Uvularized Vowels in Rongba Queyu: An Acoustic and Phonological Analysis

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Date: 2025-10-17T00:00:00+00:00

Abstract

From an articulatory perspective, "uvularization" refers to the retraction of the dorsum of the tongue towards the uvula, an articulatory gesture primarily caused by the contraction of the styloglossus muscle and related muscles (Evans et al. 2016). Although uvularization has traditionally been regarded as a feature of consonants in the world' s languages (e.g., Al-Tamimi & Heselwood 2011), in recent years scholars have discovered uvularization phenomena in vowels in some Tibeto-Burman languages, such as Qiang (Sun Tianxin & Yu Wensheng 2013; Evans et al. 2016), Xinlong Muya (Van Way 2018), and Queyu (Zheng 2023; Guan 2024). This paper aims to investigate the acoustic and phonological characteristics of uvularized vowels in the Rongba dialect of Queyu. Queyu (ISO 639: qvy) is an underdocumented Sino-Tibetan language primarily distributed in Litang County, Xinlong County, and Yajiang County of the Ganzi Tibetan Autonomous Prefecture in Sichuan Province, China (Lu Shaozun 1985). The vowel system of Rongba Queyu is relatively complex, comprising eight plain vowels, five of which have corresponding uvularized counterparts (Zheng 2023). The pairing of plain and uvularized vowels is supported by morphological evidence, such as the parallelism in verb vowel alternation patterns. As shown in the table below, in a parallel vowel alternation pattern, verbs become o or o when the subject is first-person singular, and correspondingly become e or e when the subject is second-person plural; additionally, uvularized vowels participate in vowel harmony processes. For example, the negative prefix m - undergoes assimilation by the uvularized vowel [o] of the following verb stem, surfacing as [ma]. This establishes that a is the uvularized counterpart of : m -t ó→[m´-t ˋ] 'neg.npst-drink.1sg' m -ro →[mà -ró] 'neg.npst-laugh.1sg' . Acoustically, compared to their plain counterparts, uvularized vowels exhibit a lower second formant (F2) and a greater distance between the third formant (F3) and the second formant (F2); perceptually, there may be substantial differences in sound quality between plain vowels and their paired uvularized counterparts. For instance, the plain vowel /e/ is phonetically realized as [ ], while its corresponding uvularized

vowel /e / is perceptually closer to the central vowel [ə]. These acoustic and perceptual differences are related to the physiological articulatory mechanism of uvularization: namely, tongue root retraction. Furthermore, the phonetic realization of uvularized vowels is influenced by the preceding consonantal onset, with subtle differences in sound quality that require careful attention to discern. Phonologically, through examining the distribution of uvularized vowels and related phonological processes, this study chooses to analyze uvularization as a vowel feature rather than a consonant feature. First, in terms of distribution, uvularized vowels, like plain vowels, can co-occur with consonants from all places of articulation (i.e., labial, coronal, and dorsal consonants). This distribution pattern differs from the partial opposition patterns in other languages of the world (such as "coronal emphatic consonants" in Jordanian Arabic, Al-Tamimi & Heselwood (2011)) or non-phonemic secondary articulations (e.g., the velarized lateral [ ] in English, Ladefoged & Maddieson (1996: 360-316)). This demonstrates that analyzing uvularization as a vowel feature better conforms to the principle of phonological economy; otherwise, the number of opposing consonants would double. Second, vowel harmony provides further evidence. The uvularization feature of vowels spreads leftward, extending from the verb stem to the prefix. That is: if the vowel of the verb stem is uvularized, then the directional prefix attached to that stem will also be fully uvularized; plain vowels do not trigger this change. For example: kə-t´→[ká-t̂] 'pfv-pour(water).1sg' kə-xt ´ →[qá - t `] 'pfv-ask.1sg' . Such evidence indicates that vowels divide into two natural classes: uvularized vowels can trigger vowel harmony, while plain vowels cannot. However, within the same syllable, uvularization appears to affect both vowels and consonants simultaneously. For example: when the vowel of a syllable is uvularized, the initial consonants x-, - in a consonant cluster are assimilated to uvular fricatives [-, -]: xpó → [pó] 'ice' ; z´ → [z´] 'cow' ; this suggests that uvularization may be a property of the entire syllable. Therefore, it remains to be determined whether uvularization should be considered a suprasegmental feature. From an areal perspective, similar secondary articulation phenomena also appear in neighboring languages, such as "velarization" (Sun 2000, 2004; Lin Youjing et al. 2012; Gong 2018), "pharyngealization"(Evans 2006; Chiu & Sun 2020), "tongue root retraction (RTR)" (Gao 2015), or "tense-lax" opposition (Huang Bufan 1991; Huang Yang 2023). However, whether these terms truly represent distinct articulatory mechanisms remains unclear. To further investigate these differences, it is necessary to employ ultrasound imaging and other methods to study their articulatory mechanisms. However, although acoustic description can provide objective evidence, the phonological status of these secondary articulation features must still be determined through phonological evidence such as phonotactics and related phonological processes. Detailed investigation and description of the vowel systems of these languages will help understand the origin and evolution of such systems in Tibeto-Burman languages.

