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The emergence of obstruents after high vowels*

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While a few cases of the emergence of obstruents after high vowels are found in the literature (Burling 1966, 1967, Blust 1994), no attempt has been made to comprehensively collect instances of this sound change or give them a unified explanation. This paper attempts to resolve this gap in the literature by introducing a post-vocalic obstruent emergence (POE) as a recurring sound change with a phonetic (aerodynamic) basis. Possible cases are identified in Tibeto-Burman, Austronesian, and Grassfields Bantu. Special attention is given to a novel case in the Tibeto-Burman language Huishu.

Keywords: epenthesis, sound change, aerodynamics, exemplar theory, Tibeto-Burman, Austronesian, Niger-Congo

1. Introduction

Vennemann (1988) and others have argued that sound changes which insert segments most commonly do so in a manner that 'improves' syllable structure: they provide syllables with onsets, allow consonants that would otherwise be codas to syllabify as onsets, relieve hiatus between vowels, and so on. On the other hand, the deletion of consonants seems to be particularly common in final position, a tendency that is reflected not only in the diachronic mechanisms outlined by Vennemann, but also reified in synchronic mechanisms like the Optimality

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Theoretic NoCoda constraint (Prince & Smolensky 1993). It may seem surprising, then, that a small but robust class of sound changes exists in which obstruents (usually stops, but sometimes fricatives) emerge after word-final vowels. For example, the Tibeto-Burman language Huishu has *ruk* "breast" from earlier *ru and *sik* "blood" from earlier *ʃi (Mortensen & Miller 2011).

Discussions of individual instances of this phenomenon have periodically appeared in the literature. The best-known case is from Maru (a Tibeto-Burman language closely related to Burmese) and was discovered by Karlgren (1931), Benedict (1948), and Burling (1966, 1967). Ubels (1975) independently noticed epenthetic stops in Grassfields Bantu languages and Stallcup (1978) discussed this development in another Grassfields Bantu language, Moghamo, drawing an explicit parallel to Maru. Blust (1994) presented the most comprehensive treatment of these sound changes to date (in the context of making an argument about the unity of vowel and consonant features). To the Maru case, he added two additional instances from the Austronesian family: Lom (Belom) and Singhi. He also presented two historical scenarios through which these changes could occur: diphthongization and 'direct hardening' of the terminus of the vowel.

This study seeks to provide both a broader and deeper empirical base from which this phenomenon can be understood, building on Blust's analysis, and demonstrating that the documented cases of post-vocalic obstruent emergence (POE) represent a unified phenomenon with a shared phonetic motivation. The analysis is presented in terms of Evolutionary Phonology (Blevins & Garrett 1998, Blevins 2004, 2006), an approach that privileges diachronic explanations of sound patterns over synchronic explanations and seeks extralinguistic — physical, perceptual, and cognitive — motivations for historical changes. Specifically, I argue that these emergent final obstruents, in each known case, originate in the context of high vowels and that high vowels engender this type of change because of their aerodynamic properties. Since high vowels and their homorganic glides entail a constriction of the vocal tract — resulting in a relatively high oral air pressure and a relatively small difference in the supraglottal and subglottal pressures — there is variable devoicing of the terminus or terminal off-glides of high vowels. The resulting whisper or 'glottal catch' is reanalyzed by learners as an obstruent coda. The differences in phonetic properties of the resulting obstruents (stop versus fricative, dorsal versus coronal) may be partially explicable in terms of learning biases imposed by the preexisting phonotactic patterns of the affected languages.

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2. Introduction to the principal cases

2.1 Tibeto-Burman: Maru

The first case of post-vocalic obstruent emergence to gain significant attention was in Maru, a Tibeto-Burman language of the Burmish group within Lolo-Burmese, spoken in Northern Burma and Southern China. In Maru, the rhymes corresponding to Inscriptional Burmese *-iy* and *-uw* have become *-it* and *-uk* respectively. Thus Maru's closest relative, Atsi, has *khyí* for "foot" but Maru has *khyìt*. That Maru had developed secondary stops after some vowels was probably first reported by Karlgren (1931), who mentions it only as a side-note. Likewise, Benedict (1948), who may have discovered this development independently, mentions it only as a parallel example to explain the apparent existence of Old Chinese obstruent codas in reflexes of Proto-Sino-Tibetan open syllables. It was only with Burling's (1966, 1967) rediscovery of the non-etymological stops in Maru that a rigorous attempt was made to show that they were a secondary development rather than a conservative feature of the language. Burling showed that a simpler reconstruction of the tonal system of Proto-Lolo-Burmese, with no tonal contrast in stopped syllables, was possible if and only if some Maru final stops (those without parallels in the other Lolo-Burmese languages) were a relatively recent development. Burling's argument was initially met with a mixture of hostility (Miller 1970), cautious skepticism (Matisoff 1968), and approval (Lyovin 1968). However, the accumulated body of evidence has led most working Tibeto-Burmanists, even some who were initially skeptical, to accept his thesis (Bradley 1979, Matisoff 2003). The change is remarkably regular and a perusal of Dai et al. (1992) yields over 80 forms exemplifying it (see Table 6 below).

2.2 Tibeto-Burman: Huishu

There is a similar case of POE found in the Tangkhulic subgroup of Tibeto-Burman. Huishu, spoken in northern Manipur State, India, has -/ik/ and -/uk/ where Proto-Tangkhulic has *-i and *-u/*-ɨ (Mortensen & Miller 2011). In Huishu, POE occurred after an earlier sequence of changes in which stop codas in three places of articulation (*-p, *-t, *-k) inherited from Proto-Tangkhul merged as glottal stop except after (Huishu) mid vowels so that Proto-Tangkhul *-cɐp > H *-tsaʔ* "weep", Proto-Tangkhul *-thɐt > H *-thejʔ* "kill", and Proto-Tangkhul *-khɐk > H *-khoʔ* "breath", but Proto-Tangkhul *-kup > H *-kɐp "finish". After mid vowels, *-p was preserved but *-t and *-k became -/ʔ/. Data supporting these reconstructions and posited changes are given in Table 1.

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Table 1. The reflexes of Proto-Tangkhul (PT) coda stops in Huishu with supporting data from Ukhrul, Kachai, and Tusom.

PT	Huishu	Ukhrul	Kachai	Tusom	
*jip	*kʰə-jep*	–	*kʰə-jip*	–	"sleep"
*kup	*kə-kɐp*	*kə-kup*	*kə-kup*	–	"finish"
*tep	*kə-tɐp*	–	–	*kə-ta*	"slow"
*kʰop	*kə-kʰɐp*	*kə-kʰop*	*kə-kʰip*	–	"sew"
*cap	*kə-tsaʔ*	*kə-cɐp*	*kə-cap*	*kə-tso*	"cry/weep"
*ʃap	*ʃe-kə-saʔ*	*kə-ʃɐp*	*kə-ʃap*	*sɯ-li-kə-so*	"have ability"
*nap	*kʰə-naʔ*	*kʰə-nɐp*	*kə-nap*	*kʰa-n-na*	"stick (v.)"
*hrit	*kʰə-rejʔ*	*kʰə-rit*	*kʰə-rɐt*	*kə-hrɯ*	"heavy"
*kʰut	*ʔa-mu-kʰuʔ*	*mej-kʰut*	*mə-kʰut*	*ma-kfɯ*	"smoke"
*mot	*ʔa-moʔ-tʰu*	*mot-tʰej*	–	*ʔə-me-tχa*	"banana"
*pet	*kə-nə-vejʔ*	*kʰə-ŋə-pet*	*kʰə-ŋə-pot*	*ta-pʰe-pʰe*	"soft (to touch)"
*tsɐt	*kə-tsejʔ*	*kə-tsat*	–	*kə-ze*	"walk"
*wɐt	*kʰə-vejʔ*	*kʰə-vat*	*kʰə-wat*	–	"burst"
*ʃɐt	*tə-tsejʔ*	*ci-ʃat*	*ci-ʃit*	*si-he*	"eight"
*tat	*kə-kə-kejʔ*	*kʰə-kə-tɐt*	*kə-kə-tɐt*	*ʔə-mieʔ-kʰa-kə-de*	"cut"
*tʰat	*ja-kə-tʰejʔ*	*sa-kə-tʰɐt*	*su-kə-tʰɐt*	*ta-kə-tʰe*	"kill"
*hrik	*ʔa-roʔ*	*rik*	*ʔa-rɐk*	*ʔɯ-kuə-hruə*	"louse"
*mik	*ʔa-moʔ*	*ʔa-mik*	*ʔa-mɐk*	*ʔɯ-mɯ*	"eye"
*rik	–	*rik-kʰa*	*tʰaw-lɐk*	–	"armpit"
*tsik	*kə-tsoʔ*	*kə-tsik*	*kʰə-ðɐk*	*kə-zɯ*	"black"
*kʰuk	*ʔa-mu-kʰuʔ*	*ʔa-kʰuk*	*pʰi-kʰuk*	*kxu-tsɯ*	"knee"
*ruk	*sə-ruʔ*	*tʰə-ruk*	*ʃə-ruk*	*t-ru-he*	"six"
*tʰuk	*kə-tuʔ*	*kə-tʰuk*	*kə-tʰuk*	*kə-tʰu*	"deep"
*buk	*ʔa-wuʔ*	*a-vuk*	*wuk*	*ʔɯ-pu*	"belly/stomach"
*lek	*kə-mə-leʔ*	*kʰə-mə-lek*	*kʰə-mə-lek*	*kʰə-mə-lɯə*	"lick"
*tek	*kə-mə-keʔ*	*kʰə-mə-tek*	*kʰə-mə-tek*	*kʰa-n-tɯə*	"green"
*ʃok	*ʔu-kə-suʔ*	*kə-ʃok*	–	*kə-su*	"emerge"
*tlok	*ʔa-kow-nə-luʔ*	*ʔa-ŋə-tok*	–	*ʔu-kuə-du*	"brain"
*ʃɐk	*kə-soʔ*	*kə-sɐk*	–	–	"difficult/hard"
*maak	*ʔu-maʔ*	*ʔi-mak*	*ʔa-mok-u*	*kʰə-mɯə*	"brother-in-law"
*jak	*kə-kʰə-joʔ*	*kə-kʰə-jɐk*	*kə-kʰə-jak*	*kʰa-kə-sχa*	"ashamed"
*kʰak	*ʔa-kʰoʔ*	*ʔa-kʰɐk*	*ʔa-kʰak*	*ʔə-kʰa*	"breath"
*dak	*kʰə-roʔ*	*kʰə-rɐk*	*kʰə-ðak*	*psɯ-kə-to*	"weave"

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This left Huishu with a contrast in stop codas between *-p and *-ʔ, where *-p had a very limited distribution. In fact, *-p seems only to have contrasted with *-ʔ after *e, since there is no evidence for *-ɐp or *-op sequences in modern Huishu (Table 2). I posit that POE occurred at this point. Proto-Tangkhul *-i, *-u, and *-ɨ became Huishu /ik/, /uk/, and /uk/, respectively. This led to the rhyme inventory in Table 2.

