The Phonological System of Bai

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Bai

Bai (ISO 639-03, bfs) is a common Sino-Tibetan spoken by the Bai people living in the southwestern province of Yunnan, China. It is spoken by around 1.2 million people (2003). Now the majority of its speakers are living in Dali Bai Autonomous Prefecture in northwest Yunnan. Note that most modern linguists in China classify Bai as either an isolate language or as a member of the Loloish group (suggesting Tibeto-Burman), while there has been evidence that Bai is more Sinitic because discovering its basic terms relied heavily on archaic Chinese etymologies.

The Bai language and the Bai people have long been in contact with various Chinese languages (esp. Old Chinese, not Mandarin) and Tibetan languages due to social and political reasons. The region was ruled by Tibetan king before 8th Century, succeeded by the Tang Dynasty, the most powerful at that time. They started to adopt Old Chinese as the language used for daily communication with the incoming Han people (major population of China). Other factors, such as inter-marriages customs with Han people and the superiority of Old Chinese at that time, prompted Bai people to borrow Chinese words and incorporate them into their own language. Some written forms of the language were developed, although most of them were destroyed by Genghis Khan's army when conquering mainland China.

According to the first comprehensive report on the Bai language in 1958, linguists in China found three major dialects, spoken in Dali, Jianchuan, and Bijiang, differing in many aspects, e.g. number of vowels used.

In this language sketch, the sounds are from the dialect of Jianchuan, with data mainly coming from the book Baiyu jianzhi (Xu, Lin and Zhao, Yansun, 1984) because Jianchuan has a much more well-preserved Bai language environment and culture.

Surface sounds in IPA

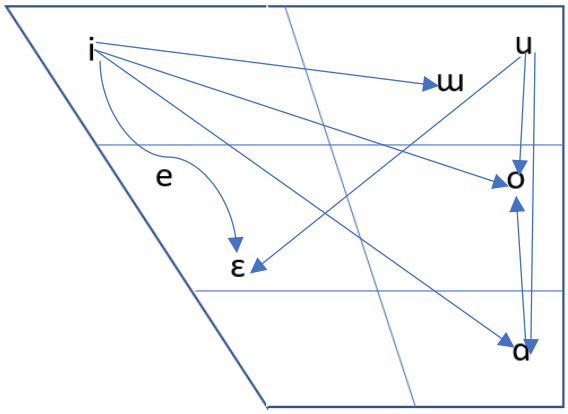
Consonants

	bilabial		labiodental		alveolar		palatal		velar		glottal
	[-voice]	[+voice]	[-voice]	[+voice]	[-voice]	[+voice]	[-voice]	[+voice]	[-voice]	[+voice]	[-voice]
plosive	p p^h				t t^h				k k^h		ʔ
nasal		m				n				ŋ	
fricative			f	v	s	(z)	ɕ		x	ɣ	h
affricate					$\widehat{ts}$ $\widehat{ts^h}$		$\widehat{tɕ}$ $\widehat{tɕ^h}$				
approximant				ʋ		l		j			

Comments:

- For stops and affricates, the main contrast is aspiration, e.g. /p/&/p^h/ are different phonemes instead of different allophones of /p/. The same is for /t/&/t^h/, /k/&/k^h/, /$\widehat{ts}$/&/$\widehat{ts^h}$/, and /$\widehat{tɕ}$/&/$\widehat{tɕ^h}$/.
- When the labialdental approximant /ʋ/ can be used both as a consonant and a vowel. When /ʋ/ is word-initial, it acts as a consonant.
- /z/ is in parentheses because it is not in the underline representation of the dialect of Bai in Jianchuan but is sporadically pronounced. /z/ does exist in the dialect of Dali.
- The palatal approximant /j/ exists in the dialect of Jianchuan, but not present in dialects of Dali and Bijiang. In the lexicon of these two dialects, according to *Xu, Lin and Zhao, Yansun, 1984* , /j/ is pronounced as voiced retroflex nasal /ɳ/, e.g. for the word ‘silver’, the lexicon is /j$\tilde{i}^7$/ in Jianchuan, /ɳi^7/ in Dali and Bijiang. Interestingly, the vowel following /j/ is nasalized. Therefore, the two version of this lexicon may have been the same but they are now developed into two variants.
- Glottal stop occurs before the vowel when the vowel itself is pronounced as a syllable.
- Voiceless glottal fricative is pronounced when the following vowel is nasal. /h/ does not exist in lexicon (underlying representation)

Vowels



The labialdental approximant /ʋ/ works as a vowel after a consonant, and it can be nasalized into /ʋ̃/, but it does not form diphthongs.

When we include the labialdental approximant /ʋ/ into vowel set, we have eight oral monophthongs in total – {i,e,ɛ,ɑ,o,u,ɯ,ʋ}. Except for /u/, all the previous vowels have their nasal counterparts – {ĩ,ẽ,ɛ̃,ɑ̃,õ,ɯ̃,ʋ̃}.

In Bai, the seven diphthongs are {ɑo,iɛ,iɑ,io,iɯ,ui,uɛ,uɑ}. Except for /ɑo/, all the diphthongs have their nasalized counterparts – {iɛ̃,iɑ̃,iõ,iɯ̃,uĩ,uɛ̃,uɑ̃}. It is interesting to note that from the vowel chart we can observe that /ɑo/ is the only diphthong we have that corresponds to an arrow pointing upward, meaning a decrease in F1 value, so it might be reasonable to assume that increase in F1 value suffices nasalization.

Therefore, in Bai, there are thirty vowels in total, classified in the table below.

