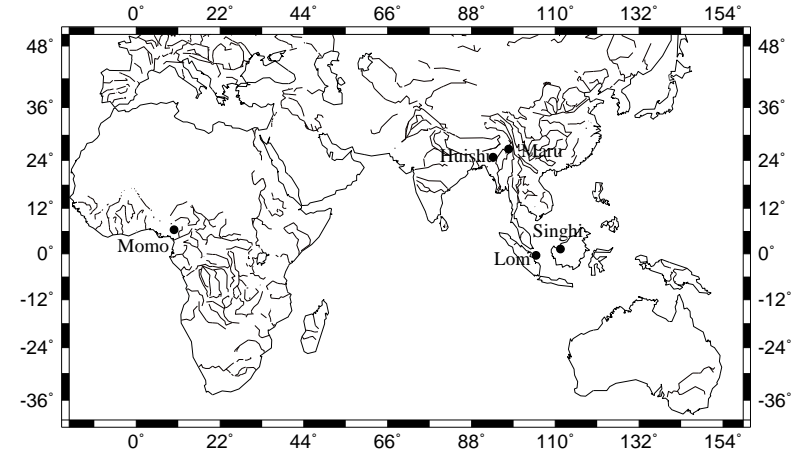


Figure 1: Approximate geographical locations for some of the languages discussed in this paper.

2 Huishu

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

<i>p</i>	<i>t</i>	<i>k</i>	<i>ʔ</i>
<i>ph</i>	<i>th</i>	<i>kh</i>	
	<i>ts</i> [tʃ, ts]		
	<i>s</i> [ʃ, s]		<i>h</i>
<i>v</i>	<i>r</i>	<i>j</i>	
	<i>l</i>		
<i>m</i>	<i>n</i>	<i>ŋ</i>	

Table 1: Huishu onset inventory.

<i>-a</i>	<i>(-ə)</i>	<i>-e</i>	<i>-ej</i>	<i>-i</i>	<i>-o</i>	<i>-ow</i>	<i>-u</i>
<i>-am</i>	<i>-əm</i>	<i>-em</i>					
	<i>-en</i>			<i>-in</i>			<i>-un</i>
<i>-aŋ</i>	<i>-eŋ</i>						<i>-uŋ</i>
	<i>-ər</i>						
	<i>-ep</i>	<i>-ep</i>					
				<i>-ik</i> [-ic]			<i>-uk</i>
<i>-aʔ</i>	<i>-eʔ</i>	<i>-ejʔ</i>			<i>-oʔ</i>	<i>(-ow)</i>	<i>-uʔ</i>

Table 2: Huishu rhyme inventory.

3 The Emergence of Dorsal Stops in Huishu

3.1 Preliminaries

- (4) a. 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*.
- b. In pre-Huishu, all instances of PTk **-t* and **-k* became ***-ʔ*, as did **-p* after low vowels (**a* and **ə*).
- c. This left pre-Huishu with a two-way stop-coda contrast between ***-p* and ***-ʔ*.
- (5) a. Subsequently, dorsal stop codas emerged after high vowels in open syllables. Thus the pre-Huishu rhymes ***-i* and ***-u* (< PTk **-u*, **-i*) > /-ik/ [ic^h] and /-uk/ [uk^h].
- b. All instances of /k/ in modern Huishu reflect these emergent or epenthetic stops.
- c. 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.

3.2 The data

- (6) a. 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.

- b. The following table gives the Huishu data along with cognate forms from Standard Tangkhul and Kachai (another Tangkhul language) and reconstructed forms for PTk¹ and Proto-Tibeto-Burman (PTB; Benedict 1972; Matisoff 2003).