Table 2. Huishu rhyme inventory. Rhymes with non-etymological stops are indicated by a box.

-i	-u	-e	-o	-ɐ	-a
		-ep		ɐp	
-ik	-uk				
	-uʔ	-eʔ	-oʔ		-aʔ
		-em		-ɐm	-am
-in	-un			-ɐn	
	-uŋ			-ɐŋ	
		-ew	-ow		
		-ej			

As a result, Huishu /ik/ corresponds to Ukhrul /i/ and Huishu /uk/ corresponds to Ukhrul /u/, as in Table 3. Ukhrul and Huishu share the merger of *u and *ɨ, which is not shared by Kachai and Tusom. In Kachai, *i and *u have generally become /ɐ/ (except after labiodentals) and *ɨ has become /i/. In Tusom, the two high peripheral monophthongs have become the high vowel /ɯ/, which is realized as a syllabic fricative in certain environments ([v̩] after labials, [z̩] after coronal fricatives and affricates) and a very high, back vowel elsewhere. The vowel *ɨ is reflected as [y].

Table 3. Examples of non-etymological stops in Huishu and comparisons with Proto-Tibeto-Burman (Matisoff 2003), Proto-Tankhul (Mortensen & Miller 2011) and three Tangkhulic languages, Ukhrul, Kachai, and Tusom (Mortensen & Miller 2011).

PTB	PT	Huishu	Ukhrul	Kachai	Tusom	
*kri	*ci	*kə-tsik*	*kʰə-ŋə-ci*	*kʰə-ŋə-tsɐ*	*kə-tsɯ*	"fear"
	*ci	*ʔa-nə-tsik*	*ʔa-ŋə-ci*	*ʔa-ŋə-tsɐ*	*ʔə-n-tsɯ*	"horn"
	*ci	*ʔa-mə-tsik*	*mə-ci*	*mə-tsɐ*	*mə-tsɯ*	"salt"
	*li	*kʰə-li*	*kʰə-li*	*kʰə-lɐ*	–	"steal"
	*mi	*kʰə-me*	*kʰə-mi*	*kʰə-mɐ*	–	"give"
	*ni	*ʔa-nik*	*a-ni*	*ʔa-nɐ*	*ʔa-nɯ*	"mother-in-law"
*s-nis	*ni	*tʰi-nik*	*ʃi-ni*	*ʃi-nɐ*	*sɯ-na-he*	"seven"

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Table 3. (*continued*)

PTB	PT	Huishu	Ukhrul	Kachai	Tusom	
*g-nis	*ni	*kʰə-nik*	*kʰə-ni*	*kʰə-nɐ*	*kʰa-na*	"two"
	*ri	*kə-mə-lik*	*kʰə-mə-ri*	–	–	"blow"
*r-tsəy	*ri	*ʔa-rik*	*ʔa-ri*	*ʔa-rɐ*	–	"medicine"
*si	*si	*ʔa-roʔ-sik*	*rik-si*	*rɐk-sɐ*	*n-tsɯ*	"comb"
	*si	*kə-sik-a*	–	*kə-sɐ*	–	"one"
*b-ləy	*ti	*mə-kik*	*mə-ti*	*pə-tsɐ*	*mə-lɯ-a*	"four"
	*tsi	*tsa-nə-tsik-kʰe*	*kʰə-ŋə-tsi*	–	–	"tight"
*səy	*tʰi	*kə-tik*	*kə-tʰi*	*kə-sɐ*	*kə-tsɯ*	"die"
	*tʰi	*kə-tik*	–	–	*kə-tsɯ*	"numb"
*s-hywəy	*ʃi	*ʔa-sik*	*ʔa-ʃi*	*ʔa-sɐ*	*ən-sɯ*	"blood"
	*bu	*ʔa-vuk*	*ʔa-wo*	*hi-vu*	*ʔə-pvɯ*	"grandfather"
	*du	*ʔa-ruk-re*	*i-ru*	*i-ðɐ*	*ko-tsy-nɯ*	"grandchild"
	*du	*mə-ruk-kʰe*	*kʰə-ru*	–	–	"chop"
	*kʰu	*ʔa-kʰuk-ke*	*ʔa-ku*	*ʔa-kʰɐ*	–	"insect"
*nəw	*nu	*ʔa-nə-nuk*	*a-nu*	*nɐ-tɐ*	–	"breast"
	*pu	*mə-huk*	*mɐ-fu*	*ma-fu*	–	"elephant"
*g-rus	*ru	*ʔa-ruk*	*ʔa-ru-kuj*	*ʔa-rɐ*	*ʔɯ-rɯ-kuə*	"bone"
	*su	*kə-mə-suk*	*kʰə-mə-su*	*kʰə-mə-si*	*kʰa-n-sɯ*	"tie"
	*su	*kə-nə-suk*	*kʰə-ŋə-su*	–	–	"wash"
	*tsu	*se-tsuk-kʰe*	*sa-kə-tsu*	–	–	"touch"
	*wu	*kə-nə-vuk*	*kə-ŋə-vu*	*kə-hɐ*	–	"carry"
	*ʃu	*ʔa-mə-tsuk*	*na-ʃu*	–	*nõ-sɯ-le*	"dove"
*har-rəy	*dɨ	*ʔa-ho-pʰə-ruk*	*hɐr-ru*	*har-ði*	*uə-tsy*	"egg"
*rəy	*dɨ	*ʔa-ruk*	*tɐ-ru*	*tuŋ-ði*	*n-tsy*	"water"
*kʷəy	*hwɨ	*ʔa-huk*	*fu*	*ʔa-hwi*	*y*	"dog"
*m-nwəy	*nɨ	*kə-mə-nuk*	*kʰə-mə-nu*	*kʰə-mə-ni*	*kʰa-n-ny*	"laugh/mock"

The merger of *ɨ and *u in Huishu and Ukhrul may be a shared innovation. That Huishu and Ukhrul might form a subgroup is suggested by other parallel innovations including the sound change *d > /r/, merging *d with *r. Examples are given in Table 4.

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Table 4. Reflexes of Proto-Tangkhulic *d.

PT	Ukrul	Huishu	Kachai	Tusom	
*dɨ	*hɐr-ru*	*ʔa-ho-pʰə-ruk*	*har-ði*	*uə-tsy*	"egg"
*dɨ	*tɐ-ru*	*ʔa-ruk*	*tuŋ-ði*	*n-tsy*	"water"
*dak	*kʰə-rɐk*	*kʰə-roʔ*	*kʰə-ðak*	*psɯ-kə-to*	"weave"
*da	*kə-kʰə-ra*	*kə-kə-re*	*kə-kʰə-ðu*	*kʃie kʰ-kə-ti*	"sharpen"
*du	*i-ru*	*ʔa-ruk-re*	*i-ðɐ*	–	"grandchild"

While both of these sound changes are relatively common and therefore cannot establish subgroup relationships beyond a reasonable doubt, taken together they are consistent with a scenario in which Huishu and Ukhrul are descended from a common ancestor in which *u-*ɨ merger had already occurred (along with *d-*r merger) and that non-etymological /k/ in Huishu developed afterward.

There are non-trivial phonetic differences between the secondary coda (/k/) and the primary coda (/p/). Coda /p/ is typically unreleased; /k/ always has a loud fricated release, often with detectable formants. Example spectrograms showing this difference are given in Figure 1.

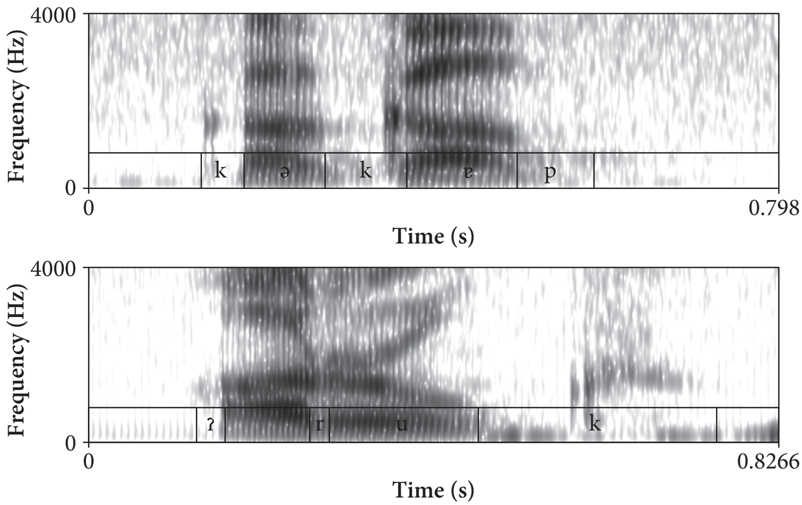

Figure 1. Spectrograms of Huishu *kəkɐp* "finish" (above) and *ʔaruk* "bone" (below). The release burst in *ʔaruk* can be seen in the second half of the region labeled /k/.

