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Palatalization in Laomian: evolution and resistance

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Palatalization is a common phenomenon in the Laomian language of South-east Asia. This paper compares the phonetic bilabial, velar, and coronal consonants of Laomian and their counterparts in related languages. A phonological analysis of the evolution of palatalization in Laomian is provided from a feature geometry perspective using the frameworks of nonlinear phonology and Optimality Theory. The results show that bilabials in Laomian, like those in related languages, include only the simple palatalized form 'bilabial + glide j' without evolving into affricates. Velars, based on different functions of [i], evolve into prepalatals and 'velar + glide j' respectively. Alveolars turn into prepalatals before vowels with the [-back] feature. A limited set of words in Laomian can still be pronounced in two ways with consonants belonging to two categories, reflecting different evolutionary stages of phonetic chains.

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Introduction

Prepalatals and postalveolars[1] do not coexist in the vast majority of languages (Xu, 1998). In the Ngwi-Burmese languages, prepalatals dominate while postalveolars and midpalatals[2] are rare. The evolution of initial consonants in the Ngwi-Burmese languages includes the simplification of consonant clusters. Bilabial or velar plosives, the primary consonants, followed by fricatives as secondary (post) consonants, become affricates after palatalization (Xu, 1998). The speed of evolution varies according to the constraints of the initial consonant system of each language.

Within the Bisoid linguistic subgroup of Southern Ngwi (Bradley, 2015), Laomian and Bisu are very closely related while some scholars have classified Laomian and Laopin as language varieties of Bisu, which is distributed along the borders of China, Thailand, Burma, and Laos[3] (Xu, 1998). First discovered in the 1960s in northern Thailand (Nishida, 1973) and 1980s in China (Li, 1991), Bisu (and Laomian in China)[4] was determined to be a Ngwi-Burmese language belonging to the Sino-Tibetan family.

The phonetic category of *palatalization* is complex and has caused a certain amount of controversy. Zhang and Chen (2018) regarded palatalization as a natural category with uniform features of pronunciation and consistent phonological behavior, meaning that all sounds exhibiting these features and behavior can be classified into this category. Ladefoged and Johnson (2015) proposed a distinction between primary and secondary palatalization. The former refers to more palatal primary articulations, while the latter refers to primary articulations with a high frontal tongue position (like that in [i]), exemplified by [tj] and [kj]. Secondary palatalization often results from primary palatalization. All vowels in Laomian involve the tongue body, while the front vowels are also coronal. These two features of the front vowel (coronal or tongue body) are extended to adjacent consonants. Halle refers to the universal choice between coronals and dorsals as palatalization (Halle, 2005).

By comparing bilabial, velar, and coronal consonants in Laomian and their counterparts in related languages, this article provides a phonological analysis of palatalization in Laomian from a feature geometry perspective using the frameworks of nonlinear phonology and Optimality Theory.

The inventory of 2800 Laomian words includes 31 onset consonants composed of 25 single consonants and 6 palatalized consonant clusters. However, the classification in Table 1 does not capture the complementary/synchronic and evolutionary/diachronic relationships between the prepalatal [tɕ], velar [k], and alveolar [ts] groups.

The evolution of palatalization in Laomian

To investigate palatalization in Laomian, the phonetic bilabial, velar, and coronal consonants in Laomian were compared to their counterparts in other language varieties of Bisoid and other Burmic languages. The account of palatalization presented here draws on the approach proposed by Pan (2015) in *Historical Real-Time Sound Shifts as Reconstructed from Geographical Apparent Time*. This involved reconstructing real-time sound shifts in the history of Laomian from geographically projected distributions reflecting apparent sound changes over time.

Evolution within Bisoid subgroup. Laomian belongs to the Bisoid subgroup of the Ngwi Branch of Burmic in the Tibeto-Burman language family. Sangkong, Phunoi, and Côông are also included in this subgroup (Bradley, 2015). While Bradley (1979) maintained that Bisoid was unequivocally a Ngwi language, its relationships with Ngwi-Burmese are now believed to be more complicated. Laomian enjoys some similarities to Ngwi-Burmese, while at the same time maintaining its own unique features. This research aims to uncover Laomian's unique status by analyzing the phenomenon of palatalization. Laomian and Huai Chomphu, spoken by most Laomian people in China and Thailand respectively, were chosen for investigation because they contain fewer loan words than other varieties that have had closer contact with Thai and Dai (Xu, 1998). The Laomian data was gathered by Xu (1998) and one author of the current study while the Huai Chomphu data derives from prior work by Profs. Nishida (1988, 1989) and Bradley (1988).

Bilabial plosives. It is important to note that nasal and plosive onset consonants are interchangeable alternatives in some words. For instance, 'grass' is mo^{31}ka^{31} in Laomian but bo^{21}ka^{21} in Huai Chomphu; 'fire' is mi^{31}tho^{31} in Laomian and bi^{21}thɔ^{33} in Huai Chomphu. Such phenomena are also located within a single dialect. For example, in Laomian, 'sky' is pronounced muŋ^{31}/buŋ^{31} and 'no', ma^{31}/ba^{31}. For these reasons and to preserve compactness, [m], [b], and other voiced consonants are omitted from this paper.

Table 2 shows the corresponding bilabial plosives used in the consonant systems of the Laomian and Huai Chomphu dialects within the Bisoid subgroup and representative examples of these bilabials.

Within the Bisoid subgroup, as Table 2 demonstrates, the bilabials correspond to each other almost perfectly, except for the cluster [pl] in Huai Chomphu, which is [p] in Laomian. Alternative articulations of 'help' in Laomian demonstrate an evolution from consonant clusters to single consonants. The form 'bilabial plosive + glide [j]' is well preserved in both language

Table 1 Onset consonants in Laomian.

Manner\Place			Bilabial	Labio-dental	Front apical	Medial apical	Palatal	Velars
Stop	Unvoiced	Unaspirated	p			t		k
		Aspirated	ph			th		kh
	Voiced		b			d		g
Affricative	Unvoiced	Unaspirated			ts		tɕ	
		Aspirated			tsh		tɕh	
Nasal			m			n	ȵ	ŋ
Lateral						l		
Fricative	Unvoiced			f	s		ɕ	x
	Voiced			v	z		ʑ	
Palatalization			pj					
			phj					kj
			bj					khj
			mj					

Based on Xu (1998), cross-checked with authors' field data.

Table 2 Corresponding bilabials and representative examples[a] within the Bisoid subgroup.

Gloss	Laomian		Huai Chomphu	
Destroy	phj	phja^{33}	phj	phja^{33}
Bee	pj	pja^{31}	pj	pja^{21}
Fly		pjam^{55}		pjam^{55}
Monk	ph	pha^{33}	phl	phlaʔ^{33}
Silver		phu^{55}		phlu^{55}
Help	p/pl	plɔŋ^{31}/pɔŋ^{31}	pl/phl	plɔŋ^{21}
Full		aŋ^{33}pɯŋ^{33}		ʔaŋ^{33}plɯŋ^{33}
White[b]		aŋ^{33}pon^{31}		phlu^{33}

[a]The lack of contrastive minimal pairs is explained using Optimality Theory in the section "The phonological interpretation of palatalization in Laomian".
[b]In Laomian, aŋ^{33} (a prefix generally used with adjectives) can be deleted, especially when used together with other roots to form fixed expressions (Xu, 1998). Therefore, words with and without aŋ^{33}count as two variations of the same word within different contexts.

