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VOWEL HEIGHT AND REGISTER ASSIGNMENT IN KATUIC

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Abstract

As has been previously demonstrated in the literature on Katuic (Ferlus 1974a, Diffloth 1982, Sidwell 2005), there are languages in the Katuic language family, an Austroasiatic sub-branch, with register systems whose emergence cannot be comprehensively explained in terms of the classical model of registrogenesis (also called the Khmer model). These include the Pacoh and Ta'oi languages. In this article, I will present evidence that registrogenesis began in these languages in the prototypical way, but register contrast within the Proto-Katuic monophthong height series was subsequently neutralized along a particular pattern; all close vowels merged to lax register and all open vowels merged to tense register. This phenomenon is related to the restructuring of tense close vowels and lax open vowels in many register Austroasiatic languages in that tense close vowels and lax open vowels are eliminated in both cases. The origins of register development in these languages were thus obscured and subsequent vowel shifts reintroduced register contrasts that no longer correspond with proto-language initial consonant voicing. I present evidence from other Katuic languages that indicate the plausibility of these kinds of changes and, finally, I incorporate this vowel height-induced register reorganization into the classical model of registrogenesis, expanding its explanatory power to include languages that have undergone register neutralization within their vowel height series.

Keywords: Katuic, register, registrogenesis, historical phonology
ISO 639-3 codes: pac, tto, tth, oog, bru, kdt, ngt

1 Introduction

1.1 Katuic

The Katuic languages are an Austroasiatic (AA) language family spoken primarily in southern Laos but also in neighboring areas of Vietnam, Thailand and Cambodia. Lexically, they are divisible into six major ethnolinguistic groups: Kuay, Bru, Pacoh, Ta'oi, Kriang and Katu (Miller & Miller 1996). Bru and Kuay are grouped together as the West Katuic languages based on shared phonological developments (Ferlus 1979, Diffloth 1982, Sidwell 2005) and Sidwell also sub-groups Ta'oi and Kriang as the Ta'oi languages.

1.2 Register Diversity within Katuic

Within Katuic, a variety of languages with typologically diverse phonemic register systems is found. Known Katu varieties are non-registral, but the remaining known Katuic languages either have register contrast currently or did so in the past.

West Katuic (WK) languages developed register prototypically, along the so-called 'Khmer model' pattern of registrogenesis (Huffman 1976, Ferlus 1979, Diffloth 1982). These languages underwent splits in Proto-Katuic (PK) vowels conditioned by initial consonant voicing, which resulted in a vocalic register split with an unmarked tense register (modal phonation) following PK voiceless initials and a marked lax register

(breathy phonation) following etymologically voiced initials with accompanying devoicing in the PK voiced stops.

Kriang (also called Ngeq/Ngeh in the literature) developed register along the canonical pattern in the environment following PK voiced and voiceless stops but following other natural classes of onsets, register is absent in some varieties and conditioned by vowel height in others (Ferlus unpublished, Gehrmann unpublished, Huffman 1976, Huffman 1985, Huffman unpublished, Smith 1976, Theraphan 2001).

Pacoh differs significantly from WK and Kriang in that it has a tense-marked register system (tense register: retracted tongue root/pharyngealized quality) that is only contrastive in mid vowels and diphthongs (Watson 1996, Alves 2006). This is unexpected because PK voiced stop initials are devoiced and phonemically merged with PK voiceless stop initials as in WK and Kriang, but mid vowel and diphthong register assignment does not correspond with PK initial voicing (Diffloth 1982, Sidwell 2005). Register carries a low functional load in Pacoh, given that there are differences of vowel quality as well as phonation in the proposed register pairs and closely related Kado and Pahi do not have register contrast at all (Gehrmann, unpublished, Watson, personal communication).

Ta'oi languages can be split into two sub-groups (Schmutz 2013). Ta'oiq (sub-varieties of which are called Ong, Ir and Katang) has a tense-marked register system (tense register: creaky phonation) that is contrastive for all vowels excepting close central vowels, which are always lax. The tense register has also regularly conditioned consonantal restructuring in many cases for final oral and nasal stops, resulting in a series of glottalized final consonants. Ta'uas (also called Ta'oih) does not have vocalic register contrast but does have glottalized finals in cognate etyma indicating that the most recent common ancestor of Ta'oiq and Ta'uas, Proto-Ta'oi (PT) was a tense-marked register language with altered final consonants. Like Pacoh, PK voiced initials are devoiced in Ta'oi but PK initial voicing does not correspond with register assignment in the modern languages (Diffloth 1989, Ferlus 1974a). Note that the use of the term Proto-Ta'oi here is not meant to include the Kriang languages, as in Sidwell's (2005) Katuic classification, nor is it meant to include the sparsely attested Ta'oi varieties of Vietnam, which appear to be dialects of Pacoh (Sidwell 2005, Nguyễn 1986, Alves, unpublished).

Despite the diversity of register systems within Katuic, a common thread runs through all of these languages – vowel height has played an important role in determining the course of register development in all of them, though not always in exactly the same way. In this paper, the interaction between vowel height and register development in the Katuic languages is explored and the implications of this interaction for our understanding of registrogenesis in general are discussed. Finally, an expanded model of registrogenesis is proposed, one that is able to account for all of the diverse register systems found in the modern Katuic languages.