On the one hand, it is not surprising that /k/ should have a stronger release burst than /p/. However, the release burst is dramatically longer, louder, and more fricative-like than the releases for /k/ in other languages in the area. It might be more closely transcribed as [kx], or [kx ~ cç] following /i/. This phonetic property by

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itself suggests that there is something unusual about these stops. Later, I will argue that this release is a vestige of the original phonetic nature of these segments.

Although cognate obstruent codas do not appear in any of the closely related languages, some Huishu lexical items with emergent *-k* have Maru cognates with emergent stop codas. In light of the scholarly consensus on Maru emergent stops, this is best seen as the result of parallel developments in different branches of Tibeto-Burman. Both Benedict (1972) and Matisoff (2003) reconstruct the primary rhymes reflected by Maru -/it/ and -/uk/ and Huishu -/ik/ and -/uk/ as *-əy and *-əw respectively. If these stops are treated as etymological, as Wolfenden (1939) and Miller (1970) proposed for Maru, and cognate in Maru and Huishu, they would have to be reconstructed for Proto-Tibeto-Burman. Doing so has several disadvantages: Burling's relatively simple and elegant reconstruction of the Proto-Lolo-Burmese tonal system, and its intellectual descendants, would have to be rejected in favor of something much less principled — for example, an additional obstruent coda would have to be posited for Proto-Tibeto-Burman, one that was very common in the proto-language but so prone to deletion it disappeared in all daughter languages but two. More troubling, since *-əy and *-əw function as the primary high vowels in open syllables in the Benedict/Matisoff reconstruction (the open syllable counterparts to *iː and *uː), asserting that they were actually vowel-obstruent sequences would imply that only a few Proto-Tibeto-Burman roots could be reconstructed having open syllables with high vowels. This strange skewing of distributions would call for explanation. Once the prejudice against what Miller called 'Burling's theory of spontaneous generation of final stops' is relaxed, and it is allowed that stops can emerge after final vowels, a far more economical solution to these problems is available.

2.3 Grassfields Bantu

A development especially reminiscent of the Huishu case is known from certain Grassfields Bantu languages of Cameroon. Stallcup (1978) noted that there were non-etymological -/k/ codas in certain Momo languages such as Moghamo, and noted the parallel between this innovation and the emergence of final stops in Maru. Moghamo -/ek/, -/ək/, and -/ok/ correspond to word final -/i/, and -/ɨ/, and -/u/ in the closely related language Meta. Thus, for Meta *ə̀-tű* "head" and *fí-bí* "knife", Moghamo has *-tók*̀ and *fí-bék*̀. Stallcup's analysis concentrates on Batibo Moghamo, but he notes that non-etymological velar stops are also present in other Momo languages including Oshie and Ngie (they are also present in the Bamileke language Fomopea; see Ubels 1975). Although they are synchronically word-final, Stallcup argues that the stops developed from intervocalic glides. Nonetheless, he entertains an alternative hypothesis that they developed after word-final high

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vowels, following Burling's 1966 proposal for Maru. When a broader range of data, including the independent cases of emergent obstruents in Bamileke languages are examined, the value of this second hypothesis becomes evident (see §3.1.3).

2.4 Austronesian

There are related cases in at least two Austronesian languages: Lom (Belom), a 'Middle Malay' dialect of Bangka island, east of Sumatra, and Singhi, a 'Land Dayak' language of Borneo (Blust 1994). The Lom case is very similar to the cases enumerated so far: word-finally, PAN *-i becomes Lom *-ic* and PAN *-u becomes *-ek*. Thus, PAN *isi "flesh" and *asu "dog" become *isic* and *asek* respectively. The Singhi development differs from other cases in that the new segment is a fricative rather than a stop. PAN *-i and *-u become Singhi *-is* and *-ux*. Thus, *iti "this" and *batu "stone" become *itis* and *batux*.

2.5 North Germanic

The Singhi case bears a more than passing resemblance to the 'occlusivization' seen in certain Scandinavian dialects. For example, in certain Danish dialects of Jutland, high vowels are produced with a devoiced or fricative off-glide (Andersen 1972: 26–27). Thus, *bi* "bee" is pronounced as [bii̥] in some varieties and as [biç], [bik^j] or [bic] in others. The Danish case differs from Maru, Huishu, and so on in that emergent obstruents are not confined to open syllables (e.g. *lun* [luxn] "warm"). The development of these 'parasitic' obstruents is apparently conditioned historically by *stød* (Ejskjær 2005: 1725, 2006), a laryngeal prosody often characterized by creaky phonation. The fact that they are conditioned by a suprasegmental prosody rather than a position in prosodic structure may account for some of their divergent properties.

POE has been documented in at least three major language families, with cases distributed from the Indonesian Archipelago to central Africa. Each case represents a robust, regular sound change with similar inputs and a similar output. Evolutionary Phonology (Blevins 2004), following a long tradition, holds that recurrent sound changes are likely to be 'natural' — driven by physical and psychophysical constraints. I will argue below that POE is a 'natural' change in the sense that it has a clear, unified, extralinguistic motivation, but 'unnatural' in that it is only likely if a particular combination of phonetic and structural conditions are met. This accounts for the relative similarity of the observed patterns but the relative rarity of the phenomenon as a whole.

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3. High vowels as a context for POE

The following section will argue that high vowels are a recurrent conditioning environment for POE and that this relationship follows from aerodynamic properties of high vowels that are also active in so-called high vowel devoicing (HVD). First, an examination of each major case shows that the vowel-obstruent sequences seen in HVD almost always reflect high vowels. Then, I will show that high vowels serve as the context for a related phonetic phenomenon that causes the final portions of high vowels to be realized as devoiced or fricative off-glides.

3.1 Case studies

3.1.1 *Huishu*

Of the cases of POE listed above (excluding Danish, where the history is well documented), Huishu is the one in which high vowels are most obviously the source of the emergent obstruents. This is true for the following reasons:

1. The vowels can probably be reconstructed as phonetically high even for Proto-Tibeto-Burman.
2. They can more clearly be reconstructed as high vowels at the Proto-Tangkhulic level.
3. The vowel nuclei remain high in the VC sequences resulting from POE.

In Table 3, Huishu etyma with emergent final stops are compared with reconstructions of Proto-Tibeto-Burman (Matisoff 2003) and Proto-Tangkhulic (Mortensen & Miller 2011) and three other Tangkhulic languages: Ukhrul, a phonologically conservative language which may be closely related to Huishu, and Kachai and East Tusom, languages whose relationship to Huishu is probably more remote.

The rhymes reconstructed as *-i, *-ɨ, and *-u primarily reflect the Proto-Tibeto-Burman rhymes reconstructed by Matisoff as *-əy, *-əy (after labialized onsets and *r-), and *-əw. These two rhymes are reflected as *-i* and *-u* in most branches of Tibeto-Burman. Matisoff (2003: 160) notes that they should not be interpreted as literal phonetic reconstructions. He also considers an alternative reconstruction in which *-əy and *-əw are reconstructed long high *-iː and *-uː rather than as diphthongs. He rejects this hypothesis on the grounds that (i) reconstructing these rhymes with diphthongs may provide a better match with Old Chinese and (ii) this would give Proto-Tibeto-Burman vowel-length contrasts in open syllables, which would be unusual for a Tibeto-Burman language. These reconstructions, then, are structural rather than phonetic in their motivation, and the merger of *-əy and *-əw with *-is and *-us in Tibeto-Burman languages that lose *-s (like the Tangkhulic languages) suggests that *-əy and *-əw were phonetically close to high

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vowels. The segments that gave rise to Huishu -/uk/ and -/ik/ were probably phonetic high vowels from the Proto-Tibeto-Burman stage up until POE took place.

If the Huishu forms in final -*k* are compared with geographically (and presumably genetically) close Tibeto-Burman languages outside of the Tangkhulic family (Table 5), a clear pattern emerges. In the first set, from PTB *-əy/-i/-is, cognates most commonly have a high front vowel in an open syllable. There are exceptions to both parts of this generalization: high front vowels occur in all of the branches exemplified in Table 5 — Angami-Pochuri, Zeme, Old Kuki, Kuki-Chin — but not all of the languages in those branches. Note that, PTB *-s is reflected in Mizo (and many other Kuki-Chin languages) as a final glottal stop. These glottal stops are not related to the secondary stops seen in Huishu. In the second sets, from PTB *-us/*-əw, cognates typically have a high back vowel. In the third set, from PTB *-əy after labiovelarized segments and *r-, the more conservative languages, Mizo and Khoirao, have a /ui/ diphthong. The more innovative languages, Zeme and Sorbung, have a high monophthong (just as I propose Proto-Tangkhulic did).

Table 5. Correspondences with Huishu emergent stops in Simi/Sema (Angami-Pochuri), Khoirao (Zeme), Sorbung (Old Kuki), and Mizo (Kuki-Chin). Simi, Khoirao, and Mizo data are from Marrison (1967); Sorbung data are from Mortensen & Keogh (2011).

PTB	Simi	Khoirao	Sorbung	Mizo	Huishu	
*s-hywəy	a-ji	a-ji	t^{h}ìi	t^{h}i	ʔa-sik	"blood"
*səy	a-ki-t^{h}i	si	t^{h}ìi	t^{h}i	kə-tik	"die"
*kri	–	–	ʔən-cíi	ʈi	kə-tsik	"fear"
*b-ləy	–	ma-hli	mə-líi	pa-li	mə-kik	"four"
–	a-ki-bo	ti	ʔə-kìi	ki	ʔa-nə-tsik	"horn"
–	ni	–	ʔa-nìi	ni	ʔa-nik	"mother-in-law"
*tsyi	a-mi-ti	n-ci	mə-cìi	tsi	ʔə-mə-tsik	"salt"
*s-nis	tsi-ni	si-ni	sə-ríi	pa-sa-riʔ	thi-nik	"seven"
*g-rus	ghü	ta-ru	ʔə-rúu	ruʔ	ʔa-ruk	"bone"
*nəw	ni	–	–	hnu-te	ʔa-nə-nuk	"breast"
–					kə-nə-vuk	"carry"
–	–	–	–	tu	ʔa-ruk-re	"grandchild"
–	a-ku-hu	–	ʔa-kuu	–	ʔa-k^{h}uk-e	"insect"
–	–	–	–	suiʔ	kə-mə-suk	"tie"
*k^{w}əy	a-tsü	t^{h}i	ʔʉʉ	ui	ʔa-huk	"dog"
*har-rəy	–	–	-cʉʉ	tui	-ruk	"egg"
*m-nwəy	nu	nui	mə-nʉʉ	nui	kə-mə-nuk	"laugh"
*rəy	a-zü	dui	cʉ́ʉ	tui	ʔa-ruk	"water"

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In light of these data, I propose three sources for emergent stops in Huishu: a high front vowel, a high back vowel, and a high diphthong (approximately *ui). The diphthong became Proto-Tangkhulic *ɨ and subsequently merged with the high back vowel in Huishu and Ukhrul. After this merger, POE occurred: **i and **u became Huishu /ik/ and /uk/.