Table 3 (a) Corresponding velars and representative examples within the Bisoid subgroup and (b) corresponding velars and representative examples within the Bisoid subgroup (Supplementary).

Gloss	Laomian		Huai Chomphu	
(a)				
Crab	khj	u^{31}khja^{33}	khj	ʔu^{33}khja^{33}
Horn		aŋ^{33}khjau^{55}		ʔaŋ^{33}khjaw^{55} [a]
Needle	kj	khɯŋ^{31}kjau^{33}	kj	kɔŋ^{21}kjaw^{21}
Fear	kh	khe^{33}	kh	khɛ^{33}
Foot		la^{31}khɯ^{31}		la^{21}khɯ^{21}
Duck	k	a^{31}kau^{31}	k	ʔa^{33}kaw^{21}
Medicine		tshɿ^{31}ka^{31} /tɕhi^{33}ka^{33}		tsɯ^{21} ka^{31}
Clean		kɯŋ^{55}		kɯn^{55}
Tendon		aŋ^{33}ku^{3131}		ʔaŋ^{33}ku^{21}
Star		u^{31}kɯn^{33}		ʔu^{21}kɯ^{21}
(b)				
Fall down	k	ka^{33}	kl	kla^{33}
Slow		kam^{31}		klam^{21}
Exchange	kh	khai^{31}	khl	khlaj^{21}

[a][Ap] or [at] developed into [aw] or [au] in some Bisoid subgroups (Xu, 1998).

Table 4 (a) Corresponding coronals and representative examples within the Bisoid subgroup and (b) representative examples within Bisoid subgroup (complementary).

Gloss	Laomian		Huai Chomphu	
(a)				
Salt	tsh	tsha^{31}mɛ^{21}	tsh/ch[a]	tshɔ^{21}mɛ^{21}
People		tshaŋ^{55}		tshaŋ^{55}
Tiger		tsha^{31}la^{31}		tsha^{21}la^{21}
Sweet		aŋ^{33}tshau^{55}		ʔaŋ^{33}chaw^{55}
Eat	ts	tsa^{31}	ts	tsa^{31}
Fruit	s	aŋ^{33}sɿ^{31}	s/ʃ/hj	ʔaŋ^{33}sɯ^{21}
Three		sum^{55}		sam^{33}
Iron		sam^{55}		hjam^{55}
Meat		sa^{31}		ʔaŋ^{33}ʃa^{21}
Yellow		aŋ^{33}sɿ^{55}		ʔaŋ^{33}ʃɯ^{55}
Liver	tɕh	tɕhiŋ^{31}	khj/	tshɿ/ʔaŋ^{33}tshin^{21}
Ten		tɕhe^{55}	tsh/ch/	tshɛ^{21}
Sour		aŋtɕhin^{55}	tɕh	khjen^{55}/ ʔaŋ^{33}chen^{55}
Uncle (Mother's Brother)		a^{55}tɕhi^{55} /a^{55}tɕhe^{55}		ʔa^{33}che^{21}
Rice		ko^{33}tɕhin^{55}		kɔ^{33}chen^{55}
Bite		tɕhiɛ^{33}		tɕhiɛ^{33}
Straw	tɕ	la^{55}tɕi^{55}	c	la^{33}ce^{55}
Wet		aŋ^{33}tɕin^{55}		ʔaŋ^{33}cen^{55}
Kill	ɕ	ɕe^{31}	s/ʃ	sɛ^{21}/cat^{21}
Die		ɕi^{55}		ʃi^{55}
Blood		ɕi^{31}		ʃi^{55}
Seven		ɕit^{31}		ʃet^{55}
Louse		ɕin^{55}/ ɕen^{55}		ʃen^{21}
Pee		ʔɛ^{33}ɕi^{33}		ji^{21}ʃi^{21}
Pour		ɕit^{33}		ʃɛt^{33}
(b)				
deer	tɕhe^{33}/ tshɔ^{33}		tshɛ^{33}/chat^{21}	
medicine	tshɿ^{31}ka^{31}/ tɕhi^{33}ka^{33}		tsɯ^{21} ka^{31}	

[a]The counterparts [ts/tsh] in some language varieties match [c/ch] (closer to Burmese scripts).

varieties, while the evolution of 'bilabial plosive + liquid [l]' is characterized by a loosening and dropping trend.

Velar plosives. Tables 3a, b display the corresponding velar plosives, with representative examples, used in the consonant systems of the Laomian and Huai Chomphu dialects of the Bisoid subgroup.

The examples in Table 3a show that the velar plosives in each variety correspond closely to each other. As shown in Table 3b, however, in common with the bilabial plosives, the counterpart of the cluster [kl] in Huai Chomphu is [k] in Laomian. The presence of the alternatives [k]/[kl] and [kh]/[khl] demonstrates that Laomian has evolved with simplified onsets while Huai Chomphu has conservatively preserved the onset clusters kl- and khl-.

Coronals. Table 4a, b show the coronals of the consonant systems of Laomian and Huai Chomphu, with representative examples provided.

Within both language varieties, some examples correspond perfectly or exhibit systematic correspondences despite occupying different intermediate evolutionary stages: for instance, the counterparts of [c] in Huai Chomphu are [ts](+[+back] vowels) and [tɕ](+[-back] vowels) in Laomian. A couple of evolving forms based on one sound coexist, such as [ts] and [tɕ] in the Laomian Dialect, as can be seen in Table 4b. However, in Huai Chomphu, the presence of [ts] and [c] in the same environments demonstrates the evolutionary process. Moreover, the mismatch between the velar plosives [c] and [ch] and the velar fricative [ʃ] in Huai Chomphu probably indicates an intermediate stage of evolution: one category may evolve from velar to postalveolar or prepalatal plosives.

Summary. Relatively well-ordered and regular rows based on voiced/voiceless and aspirated/unaspirated features characterize the language varieties of Bisoid. Bilabials and Velars, with 'plosive + glide j' form, are preserved well and correspond regularly, while 'Velar plosive + liquid l' has evolved inconsistently, demonstrating different stages of evolution. Common affricates—such as prepalatals, postalveolars, and alveolars—can be found in these two language varieties. Two consonants, [ts] and [tɕ] in Laomian, occur complementarily, with [ts] + vowels with the [+back] feature coexisting with [tɕ] + those with the [-back] feature, showing an obvious trend of affrication. Alternatives to some words demonstrate the evolutionary process of affrication and the simplification of consonant clusters.

Comparison with evolution in the Ngwi

Bilabial plosives. Knowledge of palatalization in Laomian was extended by comparing it with other Ngwi languages (Hani, Lahu, and Lisu were selected due to their close links to Laomian). Table 5 shows the bilabial plosives used in the consonant systems

Table 5 Comparison of Bilabial plosives with representative examples from Laomian and other Ngwi languages.

Gloss	Laomian		Hani (Lvchun)		Lahu		Lisu	
destroy	phj	phja^{33}	phj	phja^{33}	ph	phɛ^{33}	ph	phu^{33}
bee	pj	pja^{31}	pj/bj	bja^{31}si^{55}	p/bj	pɛ^{53}ma^{33}qɛ^{21}	p	tɕuɑ̠^{33}pu^{33}
flat		pje^{31}		pje^{31}		bja̠^{33}		pa^{35}
fly		pjam^{55}		pjam^{55}		bjɔ^{55}		po^{31}
silver	ph	phu^{55}	ph	phu^{55}	phj	phju^{55}	ph	phu^{33}
full	p	aŋ^{33}pɯŋ^{33}	p	aŋ^{33}pɯŋ^{33}	phj/bj	bjɔ^{33}	ph/b	bi^{33}
white		aŋ^{33}pon^{31}		aŋ^{33}pon^{31}		phju^{55}		phu^{33}

Table 6 Comparison of Velar plosives with representative examples from Laomian and other Ngwi languages.

