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Katuic Phonological Features

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Abstract
Katuic languages are spoken in Laos, Thailand, Cambodia and Vietnam. The internal phonological diversity of the Katuic branch is not as great as that of neighboring Austroasiatic branches such as Bahnaric or Vietic but there are nevertheless some noteworthy differences of phonological typology to be found within the family. This article aims to provide an overview of Katuic phonological typology by reviewing previous synchronic and diachronic phonological studies and presenting some of our own research. In doing so, we will highlight some of the important issues that remain to be explored in the study of Katuic comparative phonology.
Keywords: Katuic, phonology, typology
iso 639-3 codes: iir, kgd, oog, tto,tth, kgc, ktv, kuf, pac, phg, tgr, llo, ngt, bru, brv, xhv, sss, kdt, nyl

1. Introduction

Katuic is an Austroasiatic subgroup, spoken in Laos, Thailand, Cambodia and Vietnam. A number of sub-classification schemes have been proposed for Katuic over the past half-century (Diffloth 1982, Ferlus 1974b, Migliazza 1992, Miller & Miller 1996, Peiros 1996, Sidwell 2005, Smith 1981, Theraphan 2001, Thomas & Headley 1970, Thomas 1967). Based on a synthesis of all of the above analyses and without positing intermediate sub-groupings, the group is divisible by lexical similarity measurements into six major ethnolinguistic sub-groups, namely Kuay, Bru, Pacoh, Ta'oi, Kriang and Katu, with Katu being the most lexically divergent group and also having the greatest internal lexical diversity. The locus of greatest diversity for Katuic is found in Laos along the course of the Sekong River but great numbers of Katuic speakers have migrated westward in a population movement that began in the days of Angkor and continues to this day (Sidwell 2005).

West Katuic. The sub-grouping of Bru and Kuay languages as the West Katuic languages, marked by a number of analogous phonological developments and a greater degree of Khmer contact than is found in the other Katuic subgroups is firmly established (Diffloth 1982, Ferlus 1979, Gehrmann forthcoming, Sidwell 2005). Bru languages are typically called Bru, So or Katang and are spoken in a semicircle around the core Katuic area that stretches from some scattered communities in northeast Thailand near the Mekong River in Sakon Nakhon, Mukdahan and Ubon Ratchathani provinces, across Salavan and Savannakhet provinces in Laos and into the mountainous border areas of the Vietnamese Central Highlands. The Kuay languages are typically called Kuay, Kuy/Kui or Suay (French: Souei) and they spread out to the southwest of Bru and the Katuic homeland. Today, they are found from Salavan and Champasak provinces in Laos to a long swath of land in southern Isan between the Mun River and the Dangrek mountain range that separates Thailand and Cambodia and, from there, further south into Cambodia in Preah Vihear, Stung Treng, Kampong Thom and Kratie provinces (Diffloth 2011, Markowski 2005).

Pacoh. The Pacoh languages are spoken south of the east-most Bru languages and north of the east-most Katu languages, primarily in Thừa Thiên–Huế province, Vietnam with one variety, Pahi, being spoken in the foothills and another variety, Pacoh or High Pacoh, being spoken in the highlands (Watson 1996). Some Pacoh varieties are referred to as "Ta'oih" in Vietnam, but it is unclear at this time whether this reflects a true linguistic division. A trilingual dictionary of Pacoh, Ta'oih and Vietnamese is available which indicates that Pacoh and Ta'oih are very similar phonologically but have some notable lexical differences (Nguyễn, Doan & Phan 1986). Additionally, there is a variety spoken over the Lao border in Salavan province called Kado (Gehrmann 2014a).

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Ta'oi. The Ta'oi languages are spoken primarily in Salavan province, Laos with scattered communities also found to the south in Champasak and Sekong provinces. As noted above, there are languages called Ta'oih in Vietnam, but the term is ambiguous with Pacoh in that area and the limited data that is available indicates that Vietnamese Ta'oih belongs in the Pacoh sub-group of Katuic rather than the Ta'oi sub-group. An accurate picture of the internal diversity of the Ta'oi languages is only now beginning to take shape but there appear to be two main languages, Ta'oiq (also called Ong, Ir or Katang), which is typified by a distinctive tense-marked register system that is restructuring final stop consonants, and another variety, Ta'uas (also called Ta'uaih or Ta'oih) that does not have register contrast, both of which have their own internal diversity (Schmutz 2013). The Ta'oiq variety called Katang should not be confused with the Bru varieties called Katang. This glossonymic confusion is apparently the result of the geographic proximity of these language communities in northern Salavan province (Choo 2012, Sidwell 2005).

Kriang. Kriang languages are the southeastern neighbors of the Ta'oi branch, spoken primarily in Sekong province, Laos with scattered communities in Champasak province. Sidwell (2005) has proposed that they be sub-grouped together with Ta'oi languages. These languages have often been called Ngeq in the literature but this is an exonym and speakers prefer to use their endonym, Kriang. More work is needed on the dialectology of Kriang languages, but most varieties seem to differ primarily in terms of register correspondence (Smith 1973, Theraphan 2001). One important and registrally divergent Kriang language called Chatong was discovered by Theraphan (2001).