2 Pacoh Languages: Register Assignment Conditioned by Vowel Height

Mid vowel register assignment in Pacoh has been shown by Diffloth (1982) to be a result of the convergence of vowel phonemes that were previously differentiated phonemically by vowel quality. Sidwell (2005) confirmed Diffloth's analysis using the larger set of comparative data at his disposal. I have collected data on Kado, which is closely related to Pacoh and yet non-registral. The Kado data provides even more support for the theory that Pacoh has reanalyzed vowel height differences into register differences in the mid vowels.

Table 1 below illustrates how Proto-Katuic (PK) diphthongs *ie, *uo introduced a fourth level of vowel height contrast in Proto-Pacoh (PP), which was subsequently reanalyzed as mid vowel register contrast in the long vowels. Note that this is my own analysis, based on Diffloth (1982) and Sidwell (2005). The PK vowels reflect Sidwell's (2005) reconstruction throughout this paper and I use the convention of adding .D and .M to PK *ii and *uu to reflect the set of correspondences that are diphthongal and monophthongal respectively in WK and Pacoh.

Table 1: *From Proto-Katuic to Proto-Pacoh to modern Kado and Pacoh. Vowels in parentheses are vowels that were introduced irregularly, increasing vocalic symmetry.*

PK	PP	Kado	Pac	PK	PP	Kado	Pac
*ii.D, *ia	*iə	iə	iə				
*ia	*e̤a̤	ea [ᵉa̤ː]	e̤a̤				
*ii.M	*ii	ii	ii	*i	*i	i	i
*ie	*ee	ee [ɛː]	ee	-	-	-	(e)
*ee	*e̤e̤	ɛɛ [æ̤ː]	e̤e̤	*e	*e̤	e [ɛ]	e̤
*ææ	*æ̤æ̤		e̤e̤	*ɛ	*æ̤	ɛ [æ̤]	e̤
*i̤i̤	*i̤i̤	i̤i̤	i̤i̤	*i̤	*i̤	i̤	i̤
-	-	(əə) [ɜɜ]	(əə)	*ə, *iə	*ə	ə [ɜ]	ə
-	-	-	(ə̤ə̤)	-	-		(ə̤)
*aa	*a̤a̤	aa [a̤ː]	a̤a̤	*a	*a̤	a [a̤]	a̤
*uu.D	*uə	uə	uə				
*ua	*o̤a̤	oa [ᵒa̤ː]	o̤a̤				
*uu	*uu	uu	uu	*u	*u	u	u
*əə	*əə	oo	oo	-	-	(o)	(o)
*uo	*oo		o̤o̤				
*oo	*o̤o̤	ɔɔ		*o	*o̤	ɔ	o̤
*ɔɔ	*ɒ̤ɒ̤	ɒɒ [ɒ̤ː]	ɒ̤ɒ̤	*ɔ	*ɒ̤	ɒ [ɒ̤]	ɒ̤

The tense mid vowels of Pacoh share the predictable, non-contrastive retracted tongue root quality of open vowels and diphthongs /e̤a̤, o̤a̤/ and are analyzed as being in tense register. The lax mid vowels of Pacoh are –RTR, as are close vowels and diphthongs /iə, uə/ predictably. Kado has preserved four levels of PP vowel height in the back vowels but front PP *e̤e̤ and PP *æ̤æ̤ have merged as Kado /ɛɛ/. Note that Kado does preserve predictable tenseness on the open vowels and diphthongs /ea, oa/.

The Pacoh languages offer a clear example of how tense/lax features can become aligned with vowel height and subsequent vowel shifts can lead to new register pairs. This is a special case of registrogenesis by vowel convergence rather than by vowel splits, as the Khmer model predicts. In fact, a similar series of developments is also indicated in the North Bahnaric (NB) languages of Vietnam. Smith (1972) demonstrated that tense and lax register vowels in NB languages overwhelmingly correspond to open and close vowels respectively in Bahnar, a Central Bahnaric language. Bahnar is a conservative Bahnaric language in terms of vocalism, and so NB register contrasts have their origin in the alignment of phonation and proto-language vowel height, followed by vowel shifts that introduce new register contrasts as in Pacoh (Sidwell, personal communication). Note, however, that Smith himself came to a different conclusion regarding NB registrogenesis.

Importantly, the pattern of vowel height and register correspondence noticed by Smith in NB matches that of Pacoh, in that etymological close vowels became aligned with lax register and etymological open vowels became aligned with tense. One cannot help but compare this state of affairs with the kind of vocalic restructuring predicted by the Khmer model, in which tense close vowels are rejected and lower in vowel height, while lax open vowels are similarly dispreferred and consequently raise or diphthongize. This pattern is seen over and over again in the register AA languages.

3 Ta'oi Languages: the Origins of Creaky/Glottalized Register

The tense-marked register system of PT is more difficult to account for than that of modern Pacoh, but two prominent theories have been espoused in the literature. Diffloth (1989) correlates creaky rimes in Ta'oi with glottalized rimes reconstructed for Proto-Vietic and Proto-Pearic, proposing that Proto-Austroasiatic (PAA) had a tense-marked register system that contrasted creaky and modal voiced vowels. According to this theory, these three AA branches would have preserved the PAA creaky register. Ferlus (2004), on the other hand, has suggested that in Proto-Vietic, Proto-Pearic and Proto-Katuic, rimes in sesquisyllabic words may have been re-interpreted as tense/glottalized, while rimes in monosyllables remained unchanged. This would parallel the process that transformed Old Chinese sesquisyllables into tense Middle Chinese monosyllables and would have been influenced by contact with Chinese speakers along their overland trade route, which passed through the Vietic, Katuic and Pearic homelands on its way to the Gulf of Thailand.