Gloss	Laomian		Hani (Lvchun)		Lahu		Lisu	
Horn	khj	aŋ^{33}khjau^{55}	khj	aŋ^{33}khjɔ^{55}	kh	khø^{55}	kh	ɔ^{31}khɔ^{33}
Needle	kj	khɯŋ^{31}kjau^{33}	g/ɣ	a^{31}ɣo̠^{31}	g/ɣ	ɣo̠^{31}	w	wo̠^{31}
Love		kja^{31}		ga^{31}		ga^{31}		wa^{31}
Dung	kh	o^{31}khɤ^{31}	kh/tɕh	tɕhi^{31}	kh/k	khɛ^{53}	kh/k/tʃh	tʃhi̠^{33}
Feet		la^{31}khɯ^{31}		la^{31}khɯ^{31}		a^{31}khɯ^{55}		khɯ^{55}ɕɛ^{33}
Fear		khe^{33}		khe^{33}		ku̠^{33}		kɔ^{54}
Gall-bladder		pi^{31}kha^{31}		phi^{31}khɯ^{55}		ɔ^{31}kɤ^{33}		tʃi̠^{33}
Star	k	u^{31}kɯn^{33}	k/g	u^{31}kɯn^{33}	g	a^{31}gɯ^{55}	k/g	mɤ^{21}kɤ^{33}
Clean		kɯŋ^{55}		kɯŋ^{55}		gɔ^{55}		kɛ^{31}
Tendon		aŋ^{33}ku^{31}		aŋ^{33}ku^{31}		sa^{31}gu^{31}		ɔ^{31}ku^{53}tɕa^{54}
Road		ke^{55}ba^{33}		ga^{55}ma^{33}		ʑɑ^{11}gɔ^{33}		dʑɑ̠^{33}gu̠^{33}

of the Laomian and other Ngwi languages, with representative examples displayed.

Bilabials in Laomian and their counterparts in other Ngwi languages have relatively neat correspondences according to the features of voiced(less) and (un)aspirated consonants. The data above show that Laomian is closer to Hani than other Ngwi languages from the perspectives of 'plosive + glide' consonant clusters and single consonants. In the Ngwi group, the form 'primary consonant + glide' is fundamental and the bilabials contain no affricates.

Velar plosives. Table 6 compares velar plosives in the Laomian consonant systems with three other Ngwi languages; representative examples are provided.

Velars in Laomian correspond to their counterparts in other Ngwi languages in terms of aspiration (aspirated vs. unaspirated) while the correspondence between the features of voiced and voiceless consonants is less straightforward: Laomian's aspirated voiceless consonants correspond mainly to their voiceless counterparts in other Ngwi languages, whereas the unaspirated voiceless consonants correspond to both voiceless and voiced equivalents in the languages used for comparison. The form 'primary consonant + glide' in Laomian sometimes corresponds to 'primary consonant + glide' in other Ngwi languages, and to single consonants that have undergone evolutionary modifications in others. Simplified consonants in Laomian are equivalent to similar forms, prepalatals, and postalveolars in other Ngwi languages. Though affricates have not yet formed systematically, affrication remains a feature of some of the languages—Lisu in particular (Wang, 2017).

Coronals. Table 7 shows the coronals, with representative examples provided, used in the consonant systems of the Laomian and other Ngwi languages.

Some representative examples with coronals as onset consonants were identified. In terms of aspiration, coronals in Laomian correspond closely to those of other Ngwi languages, while matters are more complex in terms of voicing. Aspirated voiceless consonants in Laomian mostly correspond to those of the other Ngwi languages, whereas its unaspirated voiceless consonants equate to both their voiceless and voiced counterparts in other languages, indicating the presence of a medial stage of evolution in the Ngwi languages. The coexistence of alternatives in the same language also demonstrates that evolution is occurring.

Several forms of evolution coexist: [ts] and [tɕ] in Laomian, for instance, occur complementarily: [ts] + vowels with [+back] feature, and [tɕ] + vowels with [-back] feature. In other Ngwi languages, the environments for [ts] and [tɕ] overlap (Hani), or only one group [ts] exists (Lahu), or an alveolar [ts], postalveolar affricate [tʃ], fricative [ʃ] and retroflex [ʂ] coexist within one language (Lisu). The mismatch of places to affricates and fricatives is indicative of a medial stage of evolution in which one category is evolving into postalveolars or prepalatals.

Summary. Relatively well-ordered rows with certain regularities in terms of voicing (voiced vs. voiceless) and aspiration (aspirated vs. unaspirated) exist within Ngwi. Bilabials and velars in the form of 'plosive + glide j' are preserved well in Laomian whereas in other Ngwi languages (except Lisu), 'bilabial plosive + glide j' remains well preserved while 'velar plosive + glide j' has evolved differentially (for instance, only bilabial plosives are retained in Lahu and only aspirated velar plosives in Hani). Some languages have retained their primary consonants due to irregular evolution, while these have evolved into prepalatals or postalveolars in others. Although affricates have not yet formed systematically, the trend toward affrication is apparent in some languages, and is particularly apparent in Lisu (Wang, 2017).

Two consonants in Laomian ([ts] and [tɕ]) occur complementarily, with [ts] + [+back] vowels while [tɕ] + [-back] vowels. Some words retain two alternatives: prepalatals or alveolars within different environments (tshɔ^{33}/tɕhe^{33}, 'deer', for instance), from which an evolutionary process explaining the development of Laomian can be inferred.

Table 7 Comparison of coronals with representative examples from Laomian and other Ngwi languages.