Katu. The Katu languages are found to the east of Kriang and Ta'oi in the mountainous border area between Laos and Vietnam and then further into the Vietnamese lowlands. The Katu languages are rather under-surveyed and we know little about the internal diversity of the group aside from the clear lexical differences between the Katu varieties in Vietnam and those in Laos (Miller & Miller 1996). Known named varieties include Kantu, Dakkang, Triw and Phuong (Sidwell 2005, Theraphan 2001).

The internal phonological diversity of the Katuic branch is not as great as that of some neighboring Austroasiatic branches like Bahnaric or Vietic, to take two examples, but there are nevertheless some noteworthy differences of phonological typology to be found within the family. This article aims to provide an overview of Katuic phonological typology by reviewing previous synchronic and diachronic phonological studies and presenting some of our own research. In doing so, we will highlight some of the important issues that remain to be explored in the study of Katuic comparative phonology. Typical Katuic phonological features are reflected in main syllable onsets and codas, in the vowel inventories, and in their minor syllable structure. The following three sections provide an overview on all three areas. For main syllable initials, the reanalysis of the Proto-Katuic (PK) initial stop series and the development of pre-nasals will be addressed.

2. Katuic consonants

Many modern Katuic languages have a phonemic aspirated stop initial series, due mostly to loan words and not reconstructable to PK. Otherwise, modern Katuic languages are largely conservative when it comes to their consonant inventories and still resemble quite closely the PK consonant inventory (Sidwell 2005). Notable exceptions to this include the voiced stop series of main syllable initials, palatal main syllable finals and inventories of permissible minor syllable consonants. It should be noted as well that the consonant inventory of modern Katu and, by extension, the PK consonant system, is considered to be exceptionally conservative and Sidwell and Rau's (2015) proposed Proto-Austroasiatic (PAA) consonant inventory is essential identical to that of modern Katu, which has preserved the PAA consonants mostly intact over the ages. Sidwell's (2005) reconstructed PK consonant inventory for main syllable initials and finals is shown in Table 1.

Table 1: Proto-Katuic Main Syllable Initial and Final Consonant Inventory (Sidwell 2005)

Main Syllable Initials

*p-	*t-	*c-	*k-	*ʔ-
*b-	*d-	*ɟ-	*g-	
*ɓ-	*ɗ-	*ʃ-		
*m-	*n-	*ɲ-	*ŋ-	
	*s-			*h-
*w-		*j-		
	*l-			
	*r-			

Main Syllable Finals

*-p	*-t	*-c	*-k	*-ʔ
*-m	*-n	*-ɲ	*-ŋ	
	*-s			*-h
*-w		*-j		
	*-l			
	*-r			

2.1 Onsets

Katuic features regarding main syllable onsets are phonation of initial stops, lenition of the initial palatal implosive, and prenasalization.

Initial stop phonation. The main point of variation in Katuic main syllable initial consonant inventories concerns developments in the three series of PK initial stops. Some Katu languages tend to retain a conservative, three way voicing distinction for initial stops (voiced, voiceless and implosive), though other varieties appear to have merged the implosive with the voiced (Costello 1971, Theraphan 2001). Even in the more conservative Katu languages, we often find voiced stops where we would expect implosives indicating a trajectory of change within the Katu group that is merging PK implosive and voiced initial stops (Diffloth 1982). This development is also seen in the West Bahnaric and North Bahnaric languages which neighbor Katu to the south and east (Sidwell & Rau 2015).

The remaining Katuic subgroups have all merged the PK voiced stop series with the voiceless one (Diffloth 1982, Sidwell 2005). The devoicing of the PK voiced stops in the non-Katu Katuic languages set off a series of sound changes that led to the introduction of phonemic vowel phonation contrasts, though the relationship between initial stop devoicing and register is not yet explained in Pacoh and Ta'oi (Diffloth 1982, Ferlus 1974a). In languages that have lost the PK voiced stop series, the PK implosive series has become reanalyzed as a new voiced stop series, though in many languages light implosion is retained on the new voiced stop series. In the Kriang languages, reflexes of the PK implosives *ɓ- and *ɗ- have become completely deglottalized and in one language, Chatong, they have even devoiced, instigating a second wave of registrogenesis (Theraphan 2001).

Lenition of the initial palatal implosive. The development of the PK palatal implosive *ʃ does not always pattern with the other PK implosives *ɓ and *ɗ. Its modern reflexes have been recorded in different ways by different researchers. In some cases it does pattern with *ɓ- and *ɗ- and becomes a voiced stop /ɟ-/ as in some Katu dialects (Theraphan 2001) and Kui Ntua (Bos & Sidwell 2015). In other cases it retains its laryngeal element by moving the point of occlusion back to the glottis while the palatal closure turns into narrowing, resulting in a pre-glottalized palatal approximant /ˀj-/ as reported for Kriang (Theraphan 2001) and Ta'uaih (Haak 1993). In Bru languages, it merges with PK *j- as /j-/ as seen in Bru Khong Chiam (Green 1996) and Bru Sakon Nakhon (Tebow II & Lew 2013).