I am not currently in a position to comment on the existence of PAA creaky voice, but after reviewing new Ta'oi data and reconstructing the rimes of 936 PT etyma, I have been unable to find evidence to support the idea of sesquisyllables being the source of PT tense register (Gehrmann, unpublished). If PK sesquisyllables had conditioned PT tense register, we would expect to see at least some skewing towards tense register in the etymologically sesquisyllabic etyma but, as shown in Table 2 below, tense and lax register are essentially evenly distributed among PT sesquisyllables and PT monosyllables. The data available does not indicate a correlation.

Table 2: *Correspondence of PT register and syllable type*

	PT Sesquisyllable	**PT Monosyllable**
PT Tense V	192 (21%)	300 (32%)
PT Lax V	174 (19%)	270 (29%)

Instead, the evidence indicates that, during a period between PK and PT that I will call Pre-PT, register must have been aligned with vowel height in a pattern resembling modern Pacoh. Evidence for this is found in the significant skewing of register assignment patterns in PT, as demonstrated below in Table 3.

The statistics in Table 3 already show the telltale pattern of lax close and tense open vowel preference even before comparing PT phonemes to PK and the other Katuic branches, but the comparison with PK in Table 4 serves to confirm the theory. The PK vowel phonemes listed are those reconstructed by Sidwell (2005). A comprehensive discussion of PT and Pre-PT reconstruction is outside of the scope of this paper, but the thematic relationship between vowel height and register assignment is evident even in this brief overview. Note that PT and Ta'oiq vowels marked as V̰ in Table 4 are meant to include both creaky vowels and modal vowels with altered final consonants, as the final consonant alterations are reconstructed as having occurred between Pre-PT and PT.

Table 3: *Register incidence in Proto-Ta'oi (significant skewing is shaded)*

PT	**#**	**%**	**PT**	**#**	**%**	**PT**	**#**	**%**
*ia	5	13%				*ua	5	17%
*i̯a	34	87%				*u̯a	24	83%
*ii	27	56%	*i̶i̶	23	100%	*uu	25	53%
*i̯i	21	44%	-	-	-	*u̯u	22	47%
*ee	24	77%	*əə	29	78%	*oo	53	63%
*e̯e	7	23%	*ə̯ə	8	22%	*o̯o	31	37%
*ɛɛ	11	28%	*aa	19	14%	*ɔɔ	12	15%
*ɛ̯ɛ	29	73%	*a̯a	114	86%	*ɔ̯ɔ	67	85%
*i	14	100%	*i̶	47	100%	*u	27	100%
-	-	-	-	-	-	-	-	-
-	-	-	*ə	18	43%	*o	20	71%
-	-	-	*ə̯	24	57%	*o̯	8	29%
*ɛ	18	58%	*a	62	48%	*ɔ	5	19%
*ɛ̯	13	42%	*a̯	68	52%	*ɔ̯	22	81%

Put briefly, reflexes of PK close and mid vowels, both long and short, are overwhelmingly in lax register in the PT period and their tense counterparts are largely the result of vowel shifts (PK *ii.D, *uu.D, *ie, *iə, *uo > Pre-PT *i̯a, *u̯a, *ɛ̯ɛ, *ə̯, *ɔ̯ɔ > PT *i̯i, *u̯u, *e̯e, *ə̯, *o̯o). Mid vowel register contrast probably developed first along the same pattern as seen in modern Pacoh – the reanalysis of open-mid and close-mid vowels as tense and lax register vowels respectively – and once register contrast became a feature of the mid vowels, it was introduced in the close and open vowels as well. Tense open PT vowels *a̯a, *ɔ̯ɔ and *ə̯ are skewed significantly towards tense register, as we would expect based on the patterning evident in Pacoh and NB. The other PT open vowels *ɛ̯ɛ, *ɛ̯ and *a̯, however, are not significantly skewed towards tense register indicating that there are other factors at play here that are not yet identified. Nevertheless, on balance it is reasonable to posit that all PK open vowels were associated with tense register in Pre-PT.

To summarize, Pre-PT appears to have been a language in which phonation was predictable and conditioned by vowel height as in PP. By the PT period, vowel shifts had introduced new register contrasts in the same type of registrogenesis by vowel quality convergence that has already been described for modern Pacoh, though PT was much more strongly registral than modern Pacoh is (see Table 5 below). Most importantly, the pattern of vowel height and register alignment in Pre-PT is the same as that seen in Pacoh and NB: *close → lax, *open → tense. As for mid vowels, both PP and Pre-PT were languages with four levels of vowel height contrast, in which the close-mid and open-mid vowels patterned with the close and open vowels respectively, but Proto-North Bahnaric is not yet sufficiently well described in the literature to be able to comment on how mid vowels developed there.