	PTB	PTk	Tangkhul	Kachai	Huishu
[1] ‘blood’	<i>*s-hywəy</i>	<i>*ʔa.fi</i>	<i>ʔà.fi</i>	<i>ʔā.sè</i>	<i>ʔā.sik</i>
[2] ‘blow’	—	<i>*kə.mə.ri</i>	<i>khə.mə.ri</i>	—	<i>kə.mə.lik</i>
[3] ‘comb’	<i>*si</i>	<i>*rik-si</i>	<i>rik-si</i>	<i>rək-sə</i>	<i>ʔə.róʔ-sik</i>
[4] ‘die’	<i>*səy</i>	<i>*kə.thi</i>	<i>kə.thi</i>	—	<i>kə.tik</i>
[5] ‘fear’	<i>*kri</i>	<i>*kə.ŋə.ci</i>	<i>khə.ŋə.ci</i>	<i>khə.ŋə.tsē</i>	<i>kə.tsik</i>
[6] ‘four’	<i>*b-ləy</i>	<i>*pə.li</i>	<i>mə.ti</i>	<i>pə.tsē</i>	<i>mə.kik</i>
[7] ‘horn’	—	<i>*ʔa.ŋə.ci</i>	<i>ʔà.ŋə.ci</i>	<i>ʔā.ŋə.tsē</i>	<i>ʔa.nə.tsik</i>
[8] ‘medicine’	<i>*r-tsəy</i>	<i>*ʔa.ri</i>	<i>ʔà.ri</i>	<i>ʔa.rē</i>	<i>ʔa.rik</i>
[9] ‘mother-in-law’	—	<i>*ʔa.ni</i>	<i>ʔa.ni</i>	<i>ʔa.nē</i>	<i>ʔa.nik</i>
[10] ‘one’	—	<i>*kə.si</i>	—	<i>kə.sē</i>	<i>kə.sik-à</i>
[11] ‘salt’	<i>*tsyi</i>	<i>*mə.ci</i>	<i>mə.ci</i>	<i>mə.tsē</i>	<i>ʔā.mə.tsik</i>
[12] ‘seven’	<i>*s-nis</i>	<i>*ci.ni</i>	<i>fi.ni</i>	<i>fi.nē</i>	<i>thi.nik</i>
[13] ‘two’	<i>*g-nis</i>	<i>*khə.ni</i>	<i>khə.ni</i>	<i>khə.nē</i>	<i>khə.nik</i>
[14] ‘bone’	<i>*g-rus</i>	<i>*ʔa.ru</i>	<i>ʔa.rú-kij</i>	<i>ʔā.rē</i>	<i>ʔa.rük</i>
[15] ‘breast’	<i>*nəw</i>	<i>*ʔa.nu</i>	<i>ʔà.nù</i>	<i>nə-tē</i>	<i>ʔā.nə.nùk</i>
[16] ‘carry (on shoulders)’	—	<i>*kə.ŋə.wu</i>	<i>khə.ŋə.vù</i>	<i>kə.hē</i>	<i>kə.nə.vúk</i>
[17] ‘grandchild’	—	<i>*ru</i>	<i>ʔà.rù</i>	<i>r-ðē</i>	<i>ʔā.rúk-rè</i>
[18] ‘insect’	—	<i>*ʔa.khu</i>	<i>ʔà.kù</i>	<i>ʔà.khè</i>	<i>ʔā.khúk-è</i>
[19] ‘tie’	—	<i>*kə.mə.su</i>	<i>khə.mə.sú</i>	<i>khə.mə.sī</i>	<i>kə.mə.súk</i>
[20] ‘dog’	<i>*k^wəy</i>	<i>*hwi</i>	<i>fu</i>	<i>ʔā.hwì</i>	<i>ʔā.huk</i>
[21] ‘egg’	<i>*har-rəy</i>	<i>*har-ri</i>	<i>hər-ru</i>	<i>hər-ðì</i>	<i>ʔā.hó-phə.rük</i>
[22] ‘laugh’	<i>*m-nwəy</i>	<i>*kə.mə.ni</i>	<i>khə.mə.nù</i>	<i>khə.mə.nì</i>	<i>kə.mə.nùk</i>
[23] ‘water’	<i>*rəy</i>	<i>*ri</i>	<i>té-ru</i>	<i>tūy-ðì</i>	<i>ʔā.rük</i>

3.3 Phonetic details

- (7) a. The above data gloss over some important phonetic facts about these non-etymological velar stops.
- b. **Place of Articulation** While all of these stops have been transcribed above as /k/, phonetically they differ according to the preceding vowel: /uk/ is realized

¹The reconstructions given here are identical to those in Mortensen (2003), with one difference: the rhyme previously reconstructed as **-ej* (the reflex of PTB **-əy*) is reconstructed here given the more plausible reconstruction **-i*.

with a velar stop, but /ik/ is realized with a palatal stop (not unlike the velar stops in English).

- c. **Manner** 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.

4 Parallel Developments

4.1 Lom (Belom)

- (8) a. 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)².
- b. In Lom, dorsal stops /-c/ and /-k/ have intruded after word-final Proto-Austronesian (PAN) high vowels:

	PAN	Lom
[24] 'fire'	* <i>Sapuy</i> (> <i>api</i>)	<i>apeic</i>
[25] 'day'	* <i>waRi</i>	<i>aric</i>
[26] 'liver'	* <i>atay</i> (> <i>ati</i>)	<i>atic</i>
[27] 'pig'	* <i>babuy</i> (> <i>babi</i>)	<i>babeic</i>
[28] 'flesh, meat'	* <i>isi</i>	<i>isic</i>
[29] 'rudder'	* <i>kama-udehi</i>	<i>kemudic</i>
[30] 'left (side)'	* <i>ka-wiRi</i> (> <i>kiri</i>)	<i>kiric</i>
[31] 'husband; male'	* <i>laki</i>	<i>lakeik</i>
[32] 'floor'	Malay <i>lantai</i>	<i>lantaic</i>
[33] 'to run'	* <i>laRiw</i>	<i>laric</i>
[34] 'to die'	* <i>maCay</i> (> <i>mati</i>)	<i>mateic</i>
[35] 'to buy'	* <i>beli</i>	<i>melic</i>
[36] 'rice plant'	* <i>pajay</i>	<i>padic</i>
[37] 'clothing'	Malay <i>pakai-an</i>	<i>pakaic</i>
[38] 'beach'	Malay <i>pantai</i>	<i>pantaic</i>
[39] 'excrement'	* <i>Caqi</i>	<i>taic</i>
[40] 'rope'	* <i>Calis</i>	<i>talic</i>
[41] 'ash'	* <i>qabu</i>	<i>abek</i>

	PAN	Lom
[42] 'rice pestle'	* <i>qaSelu</i>	<i>alek</i>
[43] 'ghost; demon'	* <i>qajiCu</i> (> <i>antu</i>)	<i>antek</i>
[44] 'yes'	* <i>au</i>	<i>aok</i>
[45] 'dog'	* <i>asu</i>	<i>asek</i>
[46] 'shirt'	Malay <i>baju</i>	<i>bajek</i>
[47] 'mangrove'	* <i>bakaw</i>	<i>bakek</i>
[48] 'stone'	* <i>batu</i>	<i>batek</i>
[49] 'tunnel trap'	* <i>bubu</i>	<i>bubek</i>
[50] 'body hair'	* <i>bulu</i>	<i>bulek</i>
[51] 'that'	* <i>i-Cu</i> (> <i>itu</i>)	<i>itek</i>
[52] 'if'	Malay <i>kalau</i>	<i>kalok</i>
[53] 'wood; tree'	* <i>kaSiw</i> (> <i>kayu</i>)	<i>kayek</i>
[54] 'honey'	Malay <i>madu</i>	<i>madek</i>
[55] 'put, place'	* <i>taRu</i>	<i>tarok</i>
[56] 'headwaters'	<i>qulu</i>	<i>ulek</i>
[57] 'shark'	* <i>qiSu</i> (> <i>iu</i>)	<i>yek</i>

4.2 Singhi

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

	PAN	Singhi
[58] 'white'	* <i>putiq</i>	<i>bi-putis</i> 'European'
[59] 'yam'	* <i>qubi</i>	<i>bis</i>
[60] 'iron'	* <i>besi</i>	<i>bosis</i> 'small axe'
[61] 'behind'	* <i>udehi</i>	<i>b-udis</i> 'helm'
[62] 'this'	* <i>iti</i>	<i>itis</i>
[63] 'we (excl.)'	* <i>kami</i>	<i>kais</i>
[64] 'dig'	* <i>kali</i>	<i>karis</i>
[65] 'buy'	* <i>bili</i>	<i>miris</i>
[66] 'demand (a debt)'	* <i>tagiq</i>	<i>nagis</i>
[67] 'forbidden (by custom)'	* <i>pa-liSi</i>	<i>paris</i>

²Thanks to Juliette Blevins for directing me to Blust (1994), where Lom and Singhi are discussed

	PAN	Singhi	
[68]	'choose'	* <i>piliq</i>	<i>piris</i>
[69]	'exceed'	* <i>Iebiq</i>	<i>rebis</i>
[70]	'spear'	* <i>suligi</i>	<i>sirugis</i>
[71]	'rope, string'	* <i>taliS</i>	<i>taris</i>
[72]	'ash, fireplace'	* <i>qabu</i>	<i>abux</i>
[73]	'rice pestle'	* <i>qaSelu</i>	<i>arux</i>
[74]	'great, large'	* <i>Raya</i>	<i>ayux</i>
[75]	'stone'	* <i>batu</i>	<i>batux</i>
[76]	'new'	* <i>baqeRu</i>	<i>baux</i>
[77]	'fathom'	* <i>depa</i>	<i>dopux</i>
[78]	'interior of a country'	* <i>daya</i>	<i>doyux</i>
[79]	'louse'	* <i>kuCu</i>	<i>gitux</i>
[80]	'tree, wood'	* <i>kaSiw</i>	<i>kyux, koyux</i>
[81]	'burn'	* <i>CuNu</i>	<i>ninux</i>
[82]	'fish with poison'	* <i>tuba</i>	<i>nobux</i>
[83]	'fern'	* <i>pakuh</i>	<i>pokux</i>
[84]	'firewood shelf'	* <i>paRa</i>	<i>poyux</i>
[85]	'five'	* <i>lima</i>	<i>rimux</i>
[86]	'sugarcane'	* <i>CebuS</i>	<i>tobux</i>