3.1.2 *Maru*

Because Maru emergent obstruents have the same source in Proto-Tibeto-Burman as those in Huishu, some of the same arguments for the thesis that these stops develop from high vowels hold. Consider Table 6, showing two dialects of Maru. Maru_1 forms are taken from Burling (1966); Maru_2 forms, representing a dialect spoken in China, are from Dai et al. (1992) and Sun (1991). The table also gives cognates from Maru's closest relative (Atsi), Written Burmese, and Proto-Tibeto-Burman. Note that Maru_1 and Maru_2 are substantially identical except that -/it/ has become -/ik/ in Maru_2 (regardless of whether the /t/ resulted from POE).

Table 6. Correspondences of Proto-Tibeto-Burman (PTB), Written Burmese (WB), and Zaiwa (Atsi) with Maru emergent stops.

PTB	WB	Atsi (Zaiwa)	Maru_1	Maru_2	
*səy	se	šì	šìt	sìk	"die"
*krəy	khre	khyí	khyìt	khyìk	"leg/foot"
*rəy	re	–	ɣìt	ɣə̀k	"water"
*gyəy	kyê	jì	jìt	–	"parrot"
*kləy	khyê	khyì	khyít	khyík	"dung"
*krəw	khrui	khyúi	khyùk	khyùk	"horn"
*ŋəw	ŋui	ŋâu	ŋùk	ŋùk	"cry"
*məw	mûi	màu	mùk	mùk	"sky"
*g-rus	rûi	vùi	ɣùk	ɣùk	"bone"
*kəw	-khûi	-khàu	-khúk	-khúk	"smoke"
*r-kəw	khûi	kháu	khúk	khúk	"steal"
*pəw	ʔəphûi	phàu	phúk	àphúk	"grandfather"

As in Huishu, all the emergent stops in Maru are preceded by high vowels. However, some concern might be raised by the cognates in WB and Zaiwa, where Maru_1 -/it/ corresponds to WB -/e/ and Maru_1 -/uk/ corresponds to Zaiwa -/au/. There are reasons to believe that these are secondary developments. WB -/e/ corresponds to -/iy/ in its forerunner, Inscriptional Burmese; likewise, WB -/ui/ corresponds to Inscriptional Burmese -/uw/. Since certain other Burmish languages

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close to Maru, like Hpun (Henderson 1986), reflect PTB *-əy and *-əw as -/i/ and -/u/ (as in Hpun *xʀí* "gall" from PTB *krəy and *-nù* "bone" from PTB *nəw), there seems little reason to doubt that the early Maru reflexes were high vowels, possibly with significant diphthongization (and perhaps not unlike those implied by the orthography of Inscriptional Burmese).

3.1.3 *Grassfields Bantu: Moghamo and Fomopea Bamileke*

It appears that POE has occurred at least twice independently in Grassfields Bantu. As in Tibeto-Burman, languages with non-etymological stops form islands in a sea of languages that lack them. Of these islands, the one with the most resemblance to POE in Maru and Huishu is Fomopea Bamileke, as illustrated in Table 7:

Table 7. Comparison of forms from Proto-Grassfields Bantu (PGB) and three Bamileke languages: Fomopea (Larry Hyman, unpublished field notes), Baloum (Ubels 1975), and Fongo (Ubels 1975). PGB *E represents a vowel that is indeterminate between *e and *i.

Gloss	PGB	Fomopea	Baloum	Fongo
"head"	*tú ̀	ə-tuk	t^{h}ʊ	tfu
"tree"	*tí ́	ə-tɪk	t^{h}ə	t$^{\text{ɦ}}$ɨ
"be extinguished"	*bÉt	pɛ	pi^{x}	psai
"rot"	*bè	p^{h}iɛ	a-pi^{x}	m-bi

Where Proto-Grassfields Bantu has high vowels and Fongo has the vowels /u/ and /ɨ/, Fomopea has developed sequences of high vowels and /k/. Independently, Baloum seems to have undergone a POE-like phenomenon in another set of etyma. From Ubels 1975, it appears that /i/ can be phonetically implemented with a fricative off-glide, as [i^{x}]. In both these cases, the preponderance of evidence suggests that a high vowel is the immediate source of the emergent segments and offglides.

The non-etymological obstruents in the Momo group are better documented, but more complicated. The most persuasive case is Moghamo, though there are also instances in Ngie (see Table 8):

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Table 8. Proto-Grassfields Bantu reflexes in three Momo languages: Ngie (Gregg 2002), Meta (Lem & Brye 2008) and Moghamo (Stallcup 1978).[1]

PGB	Meta	Ngie	Moghamo	Gloss
*tú `	ə̋tú	ɑtəu	-tók `	"head"
*cùl `	ɨ̋tʃû	utʃəu	-côk	"mouth"
*bṵ́à	bú	ibəu	bók `	"dog"
*gṵ̀a	–	igəu	-gok	"fall"
–	ə̋wū	–	awok	"leg"
–	ə̀bù-ê	ɑbəu	bók `	"nine"
*lḭ́a	dʒɨ(g)	idʒək	-jə́k	"eat"
*mṵ-Vl	ɨ̋zɨmɨ́	umək	í-mə̀k	"moon"
*mì(l)	e̋mî	ɑmec	ímék `	"neck"
*L(u)ḭ́ `	i̋dʒwí	idʒutʃi	jwék `	"nose"
*ti ″	–	–	ték	"stone"
*bé	fɨ́bí	ubec	fí-bék `	"knife"

Some Moghamo non-etymological obstruents occur where a PGB high or mid vowel is reconstructed ("head", "mouth", "moon", "neck", "neck", "stone", "knife"). Others occur with a sequence of a high and non-high vowel ("dog", "fall", "eat"). The analysis can be simplified if it is assumed that, prior to POE, the ancestor of Moghmo and Ngie was like Meta in that sequences of high and non-high vowels had been simplified to high vowels alone. This would have been followed by diphthongization — still evident in the Ngie reflexes of PGB *u — and then POE. Schematically, this can be represented as follows:

Table 9. Hypothetical development of Momo stops from high vowels.

PGB		Hiatus Resolution		Diphthongization		Ngie	Moghamo
*u	>	/u/	>	[uw]	>	/əu/	/ok/
*ua	>	/u/	>	[uw]	>	/əu/	/ok/
*i	>	/i/	>	[ij]	>	/ec/	/ek/
*ia	>	/ɨ/	>	[ɨɰ]	>	/ək/	/ək/

1. The nature of the final consonant transcribed as "c" in the Ngie data is uncertain, and appears as both "j" and "dʒ" (and possibly "f") in the list provided by Gregg (2002), probably as a result of inconsistencies in the retranscription of the data from its original source (a word list attributed to Jean-Marie Hombert). Based on the available evidence, it seems most likely that the segment in question was a palatal stop or affricate.

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This hypothesis has the advantage of uniting this development with the instances of POE seen so far and seems to be consistent with the data. However, unlike Maru emergent stops, for which an origin after stem-final high vowels is now generally accepted, there is a serious competing hypothesis regarding the origin of non-etymological -/k/ in Momo languages. Stallcup (1978) proposed to explain the existence of these segments through an account that can be outlined in three parts:

1. All of the non-etymological instances of -/k/ in Momo languages reflect a single historical change predating Proto-Momo. The differences in the distribution of -/k/ among Momo languages result from deletion rather than independent innovation of -/k/ in different languages. The same seems to apply to the Bamileke languages. These losses took the form of areal sound changes radiating from the southern extent of the range of the Widikum-Tadkon subgroup of Momo (to which Moghamo belongs) and consist of the most widespread change in which -/k/ was deleted after front vowels, a more restricted change in which -/k/ was deleted after back vowels, and the most restricted change in which -/k/ is deleted after mid vowels. These stops survive in relic areas.
2. Non-etymological -/k/ developed when epenthetic intervocalic glides were reinterpreted by speakers as underlying stops. With the loss of the final vowels, intervocalic spirantization rules no longer applied to them, and the segments consequently surfaced as -/k/.
3. The vowel sequences into which the glides were epenthesized were of two types: clusters which can be reconstructed at a Proto-Bantu (and therefore Proto-Grassfields Bantu and Proto-Momo) level ("dog", "fall", "eat", etc.), and vowel clusters that resulted from the breaking of monophthongs ("knife", "stone", "head", etc.). This secondary breaking is not unprecedented, since similar developments do occur in Momo languages like Ngie and Oshie; however, Stallcup posits it in these cases just to explain the existence of emergent segments.

It is not possible here to refute Stallcup's hypothesis outright, but a few critical observations make it considerably weaker than the hypothesis advanced here (POE after high vowels).

1. Stallcup's hypothesis requires three different /k/ deletion rules spreading among already differentiated languages (indeed, different branches of Grassfields Bantu). POE after high vowels requires only a few, somewhat parallel, local innovations.
2. Stallcup's hypothesis requires positing unmotivated vowel breaking just to account for non-etymological stops.
3. Stallcup's hypothesis does not capture the relationship between high vowel contexts apparent in the data, most explicitly in Fomopea Bamilike.