Gloss	Laomian		Hani (Lvchun)		Lahu		Lisu	
Sweet	tsh	aŋ^{33}tshau^{55}	tsh/ts	tshɿ^{55}	tsh	tshɔ^{33}	ts/	-
Suck		tshup^{31}		tsu̱^{33}		tshe̱^{31}	tʃh	tʃhi^{31}
Pinch		tshɿ^{31}		tsɿ̱^{31}		tsho̱^{53}		tsɯ^{55}
Drop	ts	tsak^{33} /tsaŋ^{33}	ts/dz	dza̱^{33}/tsa^{33}	ts/dz	dza̱^{53}/tsA^{54}	dz	dzE̱^{33}
Eat		tsa^{31}		dza̱^{31}		tsa̱^{53}		dza̱^{31}
Fruit	s	aŋ^{33}sɿ^{31}	s	sɿ^{31}	s	sɿ^{11}	s/x/ʃ	-
Three		sum^{55}		sɔ^{55}		s**E̱**^{53}		sa^{33}
Iron		sam^{55}		se^{55}		so̱^{33}		-
Meat		sa^{31}		sa^{31}		sa^{31}		xua^{31}
Yellow		aŋ^{33}sɿ^{55}		sɿ^{55}		sɿ^{55}		ʃi^{33}
Liver	tɕh	tɕhiŋ^{31}	tsh/ts/tɕh	tshɿ^{31}	tsh/ts	tshɛ^{31}	tsh/tʃh	-
Medi-cine		tshɿka^{31}/ tɕhi^{33}ka^{33}		di^{31}tshi^{31}		di^{53}tshi^{31}		de^{31} tʃhi^{33}
Deer		tshɔ^{33}/tɕhe^{33}		xe^{31}tse̱^{33}		khɯ^{35}zɿ^{31}		tshe^{55}
Ten		tɕhe^{55}		tshe̱^{55}		te^{53}tshi^{33}		tshɿ^{33}
Sour		aŋtɕhin^{55}		tɕhe^{55}		tsɿ^{33}		tʃhɯ^{33}
Old/ Used		tɕhe^{33}		tse̱^{33}/dʑe̱^{33}		tshe̱^{53}		tshe^{35}e^{33}
Straw	tɕ	la^{55}tɕi^{55}	ts/	tsɿ̱^{55}/dʑi̱^{33}	ts	tsɛ̱^{55}	tʃ	tʃɯ^{33}
Wet		aŋ^{33}tɕin^{55}	tɕh/dʑ	tɕe^{55}		tsɿ^{55}		tʃɯ^{33}
Kill	ɕ	ɕe^{31}	s/	se̱^{31}	s/t/ʃ	ti^{53}	s/ʃ/ʂ	se̱^{31}
Die		ɕi^{55}	th	sɿ̱^{55}		sɿ^{33}		ʃɯ̱^{33}
Blood		ɕi^{31}		sɿ̱^{31}		sɿ^{11}		sɿ̱^{31}
Louse		ɕin^{55}/ ɕen^{55}		ṯhan^{3}		ʃin^{21}		ʂa̱n^{31}

Table 8 Comparison of Bilabial plosives with representative examples from Laomian and other Burmic languages.

Gloss	Laomian		Burmese script		Zaiwa		Achang	
Destroy	phj	phja^{33}	py	pyat	phj/ pj	pjit^{21}/ phjit^{55}	pʐ	pʐat^{55}
Bee	pj	pja^{31}	pj/pr	pja^{3}	pj	pjŏ^{21}jaŋ^{21}	tʂ/phʐ	
		tʂua^{31}ɕaŋ^{31}		Flat		pje^{31}		pra3
pje̱n^{55}		phʐap^{55}						
Fly		pjam^{55}	pjam^{22}	taŋ^{21}		tʂam^{55}	Silver	ph
phu^{55}		phr	phrwe^{2}	phj		phjun^{51}	phʐ	phʐui^{55}
Full	p	aŋ^{33}pɯŋ^{33}	pr/phr	praŋ̥^{1}	phj/	pjiŋ^{55}	phʐ/	pʐəŋ^{35}
White		aŋ^{33}pon^{31}		phru^{2}	pj	phju^{51}	pʐ	phʐo^{55}

Comparative evolution of language features in Laomian and other Burmic languages

Bilabial plosives. To further extend our knowledge of palatalization in Laomian, we compared it to other Burmic languages (Burmese script, Zaiwa, and Achang). Table 8 shows the bilabial plosives used in the consonant systems of Laomian and other Burmic languages, with representative examples displayed.

The bilabials of Laomian and other Burmic languages do not correspond particularly closely when compared to the bilabials of Laomian and other Ngwi languages. This supports the hypothesis that Laomian has a closer relationship to the Ngwi group and indicates the length of its split from the other Burmic languages as well as its different rate of evolution. The form 'primary consonant + glide' is fundamental to Laomian, while in the other Burmic languages, 'primary consonant + ʐ/r/y' exists alongside 'primary consonant + glide'. No affricates are found in the bilabials of Laomian, in the Burmese script, or Zaiwa, but a trend toward affrication is displayed in Achang.

Velar plosives. Table 9 displays the velar plosives, with examples shown, used in the consonant systems of Laomian and three other Burmic languages.

The velars of Laomian correspond less closely to other Burmic languages than the other Ngwi languages, pointing to a closer relationship between Laomian and the latter group, a longer split from the other Burmic languages, and different rates of evolution. The form 'primary consonant + glide' is fundamental to Laomian, while in the other Burmic languages, 'primary consonant +ʐ/r' is the basic form, alongside 'primary consonant + glide'. The velars of Laomian have affricate counterparts in the other Burmic languages in the form of prepalatals and postalveolars. While affricates have not yet systematically formed, a trend toward affrication is apparent in some Burmic languages.

Coronals. Table 10 shows the coronals of the consonant systems of Laomian vs. other Burmic languages. Representative examples are also provided.

In Laomian, coronals correspond less neatly to the other Burmic languages than the other Ngwi languages. This shows that Laomian has a closer relationship to the Ngwi and has been long isolated from the other Burmic languages while evolving at a different rate. In Laomian, the two consonants [ts] and [tɕ] occur complementarily in the form [ts] + vowels with the [+back] feature and [tɕ] + those with the [-back] feature. In some Burmic languages, fricatives can overlap in the environments for [ts] and other affricates, possibly demonstrating an intermediate evolutionary stage. Some words maintain two alternative meanings in Laomian, such

Table 9 Comparison of velar plosives with representative examples from Laomian and other Burmic languages.

Gloss	Laomian		Burmese script		Zaiwa		Achang	
Horn	khj	aŋ^{33}khjau^{55}	khj	khjo^{2}	khj	khjui^{51}	khʐ	khʐau^{35}
Needle	kj	khɯŋ^{31}kjau^{33}	khʐ	ap^{vii}	tʃ	ap^{55}	kʐ	ap^{55}
Love		kja^{31}		khjɑs		tʃit^{55}		kʐa^{31}
Fear	kh	khe^{33}	kr/khr/khj[a]	krɔk^{4}	kj/khj	kjuʔ^{21}	ʐ/tɕh	ʐoʔ^{55}
Dung		o^{31}khɤ^{31}		khje^{3}		khji^{21}		tɕhi^{31}
Feet		la^{31}khɯ^{31}		khre^{2}thɔk^{4}		khji^{51}		tɕhi^{55}
Gall-bladder		pi^{31}kha^{31}		tɵɑŋ̥^{3}khre^{2}		siŋ^{21}kji^{51}		saŋ^{31}tɕhi^{35}
Road	k	ke^{55}ba^{33}	kr	lam^{3}	kj/khj	khjo^{51}	kʐ/khʐ	xa^{55}mʐua^{31}
Clean		kɯŋ^{55}		kraŋ̥^{2}		kjiŋ^{21}		kʐəŋ^{31}
Tendon		aŋ^{33}ku^{31}		a^{1}krɔ^{3}		ʃŏ^{21}kji^{21}		a^{31}kʐə^{31}
Star		u^{31}kɯn^{33}		kraj^{2}		kji^{51}		khʐə^{55}

[a]This suggests the underlying form may be *Kr- with *Kr- > kj- in Zaiwa and Achang, with subsequent palatalization and simplification in Laomian. In other words, the underlying proto-language had both *Kr- and *Kj- onsets.

Table 10 Comparison of coronals with representative examples in Laomian and other Burmic languages.