Table 4: *From Proto-Katuic to modern Ta'oi varieties. Vowels in parentheses are vowels that were introduced irregularly, increasing vocalic symmetry.*

PK	Pre-PT	PT	Ta'oiq	Ta'uas
-	-	(*ia)	ia	ia
*ia	*e̯a	*i̯a	i̯a	
*ii.M	*ii	*ii	ii	ii
*ii.D, *ɨa	*i̯a	*i̯i	i̯i	
*ee	*ee	*ee	ee	ee
*ie	*e̯ɛ	*e̯e	e̯e	
-	-	(*ɛɛ)	ɛɛ	ɛɛ
*ɛɛ	*æ̯æ	*e̯ɛ	e̯ɛ	
*ɨɨ	*ɨɨ	*ɨɨ	ɨɨ	ɨɨ
*əə	*əə	*əə	əə ɔɔ	əə
-	(*ʒ̯ɜ)	(*ə̯ə)	ə̯ə	
-	-	(*aa)	aa	aa
*aa	*a̯a	*a̯a	a̯a	
-	-	(*ua)	ua	ua
*ua	*o̯a	*u̯a	u̯a	
*uu.M	*uu	*uu	uu	uu
*uu.D	*u̯a	*u̯u	u̯u	
*oo	*oo	*oo	oo	oo
*uo	*o̯ɔ	*o̯o	o̯o	
-	-	(*ɔɔ)	ɔɔ	ɔɔ
*ɔɔ	*o̯ɒ	*o̯ɔ	o̯ɔ	

PK	Pre-PT	PT	Ta'oiq	Ta'uas
*i	*i	*i	i	i
-	-	-	-	-
-	-	(*ɛ)	ɛ	ɛ
*ɛ	*e̯	*e̯	e̯	
*ɨ	*ɨ	*ɨ	ɨ	ɨ
*ə	*ə	*ə	ə	ə
*ɨə	*ʒ̯	*ə̯	ə̯	
-	-	(*a)	a	a
*a	*a̯	*a̯	a̯	
*u	*u	*u	u	u
*o	*o	*o	o	o
-	(*o̯)	(*o̯)	o̯	
-	-	(*ɔ)	ɔ	ɔ
*ɔ	*o̯	*o̯	o̯	

Table 5: *Reconstruction of Pre-Proto Ta'oi and Proto-Ta'oi Vocalism*

Pre-PT

*i̯a		*u̯a			
*e̯a		*o̯a			
*ii	*i̟i̟	*uu	*i	*i̟	*u
*ee	*əə	*oo	*e	*ə	*o
*ɛ̯ɛ	*ɜ̯ɜ	*ɔ̯ɔ	*ɛ̯	*ɜ̯	*ɔ̯
*æ̯æ	*a̯a	*ɒ̯ɒ	-	*a̯	*ɒ̯

PT

*i̯a	*ia		*u̯a	*ua			
*i̯i	*ii	*i̟i̟	*u̯u	*uu	*i	*i̟	*u
*e̯e	*ee	*ə̯ə *əə	*o̯o	*oo	-	*ə̯ *ə	*o̯ *o
*ɛ̯ɛ	*ɛɛ	*a̯a *aa	*ɔ̯ɔ	*ɔɔ	*ɛ̯ *ɛ	*a̯ *a	*ɔ̯ *ɔ

4 West Katuic & Kriang: Aberrations from the Khmer Model

Though register in WK and Kriang languages can mostly be accounted for using the Khmer model, there are some noteworthy deviations from the classical model that help to connect classical registrogenesis with the atypical register development found in Pacoh and Ta'oi languages.

*4.1 *D - *T Convergence in Kui*

The Khmer model explains the emergence of vocalic register contrast as being a byproduct of the devoicing of voiced stops. The typical progression begins with a conservative stage in which we find contrastive initial stop phonation (voiced vs. voiceless). A transitional stage follows, in which the proto-voiced stops (*D) become slack voiced stops and condition predictable breathy phonation on vowels that follow them, while proto-voiceless stops (*T) shift to stiff voiced stops with no vowel phonation alteration. A third stage may follow in which the vowel phonation differences become phonemicized as *D and *T merge phonemically. Phonetically, reflexes of *D remain slack voiced and reflexes of *T remain stiff voiced at this point, but stop phonation is now analyzed as being conditioned by vowel phonation rather than vowel phonation being conditioned by initial stop phonation in a reversal of the conditioning relationship.

WK languages are found at this third, phonemically merged, stage in almost all cases. However, one language, Kui, has re-strengthened the phonetic differences between the voiceless stop initials in /TV/ and /TV̤/ syllables as [TV] and [TʰV̤] respectively. One can argue whether it is the initial stops or the vowel phonation that is phonemic in the modern language, since pre-Kui *TV̤ and *TʰV are now indistinguishable from one another phonetically (Diffloth 1982). This state of affairs establishes the potential for *D - *T convergence to reverse itself and regressively re-establish initial stop voicing contrast among the reflexes of *D and *T.

4.2 Vowel Height – Phonation Clash Avoidance in Kuay Ntra and Bru Languages

There is a natural, cross-linguistic dispreference for tense close vowels and lax open vowels or, more accurately, it is the transition from the stiff voiced stops associated with tense register to close vowels and slack voiced stops associated with lax register to open vowels that is dispreferred (Gregerson 1976, Thurgood 2007). The Khmer model predicts that this clash of vowel height and phonation type will be dealt with by vowel height alterations, with lax open vowels raising, tense close vowels lowering and mid vowels doing either or both (Huffman 1985). This strategy effectively eliminates the dispreferred vowel height – phonation combinations by altering vowel quality to transform them into acceptable combinations.