Prenasalization. Sidwell (2005) reconstructs a series of PK minor syllables with a stop initial and a nasal final that assimilates the place of articulation of the main syllable initial - *pN-, *tN-, *cN-, *kN-, *ʔN-. For several Katuic languages, however, prenasalization appears to function as an initial consonant modification rather than as a segment of the minor syllable. These include Ta'uaih (Haak 1993), Ta'oiq (Conver, Conver & Schmutz 2014), Kriang, Chatong, Kantu, Triw and Dakkang (Theraphan 2001). Sidwell advocates for the segmental analysis based on his assertion that he hears

glottal stops preceding nasals in words like Kui /ntaaʔ/ [ʔn̩.ʻtaaʔ] ‘tongue’ (Sidwell 2005). Nevertheless, it has been reported that native speakers perceive such words as monosyllables in Katuic languages like Ta’uaih (Haak 1993), Ta’oiq (Conver, Conver & Schmutz 2014) and Bru Sakon Nakhon (Tebow II & Lew 2013). Hence, the issue of prenasalization from the synchronic point of view needs further investigation, possibly including phonetic and perceptual studies.

2.2 Codas

The coda inventory for Katuic main syllables differs from the onset inventory in that there are no voiced stops. In general, the PK final consonants have been diachronically stable and there are few mergers or reanalyses of the PK system to be found in the modern PK languages. Katuic features regarding main syllable codas are nasal mergers, glottalization, de-oralization, and loss of sibilance for PK *s.

Nasal mergers. The PK palatal nasal final *-ɲ is usually merged with PK *-n finals in Bru languages but it is retained as /-ɲ/ in So (Gehrmann forthcoming).

Glottalization. The only Katuic varieties that have undergone any significant development in their final consonant system are the Ta’oiq varieties including the previously described Ong (Diffloth 1989, Ferlus 1974a) and Katang (Ferlus n.d.). In these languages, tense register vowels restructure PK oral stops *-p, *-t, *-c and *-k to glottalized nasal stops /-mˀ/ and /-nˀ/, a glottalized palatal approximant /-jˀ/ and a glottal stop /-ʔ/ respectively. Additionally, tense register short vowels condition the glottalization of final PK nasal stops *-m, *-n, *-ɲ, and *ŋ to /-mˀ/, /-nˀ/, /ɲˀ/ and /ŋˀ/.

Other Katuic languages have developed glottalized finals from former final stops as well. PK *-c finals have lenited to a glottalized palatal approximant /-jˀ/ in the Pacoh languages, most Bru languages (excluding So where it remains /-c/) and Suay (Gehrmann forthcoming). In Pacoh, final /-c/ is still found occasionally, perhaps having been borrowed back (Watson, Watson, & Cubuat 1979). Katu has /-jˀ/ as well, but rarely and perhaps also from loan words, since Katu languages realize PK *-c finals as conservative palatal stops in almost all cases (Costello 1971). In Bru, Pacoh and Katu languages, a parallel post-glottalized labiovelar approximant /-wˀ/ is also found occasionally, but this is a very marginal phoneme and its provenance is not yet established.

Loss of stridency. PK final *-s, while remaining phonologically equivalent to initial PK *s-, lost its stridency and its realization among the modern languages ranges from a laminal [-s̪] to a voiceless palatal approximant [-j̊] or fricative [-ç] to a merger with PK *-h as in Kuay languages (Gehrmann forthcoming). The place of articulation against the passive articulator varies and is not contrastive (Sidwell 2005) which accounts for the considerable phonetic inter- and intra-speaker variability.

3 Katuic vowels

The Austroasiatic languages of Southeast Asia are known for having greater vocalic complexity than is common in the languages of the world (Weber 2012). Typically, these vowel systems have nine vowel quality distinctions (three heights and three places of articulation) sometimes doubled for length contrast and, in some languages, doubled again for register contrast (Jenny, Weber, & Weymuth 2015). Some North Bahnaric languages like Sedang have lost length contrast or reduced the monophthong inventory to a 7-vowel system like Hre and Sedang, or a 5-vowel system like in Jeh and Halang (Smith 1972). Other languages have a vowel system with more than nine vowel qualities, having added a second contrastive mid-vowel height level, such as Kơho, a Bahnaric language (Jenny, Weber, & Weymuth 2015).

Register is not reconstructed for PK but within the Katuic language family, differences of vowel inventory primarily relate to the extent to which register developed and, in some cases, restructured the PK vowel system.