Gloss	Laomian		Burmese script		Zaiwa		Achang	
Sweet	tsh	aŋ^{33}tshau^{55}	s/hs/khj	khjo^{2}	tsh/tʃh/	tʃhui^{21}	tɕh/tʂ	uai^{31}
Suck		tshup^{31}		–	tʃ	tʃup^{55}		tʂɔp^{55}
Pinch		tshɿ^{31}		sok		tshik^{55}		tɕhɔm^{55}
Drop	ts	tsak^{33} /tsaŋ^{33}	s	sak	ts/ tʃ	–	ts/tɕ	tɕɔk^{55}
Blind		tsu^{55}		–		tʃit^{21}		tset^{55}
Salt		tsa^{31}mɛ^{21}		hsa^{3}		i^{31}tʃum^{31}		tɕhɔ^{31}
Eat		tsa^{31}		sa^{3}		tso^{21}		tɕɔ^{11}
Fruit	s	aŋ^{33}sɿ^{31}	th	thas	ʃ/s	ʃi^{21}	ʂ/s	ʂə^{21}
Three		sum^{55}		tɵõ^{53}		sum^{21}		sum^{31}
Medi-cine	tɕh	tshɿka^{31}/ tɕhi^{33}ka^{33}	tʃ/th/hs/khj	hse^{3}	tsh/s/tʃ	–	ts/tɕh/ʂ	–
Deer		tsɔ^{33}/tɕhe^{33}		thɑ^{1}		tshat^{55}		tɕ^{h}et^{55}
Liver		tɕhiŋ		thɑŋ̥^{3}		siŋ^{21}		ʂəŋ^{21}
Dest-roy		tɕhe^{33}		tʃo^{53}		tʃeʔ^{21}		tseʔ^{55}
Ten		tɕhe^{55}		hsaj^{2}		tshe^{51}		tɕhe^{55}
Sour		aŋtɕhin^{55}		khjaŋ̥^{2}		tʃin^{51}		–
Straw	tɕ	la^{55}tɕi^{55}	hs/kj	hsa^{2}	s/tʃ	tsi^{55}	tɕ	tɕi^{55}
Wet		aŋ^{33}tɕin^{55}		kjaŋ̥^{2}		tʃin^{55}		tɕɔ^{55}
Kill	ɕ	ɕe^{31}	tɵ/th/thw	that/tθaʔ^{55}	s/ʃ/ɕ	sat^{55}	s/ʃ/ʂ	sat^{55}
Die		ɕi^{55}		the^{2}		ʃi^{51}		ʂɿ^{55}/ɕi^{35}
Blood		ɕi^{31}		thwe^{3}/tθui^{53}		sui^{21}		sui^{31}
Louse		ɕin^{55}/ ɕen^{55}		than^{3}		ɕin^{21}		ʂan^{31}

as ‘medicine’ and ‘deer’. Prepalatals or alveolars with different environments coexist, from which an evolutionary process to explain Laomian might be inferred.

Consonant clusters exist in the other Burmic languages, including ‘primary consonant + glide’ and other clusters. These correspond with the alveolars and prepalatals [ts] and [tɕ] in Laomian. Some affricates in Laomian correspond to non-affricates in the other Burmic languages in certain cases, but on the whole, the trend toward affrication is very obvious (Xu, 1998).

The phonological interpretation of palatalization in Laomian

Nonlinear phonology analysis. The framework of nonlinear phonology clarifies the palatalization process very effectively. Data collected by Xu Shixuan (1998) and one author of the present study (Zhang, 2016) indicate that alveolars and prepalatals coexist and can be used alternatively in Laomian, as represented by the examples ‘deer’ (‘tɕhe^{33}/ tshɔ^{33}’) and ‘medicine’ (‘tshɿ^{31}ka^{31}/ tɕhi^{33}ka^{33}’, etc.) shown in Table 4b. What makes this interesting is the coordination between initial consonants and vowel finals that meets the rule in Laomian ‘[ts] + vowels with the [+back] feature, [tɕ] + those with the [−back] feature’. This shows that alveolars and palatalization alternate in the synchronic environment and demonstrates their close relationship. From the perspective of feature geometry, nonlinear theory can be used to view this process more clearly (see Fig. 1).

Figure 1 shows that the front [i] passes its feature [−back] to the neighboring alveolar consonant, which is palatalized to become a prepalatal [tɕ] after combining the feature [−back]. Nonlinear theory could also be used to analyze the palatalization of velars, but it encounters the issue that palatalization as a phonological process, and affrication as a phonetic process, are separate aspects of language change and are triggered by different factors. Affrication is context-free and proceeds differently in different languages (Kochetov, 2016).

Optimality Theory (OT) analysis. Palatalization, grounded in phonetics, both articulatory and acoustic, is a conflict resolution strategy. Kochetov (2016) points out that fronting and raising the tongue body conflicts with gestures that articulators execute to produce consonants requiring various places and manners of articulation. He further argues that the sequence of a consonant plus a front vowel or a glide is both acoustically and perceptually

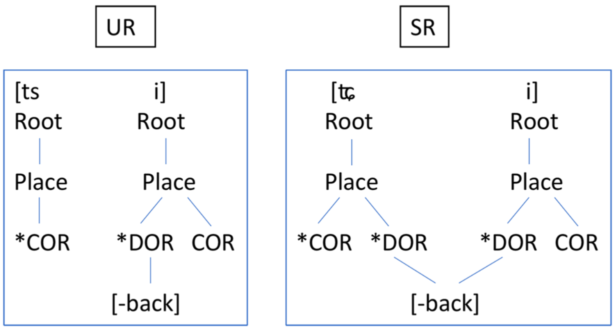

Fig. 1 Nonlinear analysis of [ts]→[tɕ] (* represents the primary pronunciation place). UR represents underlying representation; SR represents surface representation; COR represents coronal; DOR represents dorsal.

Table 11 Surface coronal and dorsal[a] obstruents in Laomian.

	Coronal						Dorsal			
	ts	tsh	s	tɕ	tɕh	ɕ	kh	k	khj	kj
Back/hard	+	+	+	−	−	−	+	+	−	−
Continuant	−	−	+	−	−	+	−	−	−	−
Anterior	+	+	+	−	−	−				
Strident	+	+	+	+	+	+				

[a]Synchronically, only 'velar plosive + glide' clusters and not 'velar fricative + glide' clusters are found in Laomian, [x]. Thus, its representative examples are not listed in this paper.

problematic 'as front vowels tend to obscure phonetic cues to place of articulation and induce affrication, ultimately leading to perceptual confusion' (Kochetov, 2016, p. 4; see also Rubach, 2019, p. 1427).

Table 11 is a phonetic inventory that includes only coronals and dorsals; labials are excluded because all the labials in Laomian and other related languages only take the form 'labial stop + glide j' without affrications. The description below follows the Halle–Sagey model of feature geometry (Halle, 1992; Sagey, 1986), in which the features [±anterior] and [±strident] are dependents of the coronal node and cannot be applied to dorsals.

All consonants in the table occur in the surface representation, with representative examples provided in section 2. Table 11, based on feature theory, depicts only the synchronic state but not the complementary/synchronic and evolutionary/diachronic relationships between the prepalatal [tɕ], velar [k], and alveolar [ts] groups. Furthermore, it cannot explain why palatalized postalveolars [tʃ] are absent from Laomian (the prepalatal [tɕ] and postalveolar [tʃ] share many features). Sidestepping the exact nature of the relevant phonetic property and assuming Rubach's (2019) method, the following segment inventory constraints are used to differentiate between the prepalatal [tɕ] and postalveolar [tʃ] groups:

(1)

a. *[tɕ]: No hissing prepalatals *[tɕ dʑ ɕ ʑ].

b. *[tʃ]: No hushing postalveolars *[tʃ tʃj dʒ dʒj ʃ ʃj ʒ ʒj].