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In other words, while Stallcup's hypothesis is not implausible on its face, it has disadvantages compared with the 'high vowel' hypothesis advanced here (and also considered by Stallcup).

3.1.4 *Lom (Belom)*

So far, we have seen possible parallel developments of emergent obstruents in Tibeto-Burman and Grassfields Bantu. It should not be surprising, then, that POE should have occurred independently, in substantially identical environments, in another language family. Of the two or more cases of POE in Austronesian, the one that most resembles POE in Huishu, Maru, and Moghamo is found in the Middle Malay language Lom (Belom). As show in Table 10, Lom emergent stops appear in reflexes of Proto-Austronesian (PAN) *-i and *-u:

Table 10. Postvocalic obstruent emergence in Lom (Blust 1994).

PAN	Lom	
*awRi	aric	"day"
*isi	isic	"flesh, meat"
*laki	lakeik	"husband, male"
*beli	melic	"to buy"
*Caqi	taic	"excrement"
*qabu	abek	"ash"
*au	aok	"yes"
*asu	asek	"dog"
*batu	batek	"stone"
*bubu	bubek	"tunnel trap"
*bulu	bulek	"body hair"
*taRu	tarok	"put, place"
*qulu	ulek	"headwaters"

Smedal (1987), from whom Blust gleaned these Lom data, noted that his "e" was sometimes backed before -/k/. Furthermore, Blust notes that Smedal sometimes transcribes the reflex of PAN *-u as -/ok/ (as in "yes", "put, place"). This suggests that Smedal's /ek/ may have been something like [ək]. Suggesting that the change of *u to /e/ before /k/ is somewhat puzzling (in part, because /u/ is unaffected elsewhere), Blust argues for an intermediate state of diphthongization such that, e.g. *qabu > *abəw > /abek/. This explanation, in its essence, is consistent with the argument presented here regarding high vowels — they are prone to two types of diphthongization, one of declining sonority and one of declining phonation.

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Nearey & Assman (1986) have shown that 'tense' vowels, even when they would be transcribed and analyzed phonologically as monophthongs, often include as part of their basic phonetic makeup, significant decreases in F1 across the duration of the vowel. That is, they may be phonetic diphthongs with a nucleus that is somewhat lower than the off-glide. The increasing constriction of the oral cavity over the duration of the vowel would also compound the difficulty of maintaining voicing (cf. §3.2) contributing to the emergence of an obstruent coda. As with Moghamo above, it is possible that the change in vowel quality of the nucleus is not the result of a radical diphthongization prior to epenthesis, but a reorganization of perceptual cues into phonological structures concomitant with the emergence of final obstruents.

3.1.5 *Singhi*

While the result of POE in the Land Dayak language Singhi is somewhat different from the results in the cases described so far — it yields fricative rather than stop codas — there can be no question but that high vowels serve as the source of Singhi emergent obstruents. The evidence for this is given in Table 11 below, comparing PAN forms to their Singhi reflexes:

Table 11. Postvocalic obstruent emergence in Singhi (Blust 1994).

PAN	Singhi	
*qubi	bis	"yam"
*besi	bosis "small axe"	"iron"
*iti	itis	"this"
*kali	karis	"dig"
*bili	miris	"buy"
*suligi	sirugis	"spear"
*qabu	abux	"ash, fireplace"
*batu	batux	"stone"
*baqeRu	baux	"new"
*kuCu	gitux	"louse"
*CuNu	ninux	"burn"
*CebuS	tobux	"sugarcane"

The same high vowels, *-i* and *-u*, are present in the PAN reconstructions and their Singhi reflexes. Both parsimony and congruence with the cases discussed so far lead to the conclusion that high vowels served as the environment from which obstruents emerged in Singhi. However, there are some reasons to believe that

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the chain of events that led to this development may have differed from that in the cases examined above. In Singhi, unlike the other languages examined, there are instances of non-contrastive and non-etymological -[h] after certain non-high vowels. Blevins (2008: 92–93) argues for a two-step process in which [h] emerges word finally and is 'buccalized' to become an oral fricative just in case it is coarticulated with a preceding high vowel. This is plausible, since the tighter constrictions of high vowels would result, aerodynamically, in greater turbulence, more aperiodic noise, and — subsequently — a percept more similar to that of an oral fricative than the looser constrictions of other vowels. Blevins's account, similar in spirit but differing in details from the general account offered below, has the advantage of accounting for the final laryngeals that appear after non-high vowels and the emergent fricatives in a unified and elegant fashion. Nevertheless, the fact that a general process of final laryngeal epenthesis is not attested in the other languages suggests that high vowels do more in POE than provide a turbulent context for coarticulation.

In light of these considerations, Singhi should be perhaps regarded as displaying a development that is like, but possibly not identical to, other cases discussed in this paper. However, it is possible that the genesis of the final laryngeals in Singhi is similar to those in the Hpun case discussed below in that they occurred more frequently with high than non-high vowels. If so, the distance between Singhi and other cases of POE would be narrowed considerably.

3.1.6 *Other possible cases in Austronesian*

Blust (1994: 124–125) notes at least two other possible cases of obstruent epenthesis in Austronesian that would fit the definition of POE as given here. Both seem to involve high vowels.

1. In reviewing Haudricourt (1971), Blust (1978) notes that /c/ and /k/ seem to appear after PAN *i and *u (respectively) in certain languages of New Caledonia, a generalization apparently missed (or at least, not explicitly stated) by Haudricourt. Grace (1972) also noted apparently non-etymological instances of -/c/ and -/k/ in certain New Caledonian languages, suggesting that they were suffixes, but providing no argument for this proposal.
2. For various subdialects of Trengau Malay, Collins (1983) gives the reflexes of PAN *i and *u as /əyk/ and /əwk/. Blust expresses skepticism about the implicit claim that the epenthetic consonants have the same place of articulation after both front and back nuclei. However, Collins's transcription, if accurate, would provide an additional parallel to the development reported for Huishu, Moghamo, and Fomopea.

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Both developments, to the extent that they can be confirmed, fit the pattern that has been observed in POE cases so far. Most significantly, they show a close association between close vowels and emergent obstruents.

3.2 High vowels and vowel devoicing

In each of the robust cases of POE examined in this paper, the non-etymological obstruents appear to have emerged after high vowels. This is significant because it allows us to present a plausible phonetic explanation for the development of these segments. High vowels share a number of unique properties, the most obvious of which is the proximity of the tongue dorsum to the roof of the mouth. This could, for example, result in accidental (near-)collisions between these two articulators, which, if it happened frequently enough, could be interpreted by listeners as an intended obstruent coda. It is also commonly held that high vowels are the least sonorous vowels and therefore the vowels phonologically closest to consonants (Hankamer & Aissen 1974). One might propose that high vowels, among all vowels, give rise to consonants because they need to change the least in order to do so. However, there is a more plausible explanatory mechanism that derives this relationship from the aerodynamic properties of high vowels, rather than from an abstract phonological parameter like sonority or a simple invocation of similarity.

Various languages are reported to have voiceless or devoiced vowels. While these have been claimed to be contrastive in a few cases, most are the result of phonological or phonetic processes. In cross-linguistic surveys, both Greenberg (1969) and Jaeger (1978) found that high vowels are more likely to be devoiced than non-high vowels. In many cases, high vowels are the only target of vowel devoicing; if non-high vowels may be devoiced, then high vowels also tend to be subject to devoicing. Jaeger attributed this to aerodynamic factors: high vowels are aerodynamically less conducive to voicing than other vowels. Later investigators like Beckman (1996) argue that high-vowel devoicing (HVD) in languages like Japanese (where devoicing occurs in the context of voiceless obstruents) is likely due to articulatory factors instead of aerodynamic constraints: high vowels are shorter than non-high vowels, and the gestural overlap from the neighboring consonants therefore occupies a larger share of the vowel's duration. These effects are most pronounced when a vowel is in a prosodically weak position and has a reduced duration and amplitude. However, subsequent investigators (Fagyal & Moisset 1999, Smith 2003) have noted that, in languages like French, (high) vowel devoicing actually occurs in prosodically prominent contexts (phrase final, utterance final) positions where vowels are lengthened rather than reduced. I will argue that the second type of HVD is most relevant to the phenomenon discussed in this paper. In the following section, I will summarize Smith's argument for

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distinguishing between these two types of vowel devoicing, introduce an additional case of the second type of vowel devoicing from the Lolo-Burmese language Hpun, and identify some of the properties of this type of HVD that make it a likely precursor for POE.

3.2.1 *High vowel devoicing in prosodically weak positions*

In many languages, including Japanese (Vance 1987), Korean (Jun & Beckman 1993, 1994), Modern Greek (Dauer 1980), Lezgi (Chitoran & Iskarous 2008), and Turkish (Jannedy 1995), high vowels are devoiced when they occur in unstressed syllables. In most of these languages, the same vowels that can be devoiced can be optionally deleted instead (Smith 2003). These devoicing effects are sensitive to speech rate such that there is more devoicing in fast speech than in careful speech. They are also sensitive to the consonantal context in which a vowel occurs. Vowels are most likely to be devoiced when they are flanked by voiceless obstruent consonants.

Beckman (1996) has argued that high vowel devoicing, at least in these cases, can be best explained as the result of an overlap between the glottal gestures for neighboring voiceless consonants and the supraglottal gestures for the vowel. This model accounts well for the recurrent properties in this kind of vowel devoicing: high vowels are devoiced because they have a relatively short duration, meaning that the gestural overlap can be very brief and still result in the devoicing of much of the vowel. The effect of reduction can be understood in the same way. Vowels that are in prosodically weak positions, and are therefore shortened, will be more vulnerable to devoicing than those in strong positions. Finally, the qualitative properties of surrounding consonants determine the type of glottal gesture that overlaps with the vowel, and thus should be a strong determinant of HVD. This type of high vowel devoicing shares few properties with POE, as exemplified in the case studies above. However, this appears not to be the only type of high vowel devoicing.