Another possible strategy for the elimination of dispreferred vowel height – phonation combinations is to alter vowel phonation instead of vowel height. This results in close tense vowels merging with the preferred lax register close vowels, open lax vowels merging with the preferred tense register open vowels and mid vowels following either of these patterns. There is no known WK language that has fully embraced

this strategy to avoid the vowel height – phonation clash, but examples of it are found in Kuay Ntra and the Bru languages.

In most Western Kuay languages, Proto-Kuay (PKuay) close vowels in tense register lower to close-mid vowels but in Kuay Ntra, register contrast is neutralized in the close vowels (Gehrmann forthcoming). PKuay close vowels which we would expect to find in in tense register are instead lax and so we can say that tense register is completely merged to lax register in the modern Kuay Ntra close vowels. This is exactly the pattern found in the close vowels of PP and Pre-PT.

In the etymologically close vowels of the Bru languages, there are many examples of lax close vowels in words that, based on evidence outside of WK, should be reconstructed with voiceless PK initials (Gehrmann forthcoming). The pattern is strongest in the more northern Bru languages, where almost all etymologically tense close vowels after PK voiceless stops are merged with their lax counterparts, but more southern Bru languages still show the pattern strongly. Notably, tense register is preserved after the other voiceless PK initials *ɓ, *ɗ, *ʃ, *s, *h and *ʔ, so the use of this strategy is confined to the environment following PK *T. This supports the assertion that it is not tense register close vowels per se that are dispreferred, but rather it is the transition from a stiff voiced stop consonant to a close vowel that introduces the vowel height – phonation clash.

*4.3 A Second Wave of *D - *T Convergence in Kui and Chatong*

A peculiarity of the Kui in Prasert's (1978) dictionary is the diphthongization of PK *aa, *ɔɔ to tense register diphthongs /ia, ua/ after PK implosive stop initials *ɓ, *ɗ and *ʃ, as discussed by Diffloth (1982). This immediately recalls the diphthongization of lax register long open vowels that is ubiquitous in WK languages. Kui, being no exception, has diphthongized PK *aa, *ɔɔ to lax register /i̤a, ṳa/ after PK voiced initials. In Huffman's unpublished field notes available on sealang.net, he describes a variety of Kui spoken in Surin province, Thailand and observes, 'I noticed in recording a fact which I was deaf to in first hearing: words with initial /b, d/ have the breathy voice and rising intonation characteristic of 2nd register.' (Huffman, unpublished) The voiced stops that he is referring to here are the reflexes of PK implosives *ɓ and *ɗ, which shifted to plain voiced following the devoicing of PK *b, *d in this language. In another variety from Sisaket province, however, Huffman found that /b, d/ were associated with tense register, as in the Kui of Prasert's (1978) dictionary.

In light of these facts, it seems that at in an earlier period, at least one of the Kui varieties spoken west of the Mekong River and north of the Dangrek Mountains was undergoing a second wave of consonant devoicing. In this second wave, subsequent to the phonemic merger of PK *D and *T, PK implosive initials *ɓ, *ɗ and *ʃ began their own devoicing process from implosive to voiced to slack voiced with allophonic breathiness on following vowels. This would have triggered vowel height raising to avoid the clash of slack voiced stops followed by open vowels resulting in onset raising and diphthongization. Before the slack voiced reflexes of PK implosives could merge with another stop series, however, it would appear that in at least some varieties, the PK implosives returned to being produced plain voiced and, consequently, vowels following them ceased to be produced breathy.

This second wave of stop devoicing is not unprecedented. It is also found in the Chatong variety of Kriang, as described by Theraphan (2001). Unlike in Kui, PK implosives appear to have merged with PK *D in most cases, both of them being realized as /T̬V/. However, about one-third of PK implosives appear as voiced stops followed by tense register vowels in the data available on Chatong so the patterning is not clear at this point.

The abortive devoicing of PK implosives in some Kui varieties is important because it provides a precedent for voiced stops to slacken, condition breathy phonation and trigger vowel height – phonation clash avoidance strategies, and then to subsequently regress to their original plain voicedness without merging into another stop series.

4.4 Register Spread in Kriang Thataeng and Kriang Koh

An important step in the registrogenetic process in the spread of register contrast out to vowels in environments other than following *D and *T. For the vocalic register split to be complete, all vowels must be assigned to one register or the other and the Khmer model predicts that initial consonant voicing will be the conditioning factor in these environments as well. As such, it is expected that *T will condition tense register along with implosive stops, glottal stops and voiceless fricatives, while *D and voiced sonorants

condition lax register. This is exactly what we find in WK languages, with the exception of the more conservative Suay (also, French *Souei*) language, which does not seem to have undergone register spread yet (Ferlus 1974b, Huffman, unpublished).

In the Kriang data that is available (Theraphan 2001, Ferlus, unpublished, Smith unpublished, Thomas 1978), breathy phonation and/or vowel height alterations conditioned by register are not found in environments other than following *D and *T, with the notable exception of Chatong, where PK implosive initials usually devoice and condition breathy phonation (see Section 4.3 above). Nonetheless, I have recently collected data for two more Kriang varieties that show a distinct and unprecedented pattern of register spread. Kriang Thataeng and Kriang Koh show only marginal register contrast after initials other than *D and *T, but close vowels, mid vowels and diphthongs are in lax register and open vowels are in tense register in the vast majority of cases in these environments. Exceptions to this pattern are found after PK *s initials where register is always tense and after PK *j and *ʃ initials (/j/ and /ʔj/ in the modern languages) where register is almost always lax. This pattern holds true in 92% of cases in both varieties, constituting a fascinating combination of the expected register spread by initial consonant voicing conditioning and the atypical vowel height conditioning found in Pacoh and Ta'oi.