Full Text

6. Conclusions and Outlook

Uvularization involves the retraction of the tongue dorsum toward the uvula, a gesture primarily caused by contraction of the styloglossus muscle and related musculature (Evans et al. 2016). Traditionally, uvularization has been analyzed as a consonantal feature, as exemplified by the "emphatic consonants" of Jordanian Arabic (Al-Tamimi & Heselwood 2011). However, recent scholarship has identified vowel uvularization in several Tibeto-Burman languages, including Mawo and Yunlinsi Qiang (Sun Tianxin & Yu Wensheng 2013; Evans et al. 2016), Xinlong Muya (actually a Hor dialect) (Van Way 2018), and Queyu, specifically in the Rongba (Zheng 2023) and Pubarong varieties (Guan 2024; 2025).

Queyu (also known as Choyul, ISO 639: qvy) is an under-documented Sino-Tibetan language spoken by approximately 7,000 ethnic Tibetans along the Yalong River in Yajiang, Xinlong, and Litang counties of the Ganzi Tibetan Autonomous Prefecture, Sichuan Province (Lu Shaozun 1985). The language is threatened, with some varieties even moribund (e.g., Tagong) (Roche 2018). Previous studies have employed different terminologies: Rongba (Zheng 2023) and Pubarong (Guan 2024; 2025) use "uvularization," while Tagong (Suzuki & Soman Wangmo 2019) uses "velarization." Earlier documentation does not mention this phenomenon (e.g., Lu Shaozun 1985; Wang Tianxi 1991; Nishida 2008). The present study draws on first-hand Rongba Queyu materials collected by the author in Litang County between 2021 and 2025.

According to Zheng (2023), the Rongba Queyu phonological system exhibits the following characteristics: the syllable structure is (C)(C)(C)V(T); monosyllabic words carry either high (marked as $\acute{\sigma}$) or low tone; and the vowel inventory comprises eight plain vowels and five uvularized vowels, totaling thirteen phonemic vowels without codas. A central question concerns how these five vowel pairs are matched.

Two phonological processes help establish the pairings. First, vowel harmony: the negative prefix m - alternates with [ma -] before uvularized vowels, demonstrating the pairing / -a /. Similarly, /o-o / and /ə-ə / pairs are evidenced through alternations, with /ə/ surfacing as an apical vowel [z] in certain contexts. Second, the parallelism in verb person agreement (vowel alternation) confirms pairings even when vowel qualities are dissimilar. In Patterns A1 and B1, first-person singular forms shift to o/o while second-person plural forms shift to e/e ; in Patterns A2 and B2, only first-person plural forms change to ə/ə . This systematic alternation helps identify the underlying vowel correspondences.

Minimal pairs in Rongba Queyu clearly illustrate the plain-uvularized contrast: /o/ vs. /o / (ko 'porcupine' vs. ko 'valley'), /ə/ vs. /ə / (t ó 'this' vs. t ó 'dirty'), /e/ vs. /e / (xpé 'Tibetan incense' vs. xpé 'leader/official'), / /

vs. / / (xp´ 'pancreas' vs. xp´ 'pus'), and / / vs. /a / (k k´ 'separate' vs. k á 'leather bag').

The acoustic analysis is based on recordings of a 47-year-old female speaker, Zerlham, born in Renda Village, Rongba Township, now residing in Litang County seat. The dataset comprises 25 minimal pairs (five pairs per vowel set), totaling 50 lexical items, each read three times in a natural style. Recordings were conducted on August 6, 2025, in the studio of the Litang County Media Convergence Center using a Sony ICD-UX575F recorder at a 44.1 kHz sampling rate. Acoustic parameters were extracted using Praat version 6.4.22 (Boersma & Weenink 2024). The minimal pairs followed a (C)CV structure where C represents coronal consonants.

Vowel segments were manually segmented and annotated in Praat. The first three formant values were extracted from the stable portion of each vowel using a Praat script that sampled ten data points per segment, which were then averaged. This yielded fifteen data points per vowel phoneme (three repetitions $\times$ five minimal pairs) for statistical analysis and visualization. Following Evans et al. (2016) on Qiang uvularization, the acoustic correlates examined were F1 raising, F2 lowering, and F3-F2 raising. Paired-sample t-tests on these measures for each vowel pair revealed statistically significant differences across all comparisons.