3.1 Monophthong Inventory

Sidwell (2005) reconstructs a symmetrical, 3x3 PK monophthong system doubled by phonemic length distinctions. Two series of diphthongs, one commencing with close front, central and back

vowels gliding into an open central vowel and another commencing with close vowels transitioning into mid front, central and back vowels, are also reconstructed resulting in a total of 24 proto-vowel phonemes as is seen in Table 2 below.

Table 2: Proto-Katuic Vowel Inventory (Sidwell 2005)

*ia	*ɨa	*ua
*ie	*ɨə	*uo
*ii	*ɨɨ	*uu
*ee	*əə	*oo
*ɛɛ	*aa	*ɔɔ

*i	*ɨ	*u
*e	*ə	*o
*ɛ	*a	*ɔ

Many modern Katuic languages have been described as having retained the symmetrical PK 3x3 vowel system, including Ngeq (Kriang) (Smith 1973), Chatong (Theraphan 2001), Pacoh (Watson 1996), Ta'uaih (Haak 1993), and Souei/Suay (Ferlus 1974c). For other Katuic languages, four contrastive vowel heights constituting a 4x3 vowel system are attested. These are all West Katuic and Katu languages, including Bru Tri (Phillips, Miller, & Miller 1976, Vương 1999), Bru Khong Chiam (Green 1996), So (Gainey 1985, Migliazza 1998), a number of other West Katuic varieties of both the Bru and Kuay subgroups analyzed by Huffman (n.d.) in his unpublished papers which have recently become available on sealang.net, Kui (Prasert 1978), Kui Ntua (Bos & Sidwell 2015), Katu (Costello 1971), Dakkang, Triw and Kantu (Theraphan 2001). Gehrmann (forthcoming) reconstructs Proto-West Katuic (PWK) with four contrastive back vowel heights due to the intrusive monophthongization of PK *ua to PWK *ɔɔ which caused PK *ɔɔ to lower to PWK *ɒɒ. Watson (1996) discusses that the twelve contrastive vowel phonemes of Pacoh can be interpreted either as a 3x3 vowel system with register contrast found only in the mid vowels, or an asymmetrical 4x3 system since the two series of mid vowels are also differentiated to a small degree by vowel quality. The salience of the phonatory differences between the two mid vowel series suggest that the vowel quality differences are conditioned by register. His ultimate solution is a 2x3 vowel system that is doubled for register at both vowel heights.

Aside from the addition or deletion of contrastive vowel heights, another complicating factor is vowel gaps due to register-related restructuring of the vowel inventory, as defined in the Khmer model of registrogenesis (Diffloth 1982, Ferlus 1979, Huffman 1976, 1985). In register languages, the vowel inventory is initially doubled with contrastive tense and lax phonation, as found in the Kriang languages. In others, certain gaps can appear when one member of a register pair restructures or merges with another phoneme. For example, most Bru and Kuay languages do not have lax register counterparts to their long open vowels /aa/ and /ɔɔ/ because these have very often restructured into diphthongs. Similarly, some Bru and Kuay languages do not have tense register counterparts to their long close vowels because they have lowered to close-mid vowels.

3.2 Diphthong Inventory

Sidwell (2005) reconstructs six diphthongs for PK arranged in two series, a close-to-open series (*ia, *ɨa, *ua) and a close-to-mid series (*ie, *ɨə, *uə) as shown in Table 2 above. Though only two series of diphthongs are reconstructed by Sidwell, he acknowledges that there are really three important sets of correspondences that involve diphthongs in Katuic. These three vowel sets are illustrated in Table 3 (D stands for diphthong, and M for monophthong).

Examples are based on West Katuic (Gehrmann forthcoming), Pacoh (Watson, Watson, & Cubuat 1979), Ta'oiq (Conver, Conver & Schmutz 2014), Kriang Thataeng (Gehrmann 2014b), and Katu An Diem (Costello 1971). The corresponding PK vowels reconstructed by Sidwell (2005) are also provided.

Table 3: Sets of vowel correspondences involving diphthongs in Katuic

	West Katuic			Pacoh	Ta'oi	Kriang	Katu	Proto-Katuic
	Proto-WK	Kuay Ntra	Bru Tri	Pacoh	Ta'oiq	Kriang Thataeng	Katu AD	
{1.D}	*ea *oa	iə uə	ea oa	ɐ̯a o̯a	i̯a u̯a	ia / i̯a ua / u̯a	ia ua	*ia *ua
{1.M}	*ɛɛ *ɔɔ	ɛɛ / ɐ̯e ɒo / o̯o	æe / ɐ̯e ɒo / o̯o					
{2.D}	*ia *ua	iə uə	i̯a u̯a	ia ua	i̯i u̯u	ii / i̯i uu / u̯u	ii uu	*ii *uu
{2.M}	*ii *uu	i̯i u̯u	ei / i̯i ou / u̯u	ii uu	ii uu			
{3}	*iə *uə		i̯ə u̯ə	ee o̯o	ɐ̯e o̯o			*ie *uo

Set {1} is the most strongly diphthongal correspondence set for Katuic. It has two subsets, one with diphthongs in West Katuic {1.D} and one with monophthongs in West Katuic {1.M}. Sidwell reconstructs set {1} as PK *ia, *ua and proposes that they split in West Katuic.