3.2.2 *(High) vowel devoicing in prosodically strong positions: French*

Fagyal & Moisset (1999) and Smith (2003) have shown that vowel devoicing in French does not have the same properties as investigators have found for HVD in Japanese, etc. Parisian French displays optional devoicing of both high and non-high vowels, with high vowel devoicing being the most frequent (Smith 2003). The best known example of HVD in French (cited by Fónagy 1989, Fagyal & Moisset 1999, and Smith 2003) is the Parisian pronunciation of *oui* "yes" as [wi̥] or even [wiç], where the onset of the syllable is voiced but the terminus is voiceless and sometimes accompanied by aperiodic noise (Fagyal & Moisset 1999). The phonetic studies by Fagyal & Moisset and Smith show that (i) vowel devoicing in French

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is largely confined to a prosodically prominent position, phrase-final open syllables; (ii) vowel devoicing in French is correlated with lengthening, not reduction, of syllable duration; (iii) there are higher rates of vowel devoicing in careful speech (e.g. read text) than in casual speech (after-dinner conversation); and (iv) devoiced vowels in French are usually only partially devoiced, with full voicing at the beginning of the vowel (where any overlap with consonant gestures would occur). Characteristics such as these led Smith (2003) to suggest that the phonetic mechanism behind French (H)VD is different than that motivating Japanese HVD.

Fagyal & Moisset recorded ten speakers of Parisian French reading a text and engaging in a conversation over dinner and analyzed the distribution of voiced and devoiced tokens of [i], [y], [u], [e], and [œ]. They found that the devoiced tokens were almost exclusively in intonational phrase-final (IP-final) positions. Smith's study, in which six subjects were recorded reading test sentences designed to elicit /i/, /u/, and /a/ in a variety of prosodic contexts, showed similar results. This is significant because Parisian French is also known to show significant lengthening of phrase-final syllables (Benguerel 1971, Lacheret-Dujour & Beaugendre 1999: 41, 244). Fagyal & Moisset also noted much higher rates of IP-final devoicing in read texts (83–11%) than in casual conversation (1.3–6.1%). In other words, French (H)VD is not associated with the typical correlates of vowel reduction.

It is significant for the current study that Smith, as well as Fagyal & Moisset, found that French vowels are almost never fully devoiced. As Fónagy (1989) had noted earlier, the devoicing process essentially split the vowel into a voiced and a voiceless (sometimes fricated) portion. I argue that this type of phonetic 'diphthongization' serves as the phonetic seed from which POE develops.

If, as Smith suggests, a mechanism that accounts well for HVD in Japanese will not make the right predictions for (H)VD in French, what drives (H)VD in French? Smith surveys a variety of options, not all of them mutually exclusive. She notes that there are two prerequisites to phonation: (i) the vocal folds must be properly adjusted and (ii) there must be a sufficient difference in air pressure between the subglottal and supraglottal cavities. Since voicing ceases partway through the production of the vowel, something in the vocal tract must change between the onset of the vowel and the cessation of voicing such that one of these criteria is no longer met.

This explanation is substantially that offered by Fagyal & Moisset: devoicing is due to a narrowing of the oral constriction. This leads to an accumulation of pressure in the supraglottal cavity so that Smith's first requirement (referred to by Ohala 1997 as the 'Aerodynamic Voicing Constraint' or AVC) is no longer satisfied. Smith notes, however, that this explanation is not completely adequate since it accounts only for high-vowel devoicing and Parisian French low vowels may be

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devoiced as well. Based on Loevenbruck's (1999) observation in French of 'hyper-articulation' in prosodically prominent positions, Smith suggests that, under Fagyal & Moisset's model, /a/ should actually be less likely to devoice in phrase-final position than elsewhere (since it should be even more open than elsewhere). However, she does not address the possibility of a tighter pharyngeal constriction, accompanying a hyper-articulated low back vowel, having a similar effect as a dorsal constriction. Smith also considers the possibility that devoicing is caused by a decrease in subglottal pressure, since such declines in pulmonic activity across utterances have been observed. However, she notes that this mechanism is inadequate, by itself, to account for the observed pattern (i.e. only the last portion of the last segment of an utterance is devoiced). Finally, she suggests that the cessation of voicing could occur because the first requirement is no longer met: the vocal folds relax phrase finally in anticipation of their return to rest position.

Smith's conclusion is that vowel devoicing in French is probably the result of a combination of these conditions. The fact that high vowels devoice at a significantly greater rate is due to the fact that more factors affect high vowels than other vowels. The Aerodynamic Voicing Constraint mechanism applies only to vowels or other segments with a tight enough constriction that a significant amount of air pressure can accumulate behind it during the articulation of the segment. This would include high vowels, and possibly vowels accompanied by a tight pharyngeal constriction (e.g. low back vowels), but not others. This effect would interact in an additive sense with both a decline in subglottal pressure and the abduction of the vocal folds. In other words, the mechanism leading to vowel devoicing in Parisian French probably includes both articulatory and aerodynamic factors, but it is primarily the aerodynamic factors that favor the devoicing of high vowels over non-high vowels.

3.2.3 *The case of Hpun*

A particularly instructive case of vowel-height conditioning laryngeal phenomena is from Hpun (Hpon), a Burmish language of Burma. It is significant not only because it is closely related to one of the languages that has undergone POE (Maru) but because the particular pattern of laryngeal effect found in Hpun elucidates how POE might take place.

Hpun is now highly endangered, but two dialects were studied by G. H. Luce in the mid-twentieth century: the Metjo dialect and a northern dialect. Some of the data from the Metjo dialect were published in Luce (1985). The wordlist from the northern dialect was published later by Henderson (1986), with considerable editing. However, she did not attempt to reconcile the numerous variants recorded by Luce, and presented them more or less as she found them, which is crucial for our purposes.

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Luce noted that some vowels were terminated by a laryngeal gesture other than modal phonation. In some cases, this sounded to Luce like an [h]; in others, as he described it, the vowel was followed by an abrupt 'glottal catch' (though usually not a full glottal stop). Importantly, these sounds do not correspond to final consonants in other Burmish languages. Final stop codas in other Burmish languages correspond to true glottal stops in Hpun and were generally distinguished from them by Luce. Neither Luce nor Henderson claimed to know whether this phenomenon was structurally significant. Henderson suggested that it was a prepausal effect (it is largely but not exclusively word-final) and likened it to a similar phenomenon in a dialect of Karen. For convenience, I will refer to these whispered or laryngealized vowel termini as 'laryngeally-defective off-glides'. These are probably identical in their origin to the epenthetic laryngeals (-[h] and -[ʔ]) that have been documented in numerous branches of Austronesian, including languages closely related to Lom and Singhi (Blevins 2008: 89).

The distribution of laryngeally-defective off-glides differs somewhat between the two dialects. In the northern dialect, they occur after a wide range of vowels, but are most common after the high vowels and [a]. Within the wordlist, there are 541 instances of vowels in open syllables or syllables that would be open if not for the emergent codas. Of these 541, 113 are followed by emergent codas and 428 are not. 189 of the vowels are high vowels and 352 are non-high. However, of the syllables with emergent codas, 62 are high (compared to 51 non-high). This distribution is highly unlikely to be due to chance ($\chi^2 = 23.87$, df = 1, $p < 0.0001$). As in the case of French vowel devoicing, vowel height is not an absolute determinant of 'laryngealization'. This is clearly right for the northern dialect, and was almost certainly right at the genesis of this phenomenon. Most of the defective off-glides occur word finally. Since Luce was eliciting individual words, it is likely that most word-final vowels are also phrase final and utterance final. However, Luce recorded instances where his glottal catches occur within compounds (e.g. *ih*^{1}*sa*^{4} "brother") suggesting that these emergent segments have come to behave as part of the realization of phonemes or morphemes, rather than being only a secondary effect of phrasal prosody and phonetic constraints. I suggest that these laryngeally-defective off-glides are similar in their ontogeny to the devoiced termini of Parisian French vowels. On the one hand, factors like decreasing subglottal pressure and anticipatory relaxation of the laryngeal articulators lead to periodic failures in voicing during the final vowel of an IP. On the other, the aerodynamic properties of high vowels contribute additional difficulty to voicing. Both causes may lead to a relatively sudden cessation of voicing during the articulation of the vowel, which may be heard as either an [h], if the vocal folds are slightly abducted, or a 'glottal catch', if, while the vocal folds are adducted, normal phonation stops due to an insufficient pressure differential across the vocal folds.

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3.2.4 *High vowel devoicing and its effects in Scandinavian dialects*

Various dialects of Swedish display devoicing phenomenon similar to those described for Jutland Danish above. In dialects like Central Standard Swedish, long high vowels in syllables closed by stops have developed a very close off-glide which may be pronounced as aspiration, a voiced fricative, voiceless fricative, or even a voiceless affricate. Thus *bit* "a bit, a bite" may be pronounced as [bit], [biht], or [biçt], and *gud* "god" may be realized as [kʉβd], [kʉɸd], or even [kʉpɸt] (Helgason 2002: 88). This super-high off-glide is not restricted to closed syllables. So, *bi* "honey bee" is realized as *bij̊*.

The Danish cases discussed by Andersen (1972) and mentioned above take this development one step further. The word *bi* "honey bee" has become [bii̥] in some dialects, [biç] in others, and [bic] in yet others. Andersen suggests that these form a progression, which he describes in terms of changes in the distinctive features of the second part of the vowel: first, in the feature [vocalic], then in the feature [consonantal], and finally in the feature [continuant]. Whether one accepts or rejects Andersen's analysis of the change in terms of distinctive features as an explanation for this innovation in Jutland Danish dialects, the progression he outlines provides a clear trajectory by which high vowel devoicing could lead to POE.