4.3 Maru (Langsu)

- (10) a. Maru (known in the Chinese literature as Langsu) is a Burmish language of Northern Burma (Kachin State) and Southern China (Yunnan Province).
- b. 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.
- c. This same argument was made earlier by Benedict (1948) and was hinted at somewhat earlier by Karlgren (1931:56ff).
- (11) a. Burling's /-t/ and /-k/ developed regularly after the reflexes of Proto-Tibeto-Burman (PTB) **-əy* and **-əw*, which appear to have become the high vowels ***-i* and ***-u* in pre-Marú.
- b. See the following comparisons between Maru, the closely related language Atsi (Burling 1966), Written Burmese (WB), and PTB (Matisoff 2003):

	PTB	WB	Atsi	Maru
[87]	'die'	* <i>səy</i>	<i>se</i>	<i>ši</i>

	PTB	WB	Atsi	Maru	
[88]	'leg/foot'	* <i>krəy</i>	<i>khre</i>	<i>khyt</i>	<i>khyt</i>
[89]	'water'	* <i>rəy</i>	<i>re</i>	—	<i>yit</i>
[90]	'parrot'	* <i>gyəy</i>	<i>kyé</i>	<i>ji</i>	<i>jit</i>
[91]	'dung'	* <i>kləy</i>	<i>khyé</i>	<i>khyl</i>	<i>khyit</i>
[92]	'horn'	* <i>krəw</i>	<i>khruí</i>	<i>khyúí</i>	<i>khyùk</i>
[93]	'mushroom'	PLB * <i>ʔ-məw^l</i>	<i>hmui</i>	<i>mâu</i>	<i>mùk</i>
[94]	'cry'	* <i>gəw</i>	<i>gui</i>	<i>gâu</i>	<i>gùk</i>
[95]	'sky'	* <i>məw</i>	<i>múi</i>	<i>mâu</i>	<i>mùk</i>
[96]	'bone'	* <i>rəw</i>	<i>rúi</i>	<i>vúi</i>	<i>yùk</i>
[97]	'smoke'	* <i>kəw</i>	<i>mí-khúi</i>	<i>khàu</i>	<i>khúk</i>
[98]	'steal'	* <i>r-kəw</i>	<i>khúi</i>	<i>kháu</i>	<i>khúk</i>
[99]	'grandfather'	* <i>pəw</i>	<i>ʔphúi</i>	<i>phàu</i>	<i>phúk</i>

- (12) a. 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 and Huang 1992).
- b. 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 as spoken in China but not those dialects spoken in Burma (where Burling did his field work on Maru).
- c. 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.

4.4 Momo and Fomopea

- (13) a. The Momo group of Grassfields Bantu languages display an innovation similar to the others discussed here (Stallcup 1978:124-132)³.
- b. Epenthetic /k/s appear after what must have been, historically, high vowels.
- c. The same development occurred (apparently independently) in Fomopea, a language from the core of the Bamileke group.
- d. Take the following examples from Proto-Grassfield Bantu (PGB) (Hyman 1979/1993), Fomopea⁴, and Moghamo (Stallcup 1978):

	PGB	Bafut	Fomopea	Moghamo
[100]	'head'	* <i>tú</i>	<i>átúk</i>	<i>á-tók</i>
[101]	'mouth'	* <i>cúl</i>	<i>ñcūk</i>	<i>í-cók</i>
[102]	'dog'	* <i>búá</i>	<i>mbúk</i>	<i>bók</i>

³Thanks to Larry Hyman for alerting me to the existence of this case and that of Fomopea.

⁴The 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.

	PGB	Bafut	Fomopea	Moghamo
[103]	‘fall’	*gɔ̃a	—	gòk
[104]	‘eat’	*lɔ̃a	—	jók
[105]	‘moon’	*mu-V	—	t-mók`
[106]	‘knife’	*bé	—	fí-bék
[107]	‘stone’	*tí`	—	aték`
[108]	‘tree’	*tí`	àtí	àtík

- (14) a. 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.
- b. However, there is external evidence, from languages like Bafut which reflect these vowels as /i/, /í/, 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).
- c. 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/⁵:

Pre-Momo > Pre-Momo' > Proto-Momo, Moghamo		
**-i	> **-ik	> -ek
**-i	> **-ik	> -ək
**-u	> **-uk	> -ok

4.5 Rhaeto-Romance

- (15) Possibly related may be the *Verschärfung* seen in the Surmeiran and Puter varieties of Rhaeto-Romance (Haiman 1988:352-353):

In syllables closed by /t/ ... inherited /i/ becomes [ik] or [ek], possibly via ?[ij]. Thus DORMIRE becomes [durmɛkr] ‘to sleep’. That this change is subphonemic is reflected in the fact that it is not indicated in the standard orthography of either dialect, and is apparently stigmatised by speakers as ‘uncouth’.