5 Five Parameters of Register Development

A more flexible and broadly descriptive model is needed to account for the kinds of register development seen Katuic and NB, which, though they show clear patterning that is able to be theoretically modeled, must be considered atypical or irregular in the context of the classical model of registrogenesis. As a starting point in the development of an expanded model, I suggest that the description of register development is better achieved by expanding the Khmer model's one linear trajectory of register development into five interrelated, constituent parameters, each of which describes a discrete linear progression.

*5.1 *D - *T Convergence*

As described above in Section 4.1, the process of *D devoicing is the catalyst for registrogenesis. The voiced stops do not devoice all at once, however. It is a lengthy process with noteworthy benchmarks along the way that are useful in the description of a register system.

Conservative: Before convergence begins, *D remains voiced and *T voiceless. In Katuic, the Katu languages are at this pre-registral stage.

Convergent: *D becomes slack voiced [D̰] and *T becomes stiff voiced [D̤]. Phonemic contrast of initial consonant voicing persists and allophonic breathy phonation is introduced. Suay and certain varies of Kriang are at this stage.

*DV > /DV/ [D̰V̤]
*TV > /TV/ [D̤V]

Phonemically Merged: *D merges into *T with an accompanying register split in the vowels. Reflexes of *D remain slack voiced and reflexes of *T remain stiff voiced but the stop phonation is now interpreted as allophonic conditioning from the vowels that follow them. Most WK languages are at this stage.

*DV > /TV̤/ [D̰V̤]
*TV > /TV/ [D̤V]

Phonetically Merged: Allophonic variation of initial stop phonation disappears. This appears to be associated with the general tensing of a lax-marked register system to a tense-marked register system, as in Pacoh, Ta'oi and the NB language Sedang.

Regressive: After the introduction of vocalic register, allophonic variation of initial stop phonation re-phonologizes and stop consonant phonation contrast is reinstated. This phenomenon is apparent in Kui and all NB languages other than Sedang.

5.2 Vowel Height – Phonation Clash Avoidance

As described above in Section 4.2, the transition from stiff voiced stops to close vowels is cross-linguistically dispreferred, as is the transition from slack voiced stops to open vowels. I have called this dispreference the vowel height – phonation clash and languages are naturally predisposed to altering vowels in order to avoid it. The following two strategies have been observed:

Altered Vowel Height Strategy: A vowel's height is altered when found in a vowel height – phonation clash situation, eliminating the clash. As a result, tense close vowels lower either in their onset only or lower completely, such that the transition is no longer from stiff voiced stops to close vowels, but rather to mid vowels. Similarly, either the onsets of lax open vowels raise or the entire vowel raises in vowel height until the transition is no longer from slack voiced stops to open vowels, but rather to mid vowels. Mid vowels may follow either pattern or both. This is the strategy described in the Khmer model and it is seen very commonly in register languages of the area, including WK, Kriang, Lavi (West Bahnaric) (Sidwell & Jacq 2003), Alak (Central Bahnaric) (Huffman, unpublished), Rengao (NB) (Gregerson 1976) and most famously, of course, Khmer.

Altered Phonation Type Strategy: A vowel's phonation type is altered when found in a vowel height – phonation clash situation, eliminating the clash. As a result, tense close vowels become lax, merging with the etymologically lax close vowels and lax open vowels become tense, merging with their etymologically tense counterparts. Mid vowels may follow either pattern. This strategy is apparent in Pacoh, Ta'oi and NB languages and it has been employed in the reflexes of PK close vowels in Bru languages and Kuay Ntra.

5.3 Register Spread

As discussed above in Section 4.4, register spread is the mechanism by which register is assigned for vowels that follow initial consonants other than *D or *T.

Conservative: Register is unspread and contrastive use of phonation is confined to the environment following *D, *T. Suay and some varieties of Kriang are like this. This constitutes a marginally registral language or an emerging register language.

Initial Voicing Alignment: Register is assigned according to initial consonant voicing for all natural classes of initial consonants. All voiced initials condition lax register and all voiceless initials, including implosives, condition tense register. This is the Khmer model's assumption and it is well attested in WK and Khmer.

Vowel Height Alignment: In environments other than following *D and *T, register is assigned by association with the naturally preferred phonation type of vowels with respect to their height. Close vowels become lax, open vowels become tense and mid vowels can go either way. This alignment pattern is evident in Kriang Thataeng, Kriang Koh, Pacoh, Ta'oiq, NB languages and in the close vowels of Kuay Ntra.

5.4 Marked Register

The Khmer model predicts the emergence of a lax-marked register system (tense: modal, lax: breathy) but tense-marked register systems are also seen in Katuic (Pacoh, Ta'oiq) and NB (Sedang). The description of the marked register is a fundamental factor in the description of a register language. Additionally, post-register languages can be indicated using this parameter once they have undergone *Register Loss*.

Conservative (Lax-Marked): A lax register marked by breathy phonation contrasts with an unmarked, modal voiced tense register.