Set {2} presents as close monophthongs in most languages but also has two subsets. One has diphthongs in West Katuic and Pacoh and tense close vowels in Ta'oiq {2.D} and the other has close monophthongs in West Katuic and Pacoh, lax close vowels in Ta'oiq. Sidwell reconstructs set {2} as PK *ii, *uu and proposes another split in WK and Pacoh. The Ta'oiq data available in 2005 was not complete enough to reveal the corresponding split in that language but new data confirms it (Conver, Conver & Schmutz 2014).

Set {3} shows diphthongs in Bru languages, mid monophthongs in Pacoh and Ta'oiq and high monophthongs elsewhere. In Ta'oiq, these mid monophthongs are in tense register while the mid monophthongs from PK *ee and *oo are in lax. In Pacoh, the etymological mid monophthongs are in tense register and PK *uo merged with PK *oo as tense but reflexes of PK *ie are lax and contrast with the tense register reflexes of PK *ee. This asymmetrical development in Pacoh was influenced by the retraction of PK *əə in that language to lax /oo/, which would have put pressure on the reflexes of PK *uo to merge with the reflexes of PK *oo as tense /o̯o/ (Diffloth 1982).

PWK was rich in diphthongs with three reconstructable series (Gehrmann forthcoming). West Katuic is internally diverse when it comes to diphthongs. Kuay languages are generally more progressive than Bru languages in this regard, with Kui even having monophthongized all PWK diphthongs. On the other end of the spectrum, Bru Tri is very conservative having preserved the PWK diphthong series more or less intact.

Though Pacoh lost PK *ie, *uo as diphthongs, it gained the diphthongs from set {2.D}, which have become reanalyzed as a tense/lax register set with the diphthongs from set {1}. Ta'oiq likely also developed the diphthongs from set {2.D}, which subsequently monophthongized to become the tense register counterparts of the reflexes of set {2.M}. This development parallels the monophthongization of PK *ie, *uo to tense register monophthongs in set {3}.

Katu and Kriang both have one series of diphthongs from set {1} while sets {2} and {3} produced only high monophthongs.

The differential development of diphthongs in Katuic is a very powerful tool for the sub-classification of this language family and more work remains to be done to clarify the relationship between Ta'oi languages and Kriang languages. Sidwell (2005) groups them together but their

differing developments in this area, namely, a split in {2} that is found in Ta'oi but not in Kriang and the monophthongization of {3} to mid vowels in Ta'oi but high vowels in Kriang, must be explained.

4 Register Systems

Traditionally, Austroasiatic register as contrastive voice quality has been understood in the context of the 'Khmer model' which takes the written record of the development of register in the Khmer language from pre-Angkorian through modern times as a blueprint for understanding register development elsewhere in the AA languages and beyond (Huffman 1976, 1985, Ferlus 1979, Diffloth 1982). The first 'conservative' stage applies to a language with voiced and voiceless initial stops. Next, a 'transitional' stage begins with voiced initial stop slackening and predictable breathy phonation on following vowels. The etymologically voiceless stops become tense to enhance contrast with the slack voiced stops while not effecting the unmarked, modal vowel phonation on following vowels. This leads to the third 'register' stage where the etymologically voiced stop initials merge with the voiceless series and the vowel system splits into pairs of vowels of identical vowel quality that contrast breathy and modal phonation. The fourth 'restructuring' stage is marked by the phonation contrasts in register pairs beginning to lose salience as register-induced vowel quality changes take hold. This generally takes the form of tense register vowel lowering and lax register vowel raising.

Within Katuic, only the Katu languages have retained the PK voiced stop series and remained at the conservative stage. All other Katuic languages are in the transitional to restructuring stages, like West Katuic and Kriang languages, though the Pacoh and Ta'oi register systems have departed from the Khmer model trajectory and developed in novel ways.

In Khmer and most West Katuic languages, not only voiced stops but all voiced onsets conditioned lax register on the vowels that follow them. Eastern Kuay (Suay) languages spoken in Laos appear to have more conservative register systems than the Bru languages and the Western Kuay languages in Thailand and Cambodia (Ferlus 1974c, Huffman n.d.). Evidence is limited, but both Ferlus's and Huffman's data reveal a register contrast after voiceless stop initials only. The lack of evidence for register contrast in syllables with the other onsets leads Huffman to propose that the PK voiced stop consonants had not yet merged with the PK voiceless series in Suay and, consequently, that the vowel system had not yet split. Ferlus' data, however, contain two words marked for lax register after non-stop initials, /ʔatu̯ŋ hu̯ul/ 'rice roasted in a bamboo joint' and /smu̯h/ 'name', and he does propose a vowel register split. Apparently, PK voiced stop initials regularly conditioned lax register in Suay but other voiced initials did not do so regularly. In light of this, Suay has a transitional register system, the most conservative system yet discovered in WK. Other WK languages have the characteristics of a "register" language, such as Kui (Prasert 1978) So (Gainey 1985, Migliazza 1998) and Bru Sakon Nakhon (Tebow II & Lew 2013), having developed contrastive register pairs at all or most vowel positions. Bru Tri (Phillips, Miller, & Miller 1976, Vương 1999), Bru Khong Chiam (Green 1996) are examples of "restructured" languages in which the former phonation contrast effects the vowel quality between the two members of a pair.