4.6 Synopsis

Huishu PTK *-i > Huishu /-ik/ [-ic^h]
 PTK *-u > /-uk/ [-uk^h]

⁵The intermediate step shown in the table as **Pre-Momo'** is possibly unnecessary for reasons discussed in Ohala (1993).

Lom PAN *-i > Lom /-ic/, /-iec/
 PAN *-u > Lom /-ek/, /-ok/

Singhi Pre-Singhi **-i > Singhi /-is/
 Pre-Singhi **-u > Singhi /-ux/

Maru PTB *-əy > Pre-Marú **-j > Maru /-it/ or /-ik/ (< /-ic/?)
 PTB *-əw > Pre-Marú **-u > Maru /-uk/

Momo Pre-Momo **-i > Mogham /-ek/
 Pre-Momo **-i > Mogham /-ək/
 Pre-Momo **-u > Mogham /-ok/

5 Competing Accounts

- (16) a. **Four desiderata:** There are four things that an account of dorsal stop epenthesis in Huishu and other languages should explain.
- (17) a. **Mechanism** The mechanism through which the change took place.
- b. **Environment** Why high vowels seem robustly to form the environment for this type of epenthesis.
- c. **Motivation** Why this sound change converts a “less marked” structure into a “more marked” structure.
- d. **Substance** Why the epenthetic obstruents have the place and manner features that they do.
- (18) **Five point bouns:** Explain the odd release of the Huishu dorsal stops.

5.1 Diphthogization plus glide fortition

- (19) a. 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 process⁶:
1. The vowels diphthongized.
 2. The off-glide was then fortified to become an obstruent.
- b. Blust notes that there are clear cases of glide fortition word-initially and word-medially in Austronesian languages (Blust 1994:112-113).
- c. This seems plausible 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/).

⁶It 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.

- d. But in Tangkhul family, there is no external evidence for diphthongization in the affected rhymes. Rather, evidence suggests that PTB diphthongs became PTK monophthongs in these words.
- e. There are plenty of diphthongs in PTK, and yet only the rhymes which we would otherwise reconstruct as high vowels are affected by the epenthesis.

5.2 Buccalization of glottal stop (“*nope*-epenthesis”)

- (20) a. Glottal stops sometimes occur at prosodic boundaries and in positions of prominence (see, for example, Dagbani as described in Hyman 1988).
- b. For this reason, En. *no!* is sometimes realized as [nɔʔ] or [nɔwʔ].
- c. Acoustically, this is similar to [nɔp], accounting for En. *nope* < [nɔʔ] < *no!*⁷
- d. Parallel development: Earlier En. *oh!* > En. [ɔw] ~ [ɔwʔ] ~ [ɔwp].
- e. This, we may call *nope*-epenthesis, after the best known example of it.
- (21) a. We might, likewise, posit that PTK **-u* and **-i* became /-uk/ and /-ik/ via *nope*-epenthesis.
- b. **-u* > ***-uʔ* > /-uk/
- c. **-i* > ***-iʔ* > /-ik/
- (22) a. **Problems:** This explanation is problematic for several reasons:
- b. Other cases of *nope*-epenthesis occur in interjections or other words that occur mostly in special prosodic environments (Hock 1991:124); in Huishu, the epenthesis is part of a regular sound change.
- c. *Nope*-epenthesis seems to occur only word-finally; in Huishu, stops are epenthesized both word-medially and word finally.
- d. *Nope*-epenthesis should not target one class of vowels preferentially; in Huishu and related cases, it is the high-vowels that form the environment for the epenthesis.
- e. An epenthesized glottal stop produced by this process would collide with other segments in the inventory:
- Case 1:** **-p, *-t, *-k* > ʔ preceded **ʔ* > *k* → there must have been distinct **ʔ* and **ʔ'*, which is possible, but one would have to have been a true glottal stop, and the other, creak. The modern reflex of the buccal stops is a true glottal stop, but creak is not a likely source for /k/.
- Case 2:** **ʔ* > *k* preceded **-p, *-t, *-k* > ʔ → there must have been distinct **k* and **k'*. This seems unlikely.

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

5.3 Constraint against open syllables

- (23) a. 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.
- b. This cannot be due to a general constraint against open syllables:
- Open syllables are almost universally assumed to be “less marked” than closed syllables.
 - Open syllables containing high vowels are targeted differentially by this type of epenthesis.
- c. Thus, the constraint would have to be against open syllables with high vowel nuclei.
- d. Under 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 the language).
- e. Furthermore, positing a universal constraint against syllable final high vowels seems to simply and arbitrarily restate part of the generalization without explaining the phenomenon.
- f. 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.