OT holds that Laomian palatalization is driven by markedness constraints[5] with individualized triggers.

(2)

a. PAL-i: A consonant and a following high vowel must agree in [±back].

b. PAL-e: A consonant and a following mid vowel must agree in [±back].

The PAL (palatalization) constraints mandate agreement in the feature [±back]. For instance, if the consonant in the output [Ci] has the feature [+back], i.e., hard, while the vowel is [−back], i.e., fronted, then PAL-i is violated. This violation can be removed in the following ways: first, palatalization, Ci → Cji, would require switching the [+back] consonant to [−back] to match PAL-i; second, retraction, Ci → Cɨ, would require the vowel to take the feature [+back]. However, OT requires that the operation of markedness constraints—here, the constraints in (2)—are controlled by faithfulness constraints, which require the features of the consonant input to be preserved by a corresponding output feature.

(3)

a. ID-C[+back]: [+back] on the consonant in the input must be preserved by a corresponding consonant output feature.

b. ID-C[−back]: [−back] on the consonant in the input must be preserved by a corresponding consonant output feature.

c. ID-V[−back]: [−back] on the vowel in the input must be preserved by a corresponding vowel output feature.

d. ID-V[+back]: [+back] on the vowel in the input must be preserved by a corresponding vowel output feature.

As mentioned earlier, palatalization is a conflict resolution strategy. To solve the conflict with velars in Laomian, two different kinds of palatalization occur depending on whether 'i/e' functions as a single final or a nucleus. Thus, in the form [i/e] + consonant finals, group [k] evolves to group [tɕ], thereby explaining why only [tɕi] and [tɕe] can be found in Laomian; when finals (rhyme) start with a head vowel [i], group [k] evolves to group [kj] with the form 'velar + glide'. Because [i] occurs in these two environments, PAL-i, rather than PAL-e, is used to analyze how velars become prepalatals; PAL-ia is chosen to represent all possibilities in Laomian, (i.e., diphthongs and tetraphthongs[6] such as [ia/iu/iam/iau/iaŋ/iap]), to analyze how velars become [velar + glide].

(4)

a. Phonemic Velar: Palatalization kh, k → tɕh, tɕ /_ i

b. Surface Velar: Palatalization kh, k → khj, kj /_ ia

The terms *surface* and *phonemic velar* (also described as "first velar palatalization' in generative literature; 'first' would suggest 'second' velar palatalization) front posteriors to dentals that are lacking in Laomian and are named according to the intensity of change. The former turns velars into prevelars with only minor alterations, while the latter makes profound changes by turning velars into strident coronals with totally different places and manners. PAL constraints (see above) can be removed in two ways: First, palatalization, Ci → Cji, and second, retraction, Ci → Cɨ. If the vowel retracts, then the possible process would be i → ɨ /ə. However, this action is blocked in Laomian, which has no ɨ /ə. Thus, the repair of the violation in [Ci] is implemented as palatalization rather than vowel retraction. From the analysis above, there is one thing for sure: ID-V [-back] is ranked higher than PAL-e and ID-C [+back]. In what follows, vowel retraction candidates such as [kɨ] are excluded from the input /ki/.

1dlcPAL-i drives the alternations in 4a, which also expresses a general palatalization process that affects not only velars but also alveolars. First, the palatalization of velars is analyzed. The outputs of palatalization before i are phonetically 'soft' consonants with the [−back] feature. This process occurs when the feature [−back] from /i/ spreads to the onset consonant and is thus expected as palatalization spreads to the consonant. To ensure that /khi, ki/ change into [tɕhi, tɕi], rather than other segments—especially not /khj, kj/, which satisfy PAL-i through the feature [-back]—the following constraints should be ranked higher to guarantee that [tɕhi, tɕi] are produced.

(5)

a. *khj: not khj

b. *kj: Not kj

Prince and Smolensky (2004) proposed the default ranking from the point of view of language typology to be *LAB, *DOR » *CORON. Based on this view, the default would be /tji thji/ as coronals are less marked than labials, and anteriors are preferred to posteriors. However, the facts of Laomian do not follow this tendency, because palatalized coronals are preferably posterior ([-anterior]). Therefore, the following segment inventory constraint should be added to guarantee that /tji thji/ does not emerge as the 'victorious' candidate:

(6) Posteriority (POSTER). Palatalized coronals must be posterior ([-anterior])

After excluding other possible candidates, /tɕh, tɕ/ and /tʃhj,tʃj/ satisfy the constraints above by sharing feature [+strident] and [−back]. The final group that emerges is [tɕh, tɕ] in Laomian, which can be achieved by ranking a. * [tʃ] higher than b. * [tɕ] in (1) above. The roadmap for the palatalization of /khi, ki/ to [tɕhi, tɕi] is now almost prepared—but turning dorsals into coronals violates IDENT-Dor.

(7) ID-Dor: The dorsal node on the input segment must be preserved on a correspondent of that segment in the output.

(8) /ki/[7]→ [tɕi]

	*kj	ID-V	PAL-i	POSTER	*[tʃ]	*[tɕ]	ID-DOR	ID-C[+bk]
ki			*!					
kji	*!							*
tji				*!			*	*
☞ tɕi tɕi						*	*	*
tʃi			*!		*		*	
tʃji					*!		*	*
ku[a]		*!						

[a]As well as violating ID-V, this conflicts with the existing form of the language.

As can be seen from (8), obedience to PAL-i produces [tɕi], a soft [−back] consonant. This is because PAL-i ranks higher than ID-C, which nonetheless violates ID-C [+back]. One thing that should be pointed out is the presence of a few [ki] sequences in Laomian, such as *phoŋ^{31}ki^{55}* ('dustpan'), *za^{31}ki^{55}* ('kid'), and *kaŋ^{31}pha^{31}kiŋ^{55}suŋ^{33}* ('vegetable farm'). This may be related to factors such as the periodical characteristics of a certain rule and the impact of language contact. Determining which sequence is fundamental requires further diachronic study.

Second, the evolution from alveolars to prepalatals would be analyzed based on 4 (a). To support this claim, the /tse/→ [tɕe] process is listed below. Only one constraint below differs from that of /ki/→ [tɕi]. To ensure that /tse/ becomes [tɕe], and no other segment—particularly not /tshj/ nor /tsj/, which satisfies the PAL-i constraint by sharing [−back]—the following constraint must rank highly so it is not dominated by the segment inventory constraints in (9):

(9)

a. *tshj: Not tshj

b. *tsj: Not tsj

(10) /tse/→ [tɕe]

	*tsj	ID-V	PAL-i	POSTER	*[tʃ]	*[tɕ]	ID-DOR	ID-C[+bk]
tse[a]			*!					
tsje	*!							*
tje				*!			*	*
☞ tɕe tɕe						*	*	*
tʃe			*!		*		*	
tʃje					*!		*	*
tso[b]		*!						

[a]The form [tse] is only found in loan words in Laomian, such as *city* 'tseŋ^{31}sɿ^{435}'.
[b]As well as violating ID-V, this conflicts with the existing form in the language.