General Tensing (Tense-Marked): A tense register marked by creaky phonation or other tense phonation features such as pharyngealization or retracted tongue root contrasts with an unmarked, modal voiced lax register. This appears to be related to the phonetic merger of *D and *T in a bid to enhance the

perceptibility of vocalic register contrasts in the absence of the allophonic variation on initial voiceless stops (see Section 6 below).

Register Loss: Vowel phonation ceases to be phonemic, typically in conjunction with some form of register restructuring (see Section 5.5 below).

5.5 Register Restructuring

Tense and lax register tend to affect different changes to rimes in a register pair. Once these changes have progressed far enough, the phonemic contrast of vowel phonation types can be said to have restructured into a different kind of phonemic contrast.

Conservative: The language remains best analyzed as having pairs of vowels of the same vowel quality differentiated primarily by phonemic differences of phonation type. The language may, nevertheless, show clear tendencies towards one of the following trajectories of register restructuring.

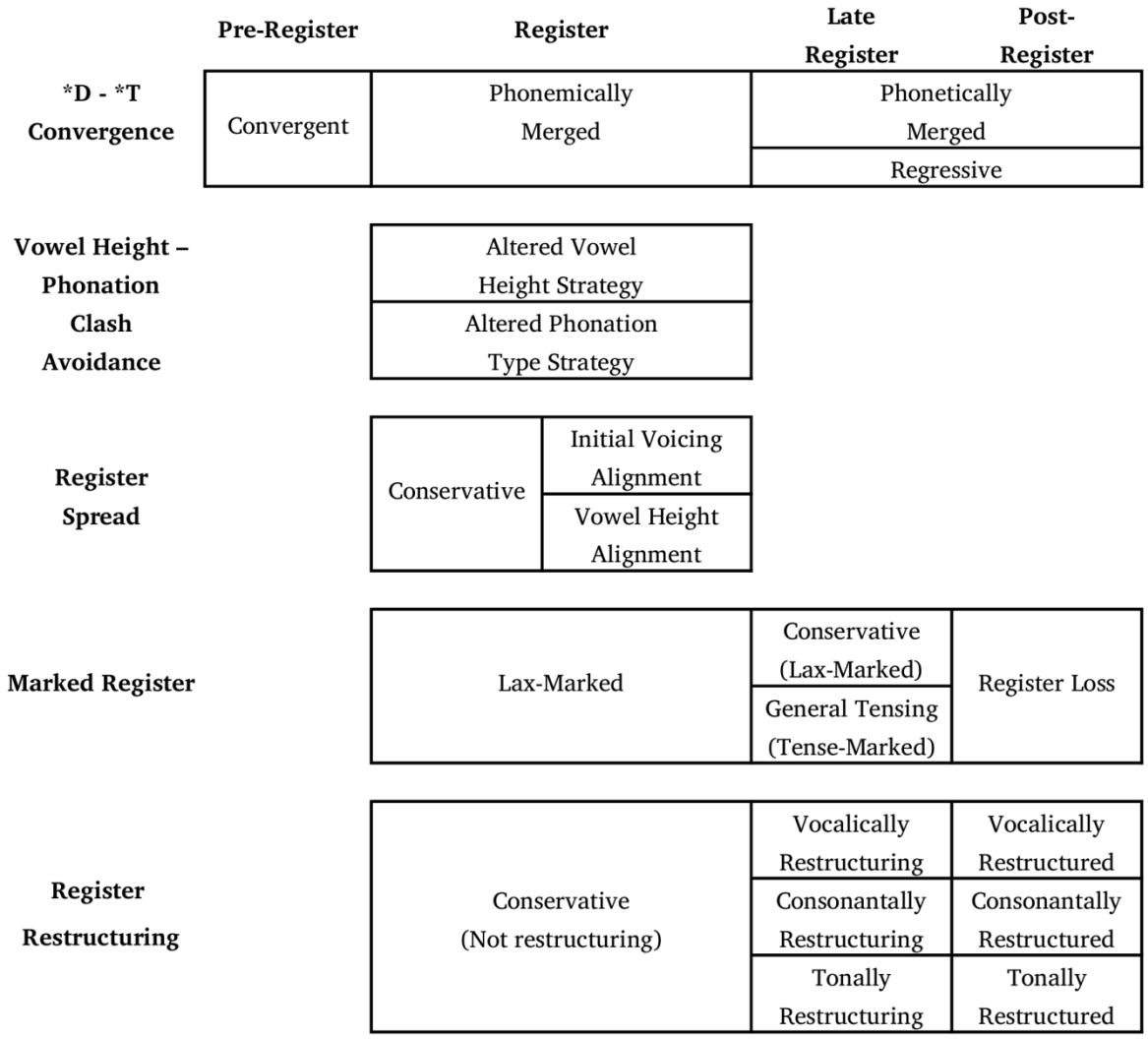
Vocalically Restructured: In languages that employ the *Altered Vowel Height Strategy* of vowel height – phonation clash avoidance, when the vowel quality differences between two vowels in a register pair become more salient than the phonation differences, register contrast can be said to have been restructured into vowel quality contrast. For example, PBru *klɒɒŋ ‘seed’ > Bru Khong Chiam /klɒɒŋ/ and PBru *klɒ̤ɒŋ ‘trail’ > Bru Khong Chiam /klṳaŋ/ (Gehrmann forthcoming, Theraphan & See 1980). This type of restructuring is predicted by the Khmer model and is associated with lax-marked register languages, such as WK languages and Khmer.