5.4 Maintenance of contrasts (push chain)

- (24) a. One might conceive of this type of epenthesis as part of a push chain.
- b. This account has the advantage of explaining the fact that it is high vowels (and perhaps other peripheral vowels) that are the targets of these epenthetic processes.
- c. Peripheral vowels are the most likely to be crowded uncomfortably by encroaching vowels because they have, as it were, no place to run.
- d. The distinctions made by such vowels can only be maintained, we might argue, by something drastic like epenthesis.
- e. We may also note, referring to the other languages in which the process has been observed, that it never seems to result in mergers⁸.
- (25) a. The impression that this was a kind of chain shift grows if we look at the changes that occurred the monophthongal rhymes between PTK and Huishu, schematized in Figure 2.

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

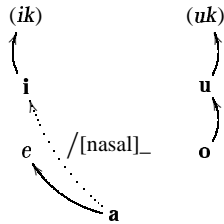


Figure 2: The development of Huishu monophthongs.

- b. Considering only this data, it might seem plausible that Huishu developed velar stops in order to keep the high-vowel rhymes from merging with reflexes of PTK **-a*, and **-o*, which were creeping up from below.
- (26) a. 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 3).

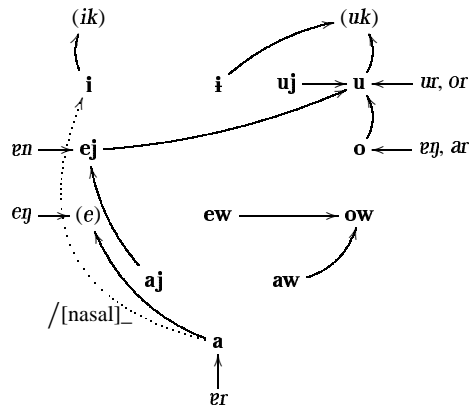


Figure 3: The development of Huishu monophthongal and diphthongal rhymes from PTK rhymes.

- b. In the motivation for the development of dorsal stop codas in Huishu was to preserve lexical contrasts, it is odd that so many mergers seemed to have occurred in the language at about the same.
- c. Huishu /u/ reflects no less than four PTK rhymes, including two very common diphthongs (PTK **-ej* and **-uj*).
- d. In light of this evidence, the push chain hypothesis seems contrived.

5.5 Maximal use of phonological space (drag chain)

- (27) a. But what if, instead of a push chain, the development of dorsal consonants was part of a drag chain?
- b. The **-t, *-k > /-ʔ/* sound change left a gap in the coda-inventory of Huishu.
- c. The epenthesis of dorsal codas helped fill this gap.
- d. Other rhymes then shifted to fill the place of the high-vowel rhymes.
- e. Still other rhymes shifted to fill these gaps, thus accounting for the apparent counter-feeding interactions between pre-Huishu sound changes.
- (28) a. **Problem:** If these sound changes were meant to give Huishu a more balanced inventory that makes better use of the available phonological space, they have failed bitterly.
- b. Huishu is left not only with a somewhat odd inventory of rhymes (see Table 28b) but with a situation where a disproportionately small number of words contain low vowels.

-a	(-e)	-e	-ej	-i	-o	-ow	-u
-am	-em	-em					
				-in			-un
-aj	-ej						-uj
		-er					
		-ep	-ep				
				-ik [-ic]			-uk
-aʔ	-eʔ	-ejʔ			-oʔ	(-ow)	-uʔ

Table 3: Huishu rhyme inventory.

- c. Huishu is an apparent counter-example to Kiparsky's (1995:663) claim that there do not seem to be any languages that display "across-the-board" raising of all vowels⁹.
- d. In fact, what seems to have happened is that a language with a rather symmetrical vowel and rhyme inventory (PTk) has suffered a dramatic reduction in this symmetry.
- e. 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.

⁹However, this is true only in open syllables. In closed syllables, the developments are not so clearly parallel.

5.6 Syllable isochrony

- (29) a. The insertion of dorsal stops after high vowels could be intended to bring about syllable isochrony (ensuring that all syllables are about the same length).
- b. High vowels are typically shorter than non-high vowels, so something extra would have to be added to syllables with high-vowel nuclei in order to bring them into sync with the rest of the system.
- c. Thus, enter the obstruents.
- (30) a. This would explain why the process targets high vowels as opposed to other vowels—it's about duration.
- b. This could also explain the aspiration of the dorsal stops (as opposed to /-p/, which only appears after mid-vowels)—the aspiration prolongs the syllable.
- (31) a. **Problems** still persist:
- b. This account **does not explain** why plosives are such a common outcome for this type of process (although their velarity could be explained by through the proposal of Carvalho 2004 that velars have the feature [high]) when [h] or the lengthening of the vowel would do the job just as well.
- c. Syllable isochrony **seems to overgenerate**. It would seem to also predict the possible deletion of coda sonorants after low vowels, but these were in fact retained.
- d. Further, this hypothesis seems helpless to explain the raising of *-o to /-u/ subsequent to dorsal stop epenthesis.