In Laomian, [tsɿ] is not treated as vowel retraction. The current study holds that the palatalization of consonants, rather than vowel retraction, is used to repair violations of PAL constraints. The method by which the [i, ɿ] issues are resolved in Chinese also applies here (scholars of Chinese commonly hold that the vowel final /i/ occurring after Jing Series initial consonants evolved into /ɿ/ (Wang, 1980, p. 163). In Laomian, [i, ɿ] share the same origin as Chinese, in which [ɿ] evolved from [i] due to assimilation. The position of [ɿ] in the vowel shape is further back than [i], with feature [+back], allowing it to coordinate with [ts] (which shares the [+back] feature), while [ts] preceding [i] is palatalized and becomes a prepalatal [tɕ].

For (4) b, PAL-ia is chosen to represent all possibilities in Laomian (i.e., diphthongs and tetraphthongs[iii], such as [ia/iu/iam/iau/iaŋ/iap]), thereby allowing velars to become [velars + glide]. Based on the ranking scheme proposed by Shi Feng (2008), finals with a head vowel are ranked #2 (diphthongs), while those with a head and a tail vowel rank #4 (tetraphthongs). The route by which velar *k* can become prepalatal *tɕ* is blocked because ID-DOR ranks high, which blocks all candidates with non-velar initials. This consequently produces several changes. First, the constraints *[tʃ] and *[tɕ] play no role at all and are omitted here; PAL-ia, rather than PAL-i, works. Thus (5), to be more specific, could be expressed as follows:

(11)

a. *khji: Not khji

b. *kji: Not kji

Based on (11), any forms with the simple final [i] or finals with [i] as a head vowel are not viable winners in the evaluation. Moreover, the head vowel [i] cannot be deleted (i.e., /kia/ would not win out in satisfying PAL-ia after the deletion of [i].)

(12) *DEL: No deletion of head vowel i

(13) /kia/ → [kja]

	*kji	ID-V	PAL-ia	ID-DOR	DEL	ID-C[+bk]	ID-V
kia			*!			*	
kjia[a]	*!					*	
☞ kja kja						*	
tɕia				*!		*	
tʃia			*!	*!			
tʃjia				*!		*	
ka					*!		*
kua		*!					*

[a]This paper follows autosegmental theory, in which the glide j is viewed as a vocalic melodic segment [i] that lacks a mora. Therefore, [kja] is not treated as a form with a deleted head vowel [i] and does not violate ID-V.

In the process of surface velar palatalization, because [i] occurs as a head vowel rather than a monophthong and is not placed at the nuclear position, the ranks of marked constraints and faithfulness change. Within these two kinds of palatalization ('Bilabial plosive + glide j' and 'Velar plosive + glide j'), there is neither malposition nor deletion of the former type due to the latter as the two occur in different environments. It seems the two forms of palatalization share the same driver, [i], but that [i] play different roles in the finals. The undominated position of ID-C [+back] in both types guarantees the overall success of palatalization in Laomian.

Conclusion: evolution and resistance

The analysis presented in this paper suggests that the correspondence between bilabials, velars, and coronals is closest among Bisoid subgroup, followed by that between Bisu and other Ngwi languages, with these features of Laomian and other Burmic languages corresponding the least. 'Bilabial plosive + glide j' and 'Velar plosive + glide j' in Laomian have different counterparts in other Ngwi and Burmic languages, with various evolutionary stages and pathways shaped by different factors. In general, glide j in Laomian could correspond with glide j, liquid r, or even l in other related languages, which could be analyzed from the perspective of articulatory phonetics because consonants are dominated by palatalization, dentalization, rhoticity, and labialization, etc. Liquids are prone to combine with plosives, forming 'plosive + liquid' clusters, after which a complex sequence of linear or nonlinear evolution could follow. These evolving forms can typically be shown as basic consonants with slackness, peripheral consonants with attribution mapping, or common affricates with palatalization or coupling, highlighting the multi-dimensionality and versatility of liquids (Wang, 2017).

Constrained by the phonological system of one language, the generation, and distribution of affricates conforms somewhat to geographic space (with other language varieties and related language branches), retaining different stages of the diachronic evolution of speech over time. This could enable researchers to identify possible evolutionary paths and forms to better understand the status of Laomian in the consonant system of the Ngwi group. Such research would help identify Laomian's relationship with those in the same and neighboring groups.

A common sound shift chain is proposed by Pan (2015) in 'Historical Real-Time Sound Shifts as Reconstructed from Geographical Apparent Time', as shown in Fig. 2.

The chain could be used to explain 'bilabial/velar plosive + glide' and the possible evolution of alveolars and prepalatals in Laomian. Based on this sound shift chain, three rules related to Laomian consonants can be extrapolated.

Rule I: Consonant+l → consonant+j. If lateral l is located before palatalized sounds, it tightens back to become ʎ, which tightens further to become j, with the complete evolutionary sequence as follows: j-:l->ʎ->j-. This sound shift chain is matched in a few words of Laomian containing the onset consonant group [pl], alternating with the group [p]. It is also shown by the abundance of the group [pl] in the Huai Chomphu, and the well-ordered correspondence of the [pj] and [kj] groups between the Bisoid language varieties and between Laomian and the other Ngwi and Burmic languages. Additionally, it is somewhat visible in the correspondences between the Laomian and Burmese script. The fact that several forms in the Burmese script correspond to one form in Laomian shows that the natural process of evolution from 'plosive + liquid' to 'plosive + glide' remains incomplete, with some ancient sounds retained. As Tables 8 and 9 show, for instance, 'pj / pr' in Burmese script corresponds to 'pj' in Laomian; 'phr' corresponds to 'ph'; 'pr' corresponds to 'p'; 'kr/khr/khj' corresponds to 'kh'; and 'kr' corresponds to 'k'. The coexistence of 'plosive + liquid' and 'plosive + glide' in Burmese script with regular correspondences in other related languages is an indicator of this evolutionary process.

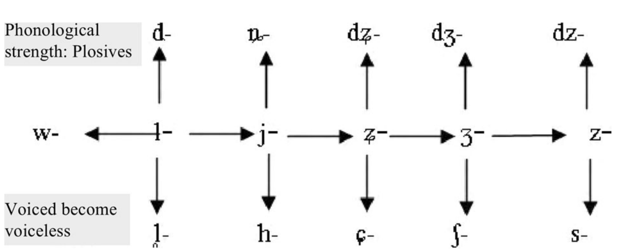

Fig. 2 A common sound shift chain. It is a chain of sound shifts often seen in various languages. The upper part represents the process of phonological strength: plosives; the lower part represents the process of the voiced becoming voiceless.

The [pj] and [kj] groups in Laomian can be followed by a few vowels (among the 2500 words collected by Prof. Xu Shixuan (1998) and the 4000 we gathered in the field, only [a, u, au, am, aŋ, and ap] can follow these groups), and share certain environments with [p] and [k] while complementing them in the following environment: Groups [p] and [k] can add [i] (when [i] is a single final or when serving as a nucleus, namely, in the form [i] + consonant final) whereas [pj] and [kj] groups cannot add any [i] or [i + consonant final] as no compound finals like [iu] or any [i + other vowels] exist in Laomian. The possibility cannot be excluded that all finals (rhymes) with a head vowel [i] such as [ia/iu/iam/iau/iaŋ/iap] may trigger palatalization of the initial consonants, while nothing would change when [i] is a single final or in the form [i + consonant final].

Rule II: Peripheral placings enlarge distinctions and increase phonological strength. The expression *j->ʑ-* represents the trend to peripheral (upper) areas while *ʑ-> ʒ-> z-* represents the trend to peripheral (front) areas. For communicative convenience, larger distinctions impart greater force, enabling syllables to be discerned more readily. Plosives, fricatives, and affricates are peripheral initials (onset consonants) that rank highly in terms of phonological strength, as proposed by Hock (1986, p. 22).