To set the series of events into motion, a language must have high vowels that are produced with considerable dorsal constriction and enough tension in the walls of the vocal tract to prevent passive expansion of the oral cavity. Devoicing of these vowels is most likely if, as in Central Standard Swedish, the vowels are produced with closing off-glides. Since a constricted oral tract is hostile to voicing, terminal devoicing of high vowels will occur at a greater frequency than devoicing of other vowels, yielding the kind of pre-pausal variation seen in Parisian French. As suggested by the Hpun cases, this devoicing may be manifest as either a devoiced vowel or glide — a weak fricative — with the vocal folds abducted, or as an abrupt interruption in voicing (with the vocal folds adducted). At the same time, the devoicing may spread through the lexicon by a kind of analogical leveling to instances of morphemes and phonemes that are not phrase final, as illustrated in Metjo Hpun. The weak fricatives may be subsequently strengthened by listeners who assume that the weak articulation is accidental. This would yield Andersen's [biç] (< [bii̥]). A subsequent reanalysis of this fricative off-glide, or a direct reanalysis of devoicing failures, would lead to Andersen's [bic]. As argued below in §4, the final obstruent that ultimately emerges is probably the result of an interaction of psychoacoustic and language-internal factors. However, the phenomenon itself is a unified one and the differences in cases are matters only of detail.

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4. Self-organization and POE

Thus far, it has been established that POE occurs, where it occurs, and an argument as been presented as to why it occurs. The next section endeavors to explain how it occurs and to use this explanation to account for certain properties of POE: variation in the obstruents produced and interaction with chain shifts and dispersion effects.

4.1 An Exemplar Model of POE

The following section attempts to provide a model of how POE occurs within an exemplar theory of learning. While POE can also be understood in traditional phonologization and others models, exemplar-based models allow us to state explicitly how POE happens from the standpoint of a rational learner. In this model, emergent obstruents develop when frequent-enough final devoicing and favorable systemic factors lead leaners to parse what had been one segment as two.

Redundancy appears to affect the acquisition of phonology by learners. A substantial body of recent phonetic literature suggests that stored phonetic representations are rich — containing both redundant details and details specific to particular lexical items and even specific utterances of a lexical item (Tenpenny 1995, Goldinger 1996, 2000, Johnson 1997, Pierrehumbert 2001). This allows talkers to use multiple cues for identifying a particular lexical or phonological item. This also means that the language learner has access to a wide range of phonetic variants from which to construct phonological representations. If such models are correct, listeners would not necessarily know which of the variant properties they perceive and store are intentional and which are the accidental result of physical or psychophysical constraints, nor would they need to know in order to achieve communicative competence. A speaker of pre-Huishu would grant equal status to the variants [ru], [ruh], [rux], and [ruʔ] of historical /ru/ "bone", but would be sensitive to their frequency.

I assume that speech episodes are organized into categories at multiple levels — both stored instances of lexical items and stored instances of utterances which are associated by a system of cross-classifying relations (Pierrehumbert 2001, 2003, Wedel 2003). This implies that higher-level units like words are related to lower level units by symbolic, rather than purely stochastic, relations, e.g. the percept [rùk] might be analyzed as including instances of /r/, /u/, /k/, and /ˋ/ (low tone). This parsing should not be seen as a linear, chronological 'slicing up' of the acoustic signal — this would be especially problematic in the case of suprasegmentals — but as the as-exhaustive-as-possible assignment of perceptual cues to segmental categories. Pierrehumbert (2003) argues persuasively that

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segmental categories originally form around 'phonetic modes' — local concentrations of phonetic properties — which can be observed independently of lexical distinctions. Older learners, however, start making use of generalizations over the lexicon in constructing segmental categories. Segmentation, she points out, can be particularly experience-dependent, with different learners arriving with different segmentations for the same lexical items. In such a model, the relation between levels is dynamic and, as the set of stored episodes changes (through the introduction of utterances and the decay of old utterances) the analysis of a lexical item into segments may also change. This is the crucial point for POE.

While POE looks somewhat unusual, it represents a phonetically-based sound change like many others. Articulatorily and aerodynamically induced errors contribute to the field of exemplars from which a learner can draw. In some of these, voicing stops while the oral articulators are still producing a vowel, resulting in an abrupt cessation of airflow, a continuation of airflow through open vocal folds, or even a weak fricative (if the oral constriction is close enough). Because aerodynamic factors particularly disfavor voicing during high vowels and close glides, high vowels are particularly likely to be affected. The effect would be especially strong if the articulators move closer together during the production of the vowel (due to diphthongization). Learners are then left with at least two ways the domain final instances of /u/ can be analyzed into categories: as a unit /u/ with the variants [u], [uw], [uw̥], [ux], and [uˀ], or as a sequence of a back vowel /u/ followed by a consonant (the source of the laryngeal disruption). The change occurs when it becomes more informative for learners to analyze lexical items containing final high vowels as sequences of a vowel and consonant rather than unit vowels with aberrant offglides. Assigning laryngeally-defective off-glides to following obstruent consonants in POE languages allows for the reduction of variance with the high vowel categories. Once the defective off-glide is factored out as an independent segment, the difference between former high vowels in word-final open syllables and high vowels elsewhere is greatly reduced. The difference between these vowels and mid vowels in open syllables may also be reduced, allowing for a model with both fewer and more homogenous categories.

POE, in its full-blown form, results when learners are drawn in by the economy of such a model and its sublexical implications influence the production of lexical items. Over time, the lexical instances of laryngeally defective off-glides that have been assigned to an existing obstruent category, and the instances of historical obstruents that already composed the category, converge in production. As detailed in §4.2, the identity of this consonant is probably influenced by the existing inventory of consonant codas for which the learner would already have a collection of exemplars. However, the fact that representations are phonetically rich means that emergent segments from POE could preserve phonetic properties

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of laryngeally defective offglides. This, I propose, accounts for the fricative releases in Huishu stops from POE. They are vestiges of earlier final fricatives (the devoiced terminus of vowels) reinterpreted as stop releases without losing all of their original properties.

4.2 Choice of obstruents

One point that still has not been addressed is the (limited) diversity of obstruents that result from POE. The table below illustrates the attested possibilities, including for completeness the Danish devoicing phenomenon described by Andersen (1972: 27) and the Trengau Malay development:

Table 12. Vowel obstruent sequences derived from earlier -*i* and -*u*.

Language / Probable historical source	**-i**	**-u**
Huishu	-ik	-uk
Fomopea	-ɪk	-uk
Moghamo	-ek	-ok
Trengau Malay	-əyk	-əwk
Maru	-it > -ik	-uk
Singhi	-is	-ux
Belom	-ic	-ək
Jutland Danish 1	-iç	-ux
Jutland Danish 2	-ic	-uk

A few generalizations emerge from this table. First, the obstruents that emerge from -*u* always have a velar place of articulation. Second, the obstruents from -*i* may have a coronal, palatal, or velar place of articulation, with a relatively even split among possibilities (three independent cases of velars, two of coronals, and two of palatals). However, if the scenario presented above is correct, one might expect palatal and velar fricatives to predominate, since they would be the immediate products of the French type of high vowel devoicing. Why are velars as common with front vowels as they are and why are palatals rarer than expected?

POE tends towards structure preservation (in a broad sense). That is, the segments that emerge in a particular language tend to already be allowed as codas in the language or, as in Huishu, to be similar to licit codas in the language. These facts can be summarized in a few general statements:

1. When obstruent codas emerge, the language already has obstruent codas.

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2. When fricatives emerge, the language already has fricative codas.
3. When coronals emerge, the language already has similar coronal codas.
4. Palatals are less likely to emerge if a language lacks palatal codas (but cf. Jutland Danish).

The following table illustrates these patterns; coda consonants that were not licit prior to POE are indicated in boldface:

Table 13. POE and coda inventories.

Language	Result		Coda manners		Coda places		
	-i	***-u***	**obs**	**fric**	**cor**	**pal**	**vel**
Huishu	-i**k** [icç ~ ikx]	-u**k** [ukx]	X				X
Fomopea	-ik	-uk	X		X		X
Moghamo	-e**k**	-o**k**	X		X		
Maru	-it > -ik	-uk	X		X		X
Singhi	-is	-ux	X	X	X		X
Belom	-ic	-ək	X	X	X	X	X
Jutland Danish 1	-i**ç**	-u**x**	X	X	X		X
Jutland Danish 2	-i**c**	-uk	X	X	X		X

These facts are consistent with a current perspective on language change that sees lifelong language acquisition as involving a feedback loop where the classification of percepts is never independent of the previous history of perception. As numerous studies have demonstrated, speech perception is heavily influenced by a listener's native language (reviewed in Hume & Johnson 2001, see Huang 2004 for an especially compelling study). This does not simply mean that a learner's perception of an L2 will be filtered through her experience of her L1, but also that her *future* perception of her L1 will be filtered through her *past* experience of her L1. If such a feedback loop exists, the coherence of a set of linguistic categories should, on the balance, increase over time. Likewise, motor routinization effects mean that the variants of lexical items most likely to be produced are those consisting of gestures common in other lexical items. In effect, sound changes will be 'canalized' by the phonologies of the languages they affect. This general class of effects is termed 'structural analogy' by Blevins (2004: 154).

Under such an analysis, stop codas are relatively common as products of POE because they are relatively common in the languages that undergo POE. Likewise, velar stops are more likely products of POE than palatal stops because palatal stop codas are less common. This analysis is challenged, though, by Huishu and

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Moghamo where velar stops are apparently introduced after both front and back vowels even though velar stop codas did not exist in the languages prior to POE.

In Huishu, it can be argued that, rather than preserving structure, POE has preserved the phonetic properties of the laryngeally defective off-glides: /uk/ is phonetically [ukx] and /ik/ varies from [icç] to [ikx]. In other words, /ik/ phonetically preserves the expected palatal articulation but seems to be drifting towards a velar articulation. This might be attributed to attraction to the other members of the /k/ category, particularly the emergent /k/'s after /u/ with which they share certain phonetic peculiarities. There is no evidence, however, that a similar scenario was present in Moghamo. In any case, the structure-preserving tendency in POE is not absolute.