Register development in Kriang languages is also recognized as following the canonical Khmer model. The devoicing of PK voiced stops was clearly the catalyst, and some degree of vocalic restructuring has been described for most varieties (Ferlus n.d., Gehrmann 2014b, Huffman n.d., Sidwell 2005, R. Smith 1973, Theraphan 2001).

The register systems of Pacoh and Ta'oiq are more difficult to account for because they differ from the register systems of West Katuic and Kriang in two significant ways. First, they are tense-marked register systems, meaning that the lax register is characterized by unmarked, modal phonation while the tense register has a marked, creaky phonation in Ta'oiq (Conver, Conver & Schmutz 2014, Diffloth 1989, Ferlus 1974a) and a pharyngealized/retracted tongue root character in Pacoh (Alves 2006, Watson 1996). It is worth noting here that Huffman (n.d.) occasionally marks phonetic breathiness on lax register vowels in his data on a language that he calls "Bru Lao" which actually reflects the Ta'oi language of Talan village discussed elsewhere by Diffloth (1989). He appears to have decided that this breathiness was not contrastive since he does not mark in on his phonemic transcriptions.

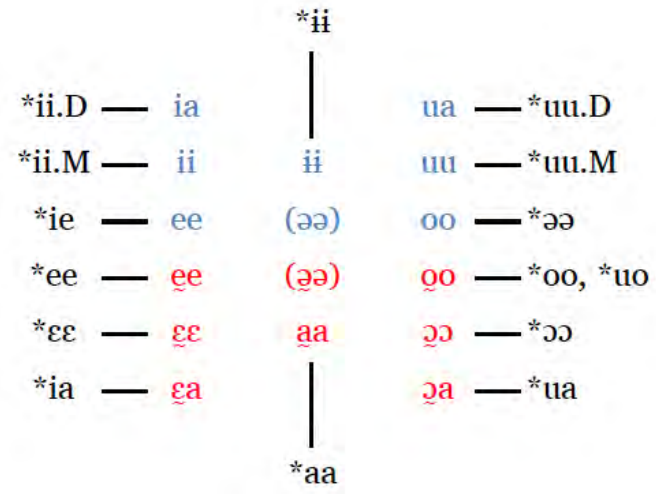
Secondly, unlike in WK and Kriang, register assignment in these languages does not correlate with PK initial consonant voicing, despite the devoicing of the PK voiced stop series (Diffloth 1982, Ferlus 1974a). Ferlus proposes that Ong developed a typical, lax-marked register system with the devoicing of PK voiced stops, but subsequent, as yet undiscovered sound changes have simply obscured this fact. Additionally, he explains the tense-marked register system as being the result of a general tensing of the whole register system referencing a parallel phenomenon in North Bahnaric that has caused Sedang to have a tense-marked register system (Smith 1972).

For Pacoh, Diffloth (1982) proposes that, although PK voiced stops have devoiced, register did not develop as a reanalysis of initial consonant voicing contrast in this language. Instead, vowel shifts led to a new contrastive vowel height level resulting in a twelve vowel system. A general tensing of a previously lax-marked register system has not been proposed for Pacoh but it appears plausible that pharyngealization would have been introduced at this point to reanalyze the two mid vowel series as being differentiated by phonation rather than vowel quality. In any case, register development in Pacoh can be explained as a function of vowel shifts rather than vowel splits. While the Khmer model produces new register contrasts from within proto-vowel phonemes that undergo a phonemic split, in Pacoh we see new register pairs emerging from the reanalysis of two formerly separate proto-vowels. This significant finding harkens back to Smith's (1972) discovery that register contrasts in North Bahnaric languages correlate with differences of vowel height in the Bahnar language. It would seem that in North Bahnaric as well, we find registrogenesis by convergence of pairs of vowels formerly differentiated by vowel quality into homorganic register pairs differentiated by phonation.

In both Pacoh (Watson, Watson, & Cubuat 1979) and Ta'oiq (Conver, Conver & Schmutz 2014), the PK close vowels are found as lax register close vowels in the modern languages while the PK open vowels have generalized to tense register. The etymological mid vowels have also generalized to a certain register in each language – lax in Ta'oiq but tense in Pacoh. The PK diphthong series *ia, *ua defaults to tense register in both languages. New register contrasts are largely based on vowel shifts which led to a register contrast in the mid vowels and diphthongs of Pacoh. Modern Ta'oiq has register contrast for all vowels and diphthongs with the exception of the high central vowel. Many of these can be traced back to vowel shifts but some new contrasts are the result of irregular developments and borrowings.