6 Proposal

- (32) a. **Principle** Language-change is the result of mistaken inferences.
- b. **Corollary** Sound-change is the result of misperception¹⁰.
- c. By *misperception*, I mean the state of affairs where the speaker attributes an incorrect intent to the speaker.
- (33) a. **Overview** High vowels are particularly susceptible to devoicing for aerodynamic reasons. A devoiced high vowel is phonetically a 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 parsed by perceivers as intentional fricatives or stops¹¹.

¹⁰For related views, see (Ohala 1993; Blevins to appear b; etc.)

¹¹The general outline of this proposal was inspired by a conversation with John Ohala, and some of the ideas (but none of the errors) present in it should be credited to him.

b. Normative path

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

6.1 High Vowel Devoicing (HVD)

- (34) a. HVD phenomena are widely known and fairly easy to explain from a phonetic standpoint.
- b. Since high vowels involve a relatively tight constriction (compared to other vowels) and are correlated with a small oral cavity, the supraglottal pressure is likely to be higher for high vowels than for non-high vowels.
- c. It follows that the pressure drop across the glottis should be relatively lower for these vowels than for other vowels.
- d. 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 high vowels than in low vowels.
- e. When devoiced, high vowels become weak dorsal (palatal to velar) fricatives.

6.2 Phonologizing the fricative

- (35) a. 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.
- b. A particularly well known example of this is Parisian French, where word-final high vowels devoice to become weak fricatives (Fónagy 1989:247)¹².
- (36) a. The fricative codas of Singhi represent a further development of the same type of pattern as is found in French.
- b. Speakers reinterpreted devoiced vowels as vowels followed by homorganic fricatives.
- c. 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.

¹²Other (non-high) vowels devoice in similar contexts, but with less frequency (Fagyal and Moisset 1999; Smith 2003).

6.3 (Mis)perceiving a stop

- (37) a. Explaining the emergence of stop codas from these fricative codas is somewhat more challenging.
- b. It is clear that the fricative was “fortified” to become a stop, but this is a label for the process, not an explanation.
- c. The clues for one explanation lie in the phonetics of Huishu (and help us answer the five-point bonus question):
- Generally, stop codas in Tangkhul and related languages are unreleased, and etymological stop codas in Huishu are no exception.
 - Huishu emergent dorsal stop codas have a strongly audible release—even aspiration.

<i>p</i>	<i>t</i>	<i>k</i>	?
<i>ph</i>	<i>th</i>	kh	
	<i>ts</i> [tʃ, ts]		
	<i>s</i> [ʃ, s]	(*ʧ)	(*x) <i>h</i>
<i>v</i>	<i>r</i>	<i>j</i>	
	<i>l</i>		
<i>m</i>	<i>n</i>	<i>ŋ</i>	

Table 4: Huishu onset inventory: what is the mystery segment?

- (38) a. Suppose a pre-Huishu speaker hears the 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.
- b. She mistakenly parses this friction as an attempt at another segment rather than as an aspect of the implementation of the vowel.
- c. What segment could it be?
- Velar fricative?** She does know about velar or palatal fricatives. They do not occur in the consonant inventory (see Table 4).
- Palatal fricative?** Same story.
- Some other fricative?** The fricative in the inventory ([ʃ] and [h]) do not have the right acoustic properties, and none of them occur in coda positions.
- Aspirated velar stop?** Yes! It has a noisy phase like the one she is hearing. Furthermore, it is a stop, and Huishu phonotactics do feature stops in coda position.
- d. So, she assumes that the noise in the vowel was a defective attempt to produce /k^h/, which she then “restores” in her own speech.
- e. Repeated enough times, this results in the observed sound change.

7 Discussion and Conclusions

- (39) a. The seeds of obstruent epenthesis after high vowels are aerodynamic and articulatory.
- b. These phonetic seeds take root and grow in the soil of language specific perception.
- (40) a. The emergence of dorsal obstruents after high vowels does not require a grammar-internal or otherwise teleological explanation:
- b. The fundamental facts of about this type of epenthetic segments fall out cleanly from a perceptual-articulatory model of sound change:

mechanism The change occurred because of a set of mistaken inferences. Aerodynamically and articulatorily induced variation was mistakenly attributed to speaker intent.

environment The process occurred in high vowels because they are more prone to devoicing than low vowels.

motivation The new form was on the winning side 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.

substance The articulatory properties of emergent obstruent proceed directly from the articulatory properties of the vowel its source.