4.3 Chain shifts, dispersion effects, and POE

Thus far, it has been implied that POE occurs primarily as the result of phonetically-driven mislearning. Systemic factors have been invoked to account for the diversity of obstruents but left aside as causes for POE. This section aims to show that they may also be causally relevant. For example, there are multiple cases where mid vowels are raised to high vowels after high vowels become VC sequences via POE (e.g. Huishu and Maru). From a post hoc perspective, the components of these chain shifts may appear to be causally related or part of a system of changes. It may be useful, indeed, to view these changes as the product of dispersion effects that serve to maximize the perceptual distinctness of categories within a phonological inventory, an approach that has seen considerable application both to the diachronic and synchronic study of phonological inventories (Liljencrants & Lindblom 1972, Lindblom 1986, Flemming 2002, 2005, Padgett 2001, 2004, Padgett & Tabain 2005). However, while there is little reason to doubt that dispersion effects exist both in individual speakers and in the history of phonological systems, it is unnecessary to appeal to global optimizations in order to understand the dispersion-like effects produced by POE. Instead, they may be derivable from the same principles of exemplar-based learning and self-organization introduced in the preceding sections.

For purposes of illustration, consider the series of phonological developments surrounding POE in Huishu, illustrated in Figure 2. The area inside the square represents the vowel space of open-syllable rhymes. The area outside the square represents closed syllable rhymes. Arrows represent historical movements of phonological categories within phonetic space:

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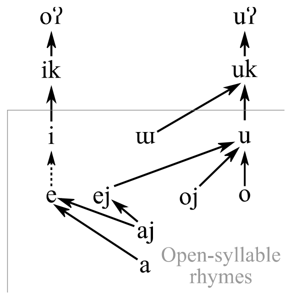

Figure 2. Chain shifts in Huishu rhymes based on Mortensen & Miller (2011).

Table 14 provides evidence for the debuccalization that occurred prior to POE and Table 15 provides evidence for mid-vowel raising which occurred after POE.

Table 14. Data illustrating that Proto-Tangkhul *-ik, *-uk > Huishu *-oʔ*, *-uʔ*.

Proto-Tangkhul	Ukhrul	Kachai	Tusom	Huishu	
*-mik	-mik	-mɐk	-mɯ	-moʔ	"eye"
*-hrik	-rik	-rɐk	-hrɯ	-roʔ	"louse"
*-tsik	-tsik	-ðak	-zɯ	tsoʔ	"black"
*-buk	-vuk	-wuk	-pu	-wuʔ	"stomach"
*-tʰuk	-tʰuk	-tʰuk	-tʰu	-tuʔ	"deep"
*-kʰuk	-kʰuk	-kʰuk	-kxu	-kʰuʔ	"knee"
*-ruk	-ruk	-ruk	-ru	-ruʔ	"six"

Table 15. Data illustrating that Proto-Tangkhul *-o > Huishu *-u* and suggesting that *-e > *-i*.

Proto-Tangkhul	Ukhrul	Tusom	Huishu	
*-lo	-lo	-lu	-lu	"buy"
*-ko	–	-ku	-ku	"nine"
*-ʃo	-ʃo	-sxu	-su	"open"
*-bo	-wo	-pu	-vu	"crawl"
*-pʰe	-pʰe	pʃi	–	"slap"
*-hwe	–	xui	hwi	"late"

As illustrated, POE was preceded by the debuccalization of most coda stops (including all instances of *-k and *-t; see also Table 1 above) and was followed by the raising of earlier mid vowels to the high position. While the evidence is fragmentary, *-e probably became /i/. Much stronger evidence shows that *-o was raised to become /u/. Since these changes are not paralleled in any of the closely related

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Tangkhulic languages, they are like to be fairly recent and to have occurred over a relatively brief period of time.

As an aggregate, these and other changes leave Huishu with a smaller and better-dispersed inventory of open-syllable rhymes (/i e u a ej ow/) than the Proto-Tangkhul system illustrated in Table 16, while filling a gap in the coda inventory.

Table 16. Proto-Tangkhul open-syllable rhymes (Mortensen & Miller 2011).

*-i	*-ɨ	*-u	*-ew		*-ow	*-ej		*-oj
*-e		*-o		*-aw			*-aj	
	*-a			*-aaw				

To what extent do these changes need to be seen as a causative or facilitating factor in Huishu POE?

Debuccalization of unreleased coda stops is extraordinarily common, probably for perceptual reasons, and requires no independent systemic explanation. According to the model presented above, it probably affected the outcome of POE by eliminating the contrast between -/t/ and -/k/, making an outcome like that in Maru less likely. It could plausibly have contributed to the fact that POE occurred at all in Huishu, by freeing up an area in phonetic space. Such effects can plausibly be derived from exemplar-based models like that invoked to account for the reparsing of vowels. Ettlinger (2007) demonstrated both push- and pull-chain behavior in a computer model that only categorized percepts (with no systemic optimization). Push-chain behavior occurred, as predicted by Labov (1994), when one category encroached upon the phonetic space of another, shifting the center of gravity of the first category and thus affecting subsequent productions. Pull-chains occurred because empty regions of the phonetic space presented no competition for percepts. Similar results were reported by Wedel (2004).

It is possible that the encroachment of Huishu mid vowels on high vowels encouraged a shift of the phonetic center of gravity for the high vowels such that exemplars with laryngeally-defective off-glides were better representatives of these categories than would have otherwise been the case. This would have been facilitated by the absence of competition from sequences like -/it/, -/ut/, -/ik/, and -/uk/. However, the case of Maru shows that the absence of such sequences is not necessary to POE. As argued above, pre-existing obstruent codas that are perceptually similar to the defective off-glides may actually facilitate POE.

Leaving aside the causes of POE, this model of segmental reanalysis actually predicts the next step in the chain shift, the raising of the former mid-vowels. If aerodynamic biases shifted the center of gravity of /u/ such that the prototypical exemplars had defective off-glides, -/o/ would face relatively little competition with -/u/ for instances with a relatively low F1 (as long as they lacked a defective

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off-glide). As a result, many exemplars of -/o/ would be minimally different from exemplars of /u/ in closed syllables and the portion of exemplars of -/u/ minus any defective off-glides. In reanalysis, a rational learner would have the opportunity to characterize the instances of /o/ and the instances of /u/ in closed syllables (including new closed syllables from POE) as members of a single category.

At least in the case of Huishu, it is plausible that systemic factors were part of the driving force that led to POE. These emerge as a natural consequence of the theory of learning assumed here and therefore add no additional burden to the model, the key proviso being that all interactions in the system are modeled locally rather than globally. At the same time, if POE is a response to systemic pressures, this may help explain its relative rarity. POE would occur just in case the (1) phonetic basis was present, (2) there was a structural analog for the emerging segment and (3) an appropriate systemic configuration was in place.

5. Conclusion

Although the emergence of obstruent codas after high vowels is uncommon enough to have escaped widespread attention from theoretical linguists concerned with the general mechanisms of sound change, its independent attestation in multiple language families and geographic regions suggests that it cannot be treated as a mere curiosity. Instead, it must be seen as a universally possible sound change, as relevant to our understanding of phonology and phonological change as any other recurrent sound change. Although POE operates in an apparently perverse fashion from the standpoint of common assumptions about phonology, inserting word final obstruents rather than deleting them and converting open syllables into closed syllables, it has clear phonetic precursors and its progress can be understood in terms of independently motivated assumptions about language acquisition, variation, and change. POE, for example, takes the divergent paths it does due to the interaction of chance and the biases that the existing phonological system impose upon the language learner.

Such biases may also play a role in determining whether, given an appropriate field of phonetic variation, POE occurs at all. This, in turn, may help to answer a larger and more difficult question: why isn't POE more common than it is? After all, the fundamental phonetic requirements for POE are not complicated — voicing must fail at an above chance rate during the production of phrase-final high vowels. It is, however, subject to certain limiting factors: The type of high vowel devoicing that acts as its precursor is far from universal and is not even the most common type of HVD. It is also more likely when these close vowels have an even closer off-glide. But, satisfying these requirements does not guarantee the

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emergence of coda obstruents. It may also be true, as I have argued, that POE relies upon structural analogy and will only occur when an appropriate structural analog exists in the language under consideration. Finally, other systemic factors may play a role. Therefore, we do not expect POE to be common.

However, the apparent rarity of POE probably results from the interaction of two types of factors: the fact that both phonetic and structural prerequisites must be satisfied in order for it to take place and the fact that it is likely to be ignored or misdiagnosed by linguists who are not familiar with POE and the cluster of related phenomena.

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Résumé

Bien qu'il existe quelque descriptions de la naissance d'obstruantes après voyelle haute, (Burling 1966, 1967 ; Blust 1994), on n'a jamais tenté de rassembler globalement des exemples de ce changement phonologique ou de leur donner une explication unifiée. Cet article vise à corriger cette situation en introduisant une émergence d'obstruante post-vocalique (POE) comme changement phonologiue récurrent aux causes phonétiques (aérodynamiques). Des cas possibles sont signalés dans les langues tibéto-birmanes, austronésiennes et bantoues des Grassfields. On suit de très près un nouveau cas en Huishu, une langue tibéto-birmane.

Zusammenfassung

Obwohl aus der Literatur (Burling 1966, 1967; Blust 1994) einige Fälle bekannt sind, bei denen Obstruenten nach hohen Vokalen auftreten, wurde noch kein Versuch unternommen, Instanzen dieses Lautwechsels umfassend zu sammeln oder für diese eine vereinigende Erklärung zu finden. Dieser Artikel versucht diese Lücke in der Literatur zu schließen, indem ein post-vokaler Obstruenten-Auftritt (POE) als ein wiederkehrender Lautwechsel auf phonetischer (aerodynamischer) Basis eingeführt wird. Mögliche Fälle wurden in den tibeto-burmanischen Sprachen, austronesischen Sprachen und Grasland Bantu identifiziert. Besondere Aufmerksamkeit wurde einem neuen Fall in Huishu, einer tibeto-burmanischen Sprache, geschenkt.

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