The following diagram, informed greatly by Diffloth (1982) and Sidwell (2005), illustrates our analysis of the vowel shifts that led from PK to the modern Pacoh long vowels and diphthongs. Marginal vowel phonemes that are not the result of a major vowel shift are in parentheses. Note that the phonemic transcription employed in this chart is more narrow than the one used in Watson (1996), and follows the convention employed by Diffloth and Sidwell which helps to illuminate the connections between these and other Katuic vowel phonemes.

Table 1: Long vowels and diphthongs from PK to modern Pacoh



The diagram illustrates how lax mid vowels were originally introduced in Pacoh by the monophthongization of PK *ie and *uo. The subsequent retraction of PK *əə to a lax mid back vowel triggered the merger of PK *uo and *oo to the tense mid back vowel. The reflexes of PK *ie, not having suffered an intrusion like the reflexes of its back counterpart, remained lax /ee/.

In summary, modern Pacoh, Ta'oiq and North Bahnaric do not show a canonical Khmer-model register split in their vowel inventory. Instead, it appears that each of the different vowel height series in earlier periods of these languages became associated with one of the two registers and subsequent vowel shifts led to the vowel quality convergence of vowel phonemes with different register affiliations, establishing new register pairs. The fact that close and open vowels generalize to lax register and tense register respectively in all of these languages, indicates that a natural tendency to reject tense register close vowels and lax register open vowels may underlie these changes. This tendency is also evident in Khmer model restructuring register systems, where tense close vowels are lowered and lax open vowels are raised and these two processes may share an articulatory motivation (cf. Gregerson 1976).

Regarding how different vowel height series become associated with a given phonation type in the first place, it is tempting to posit that this happened in conjunction with the devoicing of initial stops, which would serve as an initial source of phonatory differences that was subsequently restructured in ways not accounted for in the Khmer model. The North Bahnaric languages make this analysis difficult, however, due to the fact that Proto-Bahnaric voiced stops are preserved as voiced and distinct from the voiceless series in all North Bahnaric languages with the exception of Sedang (Edmondson, Gregerson, & Sidwell 2011).

5 Minor Syllables

Sidwell (2005) reconstructs $(C_1(V_1/C_2)).C_3(C_4)V_2(C_5)$ as the maximal syllable template for PK, with minor syllable onsets restricted to voiceless oral stops, voiced nasal stops, a glottal stop, *s-, *h-, *l-, or *r- and a nucleus formed by either a vowel *a or another consonant. The reconstructed minor syllable consonantal nucleus is comprised of the sonorants *r, *l, or a voiced nasal stop *N homorganic to the main syllable onset's place of articulation, all of which are preceded by a reduced, epenthetic vowel. In Sidwell's analysis, minor syllables of glottal stop plus nasal stop *ʔN- do not receive an epenthetic vowel but the nasal itself becomes the sonorant peak of the minor syllable [ʔN̩-]. For example, words like PK *tŋkɔɔj 'horn' and *ʔntaak 'tongue' are analyzed as /tN.kɔɔj/ [tə̆ŋ.kɔ:j] and /ʔN.taak/ [ʔn̩.ta:k].

Any minor syllable vowel nucleus is environmentally predictable, and Sidwell (2005) only indicates it explicitly after glottal initials, e.g. *ʔapaal 'shoulder', which prevents from reading it as preglottalization, and before main syllable initials of *l-, *r-, *h-, *w- and *j- as in *kalaa 'tiger' or *pahəəm 'breathe' which avoids the reading as clusters (or devoicing/aspiration in the case of *h). All other segments preceding main syllables are reconstructed without a vowel, e.g. *tkɔɔŋ 'neck'. Interestingly, Sidwell's reconstructed pattern is very similar to accounts of Austroasiatic

word-initial clusters in the production of Khmer words (Kirby 2014) and perception of Pnar words (Gruber & Ring forthcoming), where vowels in what could be interpreted as minor syllables are the outcome of articulatory and auditory facilitation; they follow clear complementary distribution and are not perceived as syllable nuclei by native speakers but are the outcome of open transitions between consonants (Hall 2006).

Minor syllables are phonologically less stable than main syllables and one must be careful when looking for etyma with cognate minor syllables because derivational morphological processes have often altered them in one Katuic language and not in others (Sidwell 2005). Nevertheless, some useful summary observations can be made about onsets and special cases of minor syllable vowel contrast.