Consonantally Restructured: In languages that have undergone *General Tensing*, the creaky register can affect final consonant lenitions (as in Ta’oiq) and/or deletions (as in Sedang). Creaky phonation is lost from the vowel as the final consonants are restructured and so, in these cases, register contrast can be said to have been restructured into final consonant differences. For example, PT *cɛ̰t ‘stab’ > Ta’oiq /cɛnˀ/ and PT *cɛt ‘axe > Ta’oiq /cɛt/ (Gehrmann, unpublished, Conver, Conver & Schmutz, unpublished).

Tonally Restructured: Differences of phonation tend to affect the pitch at which a vowel is produced. When the pitch differences become more salient than phonation differences, a register language can become restructured into a tonal language. Phonation contrasts can also persist resulting in a hybrid phonation-pitch register system, as in Vietnamese.

Error! Reference source not found. below illustrates how these five parameters of register development are aligned chronologically.

Figure 1: *A chronological representation of the register development process*



6 Total Vowel Height – Phonation Alignment

Using the five parameters model of register development proposed above, we can explain the emergence of totally vowel height aligned, tense-marked register languages like Pre-PT and Pacoh. The following table schematizes the steps necessary to transform PK to Pre-PT or Pacoh.

Table 6: *The development of tense-marked, vowel height aligned register languages*

	*D - *T Convergence	Vowel Height – Phonation Clash Avoidance	Register Spread	Marked Register
(1)	Convergent			
(2)	Phonemically Merged			Lax
(3)		Altered Phonation	Vowel Height Alignment	
(4)				
(5)	Phonetically Merged			
(6)				Tense

(1) Predictable phonation is introduced after *D and *T in the prototypical manner.
(2) The phonemic register split happens and the language now has a lax-marked register system.

(3-4) The vowel height - phonation clash is avoided by altering phonation and register spread is conditioned by vowel height association. The ordering is unclear here but the combination of these two developments produces a language in which phonation is predictable by vowel height.

(5) Once register contrast is neutralized for all vowel phonemes, there is no more allophony of initial stop consonants and the phonetic merger of *D and *T is complete.

(6) Lax-marked register systems rely heavily on the allophonically stiff and slack voiced initial stops to enhance register perceptibility. As new register pairs begin to emerge through vowel shifts, the whole register system shifts to a tense-marked system, in which phonetic cues are all found on the rime, reinforcing register perceptibility in the absence of stiff and slack voiced stop initials. This hypothesis is supported by the fact that within NB, only one language, Sedang, has phonetically merged *D and *T and that language has also shifted to tense-marked.

7 Summary and Outlook

Thurgood (2002, 2007) has established that registrogenesis and tonogenesis are two parts of one whole and that tonality emerges from the reanalysis of register or *laryngeal gestures* (i.e. *tonal restructuring*). His comprehensive model draws on research into the emergence and reanalysis of these features in languages around the world to develop one unifying model founded on universal articulatory and acoustic motivations for change. Currently, a number of Austroasiatic register languages of Southeast Asia, including Pacoh, Ta'oi, NB languages, Proto-Vietic and Proto-Pearic, are excluded from this universal model because the provenance of their register features has not been demonstrated to be the reanalysis of earlier initial consonant voicing differences.

Although Ferlus (1974a) could not account for this non-correspondence of register with proto-language initial consonant voicing in Ong (a Ta'oi language) using the data at hand, he nevertheless theorized that registrogenesis began in the canonical way in that language and proposed that an unidentified factor had led to the 'transphonologization' of the language's register system. In this paper, I have presented evidence that Ferlus's theory was correct and that the crucial factor that Ferlus was missing was the powerful influence that vowel height can exert to totally rearrange the distribution of register in a language. In light of this, the origins of the atypical register languages of Katuic can be connected back into Thurgood's unifying model as long as the restructuring influence of vowel height is properly understood and modeled

I suggest that, since an understanding of the historical development of Katuic register systems is impossible without recognizing the influence of vowel height, it is quite possible that this influence has been underestimated in the exploration of register development outside of Katuic as well. In order to test this hypothesis, a new, expanded model of registrogenesis has been proposed here, in the hopes that it will be applied to the other AA branches which still harbor register systems of mysterious origins. In this way, we can test the universality of the register development patterns evident within Katuic. In doing so, we may potentially bring the other atypical register AA languages into the fold as well.

The NB languages, which neighbor Katuic to the east, are the most obvious candidates for further testing of the expanded model, since Smith (1972) has already identified the correlation between vowel height and register there and Sidwell (personal communication) affirms this analysis. I anticipate that the biggest theoretical challenge in NB will be to model how every NB language except Sedang has maintained *D - *T contrast to this day. The origins of Proto-Vietic and Proto-Pearic tense-marked register systems should also be examined to see if the patterns of development that produced the Ta'oi, Pacoh and Sedang register systems can be applied in those contexts as well.

Moving beyond the register Austroasiatic languages of Southeast Asia, the implications of an improved model of registrogenesis are far reaching. In light of Thurgood's unified model of tonality and register development, a more perfect understanding of register development and register assignment patterns has the potential to not only enhance our ability to comprehensively explain the emergence of register systems in Southeast Asia, but to enrich our understanding of the emergence of tonality and register generally around the world.

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