The acoustic analysis demonstrates consistent patterns across all five vowel pairs. For /o -o/, F1 increased by 44.66 Hz ($t(14)=8.007$, $p<0.001$), F2 decreased by 75.07 Hz ($t(14)=-4.384$, $p=0.001$), and F3-F2 increased by 264.57 Hz ($t(14)=4.340$, $p=0.001$). Similar significant effects were observed for /ə -ə/, /e -e/, / - /, and /a - /, with F1 raising, substantial F2 lowering (ranging from -446.20 to -904.87 Hz), and marked F3-F2 increases (ranging from 447.00 to 980.66 Hz). These results confirm that uvularized vowels exhibit lower tongue body position (F1↑), tongue root retraction (F2↓), and enhanced retraction (F3-F2↑).

Uvularization is best analyzed as a vowel feature rather than a consonantal one. Both plain and uvularized vowels freely combine with labial and coronal consonants, creating robust minimal contrasts. This differs fundamentally from consonantal uvularization/velarization, such as emphatic consonants in Jordanian Arabic (Al-Tamimi & Heselwood 2011) or velarized laterals in English [ ] (Ladefoged & Maddieson 1996). However, with dorsal consonants, a complementary distribution emerges: plain vowels co-occur only with velar consonants, while uvularized vowels co-occur only with uvular consonants. This pattern suggests that uvular consonants are best analyzed as dorsal consonants that are allophonically conditioned by following uvularized vowels.

Further evidence comes from vowel harmony processes. Uvularization triggers leftward harmony, spreading from the root to prefixes. This divides the vowel system into two classes: marked "uvularized vowels" that trigger harmony, and unmarked "plain vowels" that do not. For example, the perfective prefix kə-

remains plain before a plain vowel (kə-t´→[ká-t̀] 'PFV-pour.1SG') but becomes uvularized before a uvularized vowel (kə-xt´ →[qɔ́ - t `] 'PFV-ask.1SG'). Similarly, the prohibitive prefix t - alternates with [ta] in the same context.

The harmony process exhibits monovalence: plain vowels never trigger de-uvularization. Uvularization is a unary feature that can only spread, not be undone. For instance, when the uvularized root l´ 'herd' combines with the progressive suffix - o or the nominalizer -mə, the suffixes remain plain, showing that harmony is unidirectional and non-neutralizing. Similarly, s ó - 'three' + k´ 'CLS.block' yields [s ó -k´] 'three blocks' , and xn´ - 'seven' + ó 'CLS.bundle' yields [xn´ - ó] 'seven bundles' , with no rightward spreading.

Uvularization harmony can cross multiple morpheme boundaries, spreading from the root to one or more prefixes, as in kə-mə-xk´ →[qɔ́ -mɔ́ - q] 'PFV-NEG.PST-tie.up.1SG' . This raises the question of whether uvularization is a syllable-level or suprasegmental feature. However, the process is blocked at enclitic boundaries: the locative enclitic =xa 'LOC' does not cause uvularization of the host, as in ló xpe=xa →[ló xpe= a] 'tree=LOC', not *[ló xpe = a]. Thus, while uvularization can affect multiple segments within a syllable or phonological word, its domain is constrained by various factors, leaving open the possibility of a suprasegmental analysis.

The plain-uvularized vowel opposition is not unique to Rongba but appears across many Queyu dialects, including Pubarong (Guan 2024, 2025) and Youlaxi (author's field notes), though Tagong (Suzuki & Sonam Wangmo 2019) describes it as "velarization." The phonological behavior of Rongba uvularization closely parallels that of Pubarong (cf. Guan 2025), though the phonetic realization differs: /e / is heard as a central vowel [ə] in Rongba but as [æ] in Pubarong. Beyond Queyu, similar systems are found in Mawo and Yunlinsi Qiang (Evans et al. 2016). Related secondary articulations are reported in neighboring languages, variously labeled as "velarization" in Puxi Hor and Jiarong languages, "pharyngealization" in Hongyan Qiang and Northern Horpa, "retracted tongue root (RTR)" in Pengbuxi Muya, and "tense/lax vowels" in Shad Muya. Whether these labels represent distinct articulatory mechanisms remains an open question requiring further investigation.

In summary, the Rongba Queyu vowel system comprises two classes—plain and uvularized vowels. Phonetically, uvularized vowels exhibit raised F1, lowered F2, and increased F3-F2 values relative to their plain counterparts. Phonologically, uvularization functions as a unary/monovalent feature that can affect segments within a syllable and spread leftward across morpheme boundaries, though its scope is constrained and it cannot spread rightward. Regionally, uvularization and related secondary articulations are attested in surrounding languages, though their physiological underpinnings require clarification.

Future research should employ experimental techniques such as ultrasound imaging to disentangle the various terminological labels and uncover their articulatory basis. The sociolinguistic variation of uvularized vowels within speech com-

munities also warrants investigation, particularly as the feature appears to be fading among younger speakers, giving way to a plain-uvularized quality opposition. While acoustic analysis provides objective evidence, the phonemic status and systemic organization of vowels must be established through phonotactic and phonological process evidence, which will in turn illuminate the diachronic origins and evolution of uvularized vowels and the vowel system as a whole.

Note: Figure translations are in progress. See original paper for figures.