Rule III: Voiced become voiceless, marked become unmarked. This rule means that [ʑ-] becomes [ɕ]. Many scholars have proposed that 'plosive + liquid' clusters ('bilabial + liquid' and 'velar + liquid') support a trend toward affrication and are the main source of affricates in the Tibetan-Burman group (Wang, 2017). Taking Laomian, other Ngwi, and Burmic languages into account, one possible evolutionary path may be 'kj > kʑ > (affrication) > tɕ'.

The form 'plosive + glide' in Burmese script, while very limited, corresponds to prepalatals or alveolars in Laomian and other related languages, such as 'sweet', 'sour', and 'wet' (see Table 10), which lays clues to the evolutionary path just mentioned. Furthermore, two alternatives (khjen^{55}/ʔaŋ^{33}chen^{55}; see Table 4a) exist for 'sour' in Huai Chomphu. As mentioned earlier, the mismatch of the velar plosives [c][ch] and velar fricative [ʃ] in Huai Chomphu probably indicates a medial stage of evolution: one category may evolve from velar plosives to postalveolar or prepalatal plosives. Despite the limited number of representative words to support the feasibility of this claim, the inferred evolutionary path is both viable and verifiable.

Two consonants, [ts] and [tɕ] in Laomian, occur complementarily as [ts] + vowels with the [+back] feature, [tɕ] + those with the [−back] feature. The environments for the [tɕ] group are highly limited (only [i] and [e] were identified from the data collected). According to Wang Limei (2017), such limited prepalatals may be partly derived from *ts in the Ngwi-Burmese common language period and may also arise from the 'plosives + glide' cluster. Although both [+back] and [−back] vowels can currently be added after the velar [k] group, the periodical characteristics of a certain rule and the impact of language contact cannot be ruled out definitively, leaving those [k] + [−back] vowels intact, according to this rule. Further study is required to confirm the roles and proportions of the *ts group and 'plosives + glide' cluster in historical changes to the sounds of Laomian. 'Plosive + glide' and 'plosive + liquid' consonant clusters, as well as other forms in related languages tend to move from voiced to voiceless, from more complex to simpler structures, and from clusters to single consonants with greater distinction and phonological strength.

A synchronic perspective to the analysis might also be taken. Linguistic evolution is socially driven and may include different phonetic forms arising in different regions due to migration, intermixing of ethnic groups, environmental changes, and the historical presence or absence of ethnic characters. Lacking a character-based writing system, Laomian has always been orally transmitted. The evolution of the phonetic components is closest to that of the third-class characters in Middle Chinese. Therefore, language contact with Chinese cannot be ruled out as a factor in its development.

After the division of four-Hu in Modern Chinese, labial-dental, front apical, and retroflex initial consonants can be coordinated with Kai and He Hu, but not with Qi and Cuo Hu. Conversely, prepalatals can only coordinate with Qi and Cuo Hu, but not with Kai and He Hu, which is why velars and alveolars in front of [i] and [y] become j, q, and x (IPA: tɕ, tɕh, and ɕ), which can coordinate with vowels with the [−back] feature.

Prepalatals in Laomian have two origins: one velar and the other alveolar. When [i] is a single final or when it serves as the nucleus ([i] + consonant finals), velars and alveolars undergo phonemic velar palatalization, and become prepalatals. Based on the different functions of [i], velars evolve into prepalatals and 'velar + glide j' respectively after experiencing phonemic and surface velar palatalization. When [i/e] is a single final or when it functions as the nucleus, obedience to PAL-i produces [tɕi], a soft [−back] consonant because PAL-i ranks higher than ID-C, which nonetheless violates ID-C [+back]. When finals (rhyme) start with a head vowel [i], group [k] evolves to [kj] in the form 'velar + glide'. The passage by which velar *k* becomes prepalatal *tɕ* is blocked because ID-DOR ranks high, which disqualifies all candidates with non-velar initials. Moreover, the PAL-ia constraint, rather than PAL-i, operates in this environment.

Under suitable conditions, all candidates would be palatalized in groups. However, there are some exceptions in Laomian, which is surrounded by other prominent languages because it has borrowed directly or changed the original pronunciations to match the borrowed ones, or because of the time lag arising, for example, when a pattern was established before the borrowing process occurred. Ultimately, the choice between evolution or stasis would be made by the language users—but this choice is not natural and is influenced by multiple factors.

Data availability

All data generated or analyzed during this study are included in this published article.

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Notes

1 'Prepalatal' is more common in the Sino-Tibetan family and "postalveolar" in the Indo-European family. 'Palatal' could be further divided into the three groups of 'prepalatal', 'midpalatal', and 'postpalatal' depending on the relative position (Ye and Xu, 1997). However, 'prepalatal' is used interchangeably with 'palatal', and 'postpalatal' with 'velar' in some books (Ye and Xu, 1997). 'Alveolo-palatal' is used to refer to 'prepalatal' in Ladefoged and Johnson's OTHER SYMBOLS (2015). 'Prepalatal' is used consistently in this paper to denote articulation with greater involvement of the tongue near the front of the palate with a longer constriction channel. 'Postalveolar' is a complex term, with some scholars describing it 'palate-alveolar' (e.g., Jones, 1960). In the current study, 'postpalatal' is used to avoid any confusion between 'alveolo-palatal' and 'palate-alveolar'.

2 This sound is articulated in a more advanced position than the velars and is referred to as 'palatal' in Ladefoged and Johnson (2015) and 'midpalatal' by many Chinese scholars (Ye and Xu, 1997).

3 In line with Xu (1998), three dialects of Bisu are identified in the present study: Lanmeng in China (including Laomian in Lancang County, and Laopin in Menghai County), Huaipa (including Huai Chomphu in Muang District and Phadaeng in Phan District), and Takɔ (Ban Thako) in Thailand. In the 1970s, David Bradley found several Bisu speakers in the northern Thai village of Takɔ (1988) but Bisu is no longer spoken in Takɔ (Person, 2002). It is therefore no longer appropriate to classify the language into three dialects.

4 The Ethnologue (see Ethnologue.org for more information) now classifies Bisu and Laomian as separate languages with separate ISO codes. Professor David Bradley, in his more recent publications, follows this distinction by defining them as 'Bisu' in Thailand and 'Laomian' in Lancang. Accordingly, the latter term is used in this paper to replace Bisu in China.

5 Rubach's (2017) view assumed: it would be empirically incorrect to postulate one general PAL constraint because palatalization may have different triggers in different languages or even within one language at different levels. There is an entailment relation between palatalization rules specified for particular environments, whereby palatalization before a low vowel entails palatalization before a mid-vowel and palatalization before a mid-vowel entails palatalization before a high vowel.

6 This paper assume the rank proposed by Shi Feng (2008) in his work Sound pattern: phonetics and phonology of the intersection point. Commercial Press, p. 20.

7 Candidates such as /kɨ/ or /kə/ cannot be considered because no such vowels exist in Laomian.

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Author contributions
YZ: conceived the study, collected the data, analyzed the data and drafted the manuscript. XJ: reviewed and edited the manuscript. LL: reviewed and edited the manuscript.

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The authors declare no competing interests.

Ethical approval
This article does not contain any studies with human participants performed by any of the authors.

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