7.1 Tying things together

- (41) a. 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—high vowels.
- b. The devoicing in extra-high vowels could be attributed to a preceding aspirated stop as well as to a trailing obstruent.
- c. Thus, this aspiration process can be seen as an assimilation to the same environment implicated in the epenthesis process.

7.2 Contributions

- (42) a. Identified an under-recognized cluster of empirical phenomena—the emergence of non-etymological dorsal obstruents after high vowels.
- b. Added to the repertoire of perceptual/articulatory accounts of sound change an (apparently novel) explanation of this class of developments.
- c. Argued that grammatical competence (specifically, phonotactic knowledge) plays a significant role in the (mis)perception of speech sounds but argued against teleological accounts of sound change.

References

- BENEDICT, PAUL K. 1948. "Archaic chinese *g and *d". *Harvard Journal of Asiatic Studies* 11:197–206.
- 1972. *Sino-Tibetan: A Conspectus*. London: Cambridge.
- BLEVINS, JULIETTE to appear a. "Consonant epenthesis: natural and unnatural histories". In Jeff Good (ed.), "Proceedings of the Workshop on Explaining Linguistic Universals", Oxford: Oxford University Press.
- to appear b. *Evolutionary Phonology: The Emergence of Sound Patterns*. Cambridge: Cambridge University Press.
- BLUST, ROBERT 1994. "Obstruent epenthesis and the unity of phonological features". *Lingua* 93:111–139.
- BURLING, ROBBINS 1966. "The addition of final stops in the history of Maru". *Language* 42(3):581–586.
- CARVALHO, JOAQUIM BRANDÃO DE 2004. "Représentations versus contraintes explicatives formelles et substantielles en phonologie". Ms. Université de Paris/CNRS.
- DAI QINGXIA AND HUANG BUFAN (eds.) 1992. *Zang-Mian yuzu yuyan cihui [A Tibeto-Burman Lexicon]*. Beijing: Central Institute of Minorities.
- FAGYAL, ZSUZSANNA AND CHRISTINE MOISSET 1999. "Sound change and articulatory release: where and why are high vowels devoiced in Parisian French?" In M. Ohala D. Glanville J. Ohala, Y. Hasegawa and A. Bailey (eds.), "Proceedings of the XIVth International Congress of Phonetics Sciences", Berkeley: University of California.
- FÓNAGY, IVAN 1989. "Le français change de visage?" *Revue Romane* 24:225–254.
- HAIMAN, JOHN 1988. "Rheto-Romance". In Martin Harris and Nigel Vincent (eds.), "The Romance Languages", chapter 10. New York: Oxford University Press, 351–390.
- HOCK, HANS HEINRICH 1991. *Principles of Historical Linguistics*. Berlin: Mouton de Gruyter, second edition.
- HYMAN, LARRY M. 1972. *A Phonological Study of Fe'fe'-Bamileke*. Ph.D. thesis, University of California, Los Angeles.
- 1979/1993. "Index of Proto-Grassfields Bantu roots". Unpublished index, UC Berkeley.
- 1988. "The phonology of final glottal stops". In "Proceedings of the Western Conference on Linguistics (WECOL) 1988", volume 1. Fresno: California State University.
- KARLGREN, BERNHARD 1931. "Tibetan and Chinese". *T'oung pao* 28:25–70.
- KIRPARSKY, PAUL 1995. "The phonological basis of sound change". In John H. Goldsmith (ed.), "The Handbook of Phonological Theory", chapter 21. Cambridge, MA: Blackwell, 640–670.
- MATISOFF, JAMES A. 2003. *Handbook of Proto-Tibeto-Burman: System and Philosophy of Sino-Tibetan Reconstruction*. Los Angeles and Berkeley: University of California Press.
- MORTENSEN, DAVID R. 2003. "Comparative Tangkhul". Ms. University of California, Berkeley. http://socrates.berkeley.edu/~dmort/comparative_tangkhul.pdf.
- OHALA, JOHN J. 1993. "The phonetics of sound change". In Charles Jones (ed.), "Historical Linguistics: Problems and Perspectives", London: Longman, 237–278.
- SMITH, CAROLINE L. 2003. "Vowel devoicing in contemporary French". *French Language Studies* 13:177–194.
- STALLCUP, KENNETH LYLE 1978. *A comparative perspective on the phonology and noun classification of three Cameroon Grassfields Bantu languages: Moghamo, Ngie, and Oshie*. Ph.D. thesis, Stanford.
- SUN HONGKAI ET AL. (ed.) 1991. *Zang-Mian-yu yuyin he cihui [Tibeto-Burman Phonology and Lexicon]*. Beijing: Chinese Social Sciences Press.