Some languages preserve the full inventory of PK minor syllable initials while others have experienced a reduction. An example of PK initials that are no longer permissible in some modern languages are the palatal PK minor syllable onsets *c- and *ɟ-, which vary from full or partial retention to mergers with alveolar stops and sibilants and even /h/. In Katu languages, the palatals are retained as /c-/ and /ɟ-/ while they are merged to /c-/ in Kriang and Kuay languages and So, a Bru language. Pacoh languages have merged the palatals with *t- and *d- as /t-/ and some Bru languages such as Bru Tri, Katang Phin, Bru Khong Chiam have merged them with *s- as /s-/. Ta'oi languages and Katang Rueal, a Bru language, have reduced them to the greatest degree as /h-/. Table 4 illustrates this pattern of development for minor syllable palatal stop initials (Gehrmann forthcoming).

Table 4: PK *c- and *ɟ- minor syllable initials in modern Katuic languages

Proto-Katuic		Kriang Thataeng	Bru Tri	Katang Rueal	Ta'oiq	Kado	Kantu
*-ɗas	leap	căˑdɛh	săˑɗajʰ	hăˑɗajʰ	hăˑⁿtạas	tĭˑɗas	căn.das
*cnaa	food	căr.naa	săˑnaa	hăˑnaa	hăˑnạa	tăn.naa	căn.naa
*ɟləəŋ	leech (water type)	căl.lə̤əŋ	-	hăˑləaŋ	hăˑlə̤əŋ	-	ɟăl.lʌʌŋ

PK is reconstructed has having minor syllables comprised of oral stops followed by *r. Kriang has been conservative, retaining these types of minor syllables as /Căr-/. Ta'oi languages also retain PK minor syllable containing the rhotic but add an epenthetic vowel before the main syllable for bilabial and velar onsets, as in, /prăˑ-/, /krăˑ-/. Ta'oi palatal and alveolar onsets get dropped resulting in /răˑ-/, a pattern largely found in Bru languages for all *Cr.- minor syllables. This is not common in So, which shows a variety of strategies for reducing this type of minor syllables. Kuay and Katu show irregular development in this area and no useful generalizations can be drawn at this time. Pacoh languages merge *cr.- with *tr.- as /tărˑ-/ but are otherwise conservative. The following table illustrates this pattern of development.

Table 5: PK minor syllables initials of oral stop + *r in modern Katuic languages

Proto-Katuic		Kriang Thataeng	Bru Tri	Katang Rueal	Ta'oiq	Kado
*crɓɔh	beak	căr.bɔh	răm.ɓɔh	hăr.bɔh	ră.ɓ̤ɔh	tăr.ɓɒh
*krlaj	brother-in-law	kăr.laj	ră.laj	hăr.laj	krăˑlạj	kăr.laj
*krnaa	road	kăr.naa	ră.naa	hăr.naa	krăˑnạa	kăr.naa
*trləəŋ	walking stick	tăr.lɛ̤ɛŋ	ră.laəŋ	hăr.lʌʌŋ	hăr.lɔɔŋ	tăr.looŋ
*prɗas	scatter (of embers)	păr.dɛh	păr.ɗaʲ	păr.ɗaʲ	prăˑɗạas	păr.ɗas

Most Katuic languages do not contrast vowel quality in minor syllables. In such cases, a phonemic minor syllable vowel cannot be posited at all (Tebow II & Lew 2013, cf. Shaw 1993, Gafos 1999). However, in some Katuic languages, minor syllable vowel contrast is found. For example, whereas vowel quality is neutralized in closed minor syllables in Pacoh, /a, i, u/ are contrastive in open minor syllables (Alves 2006). Sidwell (2005) considers these to be innovations born out of "assimilatory processes" rather than retentions. A similar pattern applies to certain Bru languages like Katang Phin, where /a/ and /u/ contrast in open minor syllables with voiceless velar stop onsets, as seen in /ka.taa/ 'basket' vs. /ku.taa/ 'vomit' (Gehrmann forthcoming). In these languages, minor syllable vowels present with a greatly truncated inventory of permissible vowels, no length contrast and no register contrast, clearly indicating a more peripheral vowel position than main syllable vowel. Nevertheless, the possibility of vowel contrast of any kind in this position leads one to question whether these minor syllables actually are 'minor' syllables. More theoretical investigations into syllable weight and general word structure appear necessary here.

6 Summary and outlook

The historical development of the Katuic languages is on firm footing in most respects. The consonantal development is straightforward and well in hand, though the phonological interpretation of minor syllable nasals preceding stops and whether they are syllable nuclei, codas, or modifications of main syllable onsets is an area that has yet to be dealt with comprehensively. Related to this topic are the apparently contrastive minor syllable vowels seen in West Katuic and Pacoh languages. Their development out of assimilatory processes remains to be examined closely.

Great strides have been made in understanding the vocalism of the modern Katuic languages in a historical context but the atypical register development in Pacoh and the Ta'oiq languages Ong and Katang is not yet sufficiently explained. The vowel shifts that led to the register contrasts found in these languages have been established but more theoretical work is needed to shed light on the mechanisms that led to these cases of non-canonical registrogenesis, especially if they can be tied back into the received model.

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