	#monophthong	#diphthong
#oral	8	8
#nasal	7	7

A full set of features

Sound	Place	cont	voice	son	dr	ant	high	low	front	back	cons	syllabic	lab.dent	nasal	distr.	round	lateral	tense	spr.glottis
p	lab	-	-	-	-	0	0	0	0	0	+	-	-	-	0	-	-	0	-
pʰ	lab	-	-	-	-	0	0	0	0	0	+	-	-	-	0	-	-	0	+
t	cor	-	-	-	-	+	0	0	0	0	+	-	0	-	-	-	-	0	-
tʰ	cor	-	-	-	-	+	0	0	0	0	+	-	0	-	-	-	-	0	+
k	dor	-	-	-	-	0	+	-	-	-	+	-	0	-	0	-	-	0	-
kʰ	dor	-	-	-	-	0	+	-	-	-	+	-	0	-	0	-	-	0	+
f	lab	+	-	-	+	0	0	0	0	0	+	-	+	-	0	-	-	0	-
v	lab	+	+	-	+	0	0	0	0	0	+	-	+	-	0	-	-	0	-
s	cor	+	-	-	+	+	0	0	0	0	+	-	0	-	-	-	-	0	-
ɕ	cor,dor	+	-	-	+	+	+	-	+	-	+	-	0	-	+	-	-	0	-
x	dor	+	-	-	+	0	+	-	0	0	+	-	0	-	0	-	-	0	-
ɣ	dor	+	+	-	+	0	+	-	0	0	+	-	0	-	0	-	-	0	-
ʔ	-place	-	-	-	-	0	0	0	0	0	+	-	0	-	0	-	-	0	-
h	-place	+	-	-	+	0	0	0	0	0	-	-	0	-	0	-	-	0	+
t͡s	cor	-	-	-	+	+	0	0	0	0	+	-	0	-	-	-	-	0	-
t͡sʰ	cor	-	-	-	+	+	0	0	0	0	+	-	0	-	-	-	-	0	+
t͡ɕ	cor,dor	-	-	-	+	+	+	-	+	-	+	-	0	-	+	-	-	0	-
t͡ɕʰ	cor,dor	-	-	-	+	+	+	-	+	-	+	-	0	-	+	-	-	0	+
n	cor	-	+	+	0	+	0	0	0	0	+	-	0	+	-	-	-	0	-
ŋ	dor	-	+	+	-	-	+	-	0	0	+	-	0	+	0	-	-	0	-
l	cor	+	+	+	0	+	0	0	0	0	+	-	0	-	-	-	+	0	-
ʋ	lab	+	+	+	0	0	0	0	0	0	-	-	+	-	0	-	-	0	-
j	dor	+	+	+	0	0	+	-	+	-	-	-	0	-	0	-	-	+	-
i	dor	+	+	+	0	0	+	-	+	-	-	+	0	-	0	-	-	+	-
e	dor	+	+	+	0	0	-	-	+	-	-	+	0	-	0	-	-	+	-
ɛ	dor	+	+	+	0	0	-	-	+	-	-	+	0	-	0	-	-	-	-
ɑ	dor	+	+	+	0	0	-	+	-	+	-	+	0	-	0	-	-	0	-
o	dor	+	+	+	0	0	-	-	-	+	-	+	0	-	0	+	-	+	-
ɯ	dor	+	+	+	0	0	+	-	-	+	-	+	0	-	0	-	-	+	-
u	dor	+	+	+	0	0	+	-	-	+	-	+	0	-	0	+	-	+	-
ĩ	dor	+	+	+	0	0	+	-	+	-	-	+	0	+	0	-	-	+	-
ẽ	dor	+	+	+	0	0	-	-	+	-	-	+	0	+	0	-	-	+	-
ɛ̃	dor	+	+	+	0	0	-	-	+	-	-	+	0	+	0	-	-	-	-
ɑ̃	dor	+	+	+	0	0	-	+	+	-	-	+	0	+	0	-	-	0	-
õ	dor	+	+	+	0	0	-	-	-	+	-	+	0	+	0	+	-	+	-
ũ	dor	+	+	+	0	0	+	-	-	+	-	+	0	+	0	-	-	+	-
ʊ̃	lab	+	+	+	0	0	0	0	0	0	-	+	+	+	0	-	-	-	-

Comments:

- /ʊ/ in this chart is noted as a consonant, but it is consonantal only when it is word initial.
- Diphthongs are not listed in the above table.

Structure-preserving rules:

- Labiodental
  [Labial αlabiodental] → [αlabiodental] / _
- Coronal
  [Coronal +voice -continuous] → [+nasal] / _

Minimal Set of Features

Sound	Place	cont	voice	dr	high	low	back	syllabic	nasal	distr.	round	tense	spr.glottis
p	lab	-	-	-	0	0	0	-	-	0	-	0	-
pʰ	lab	-	-	-	0	0	0	-	-	0	-	0	+
t	cor	-	-	-	0	0	0	-	-	-	-	0	-
tʰ	cor	-	-	-	0	0	0	-	-	-	-	0	+
k	dor	-	-	-	+	-	-	-	-	0	-	0	-
kʰ	dor	-	-	-	+	-	-	-	-	0	-	0	+
f	lab	+	-	+	0	0	0	-	-	0	-	0	-
v	lab	+	+	+	0	0	0	-	-	0	-	0	-
s	cor	+	-	+	0	0	0	-	-	-	-	0	-
ɕ	cor,dor	+	-	+	+	-	-	-	-	+	-	0	-
x	dor	+	-	+	+	-	0	-	-	0	-	0	-
ɣ	dor	+	+	+	+	-	0	-	-	0	-	0	-
ʔ	-place	-	-	-	0	0	0	-	-	0	-	0	-
h	-place	+	-	+	0	0	0	-	-	0	-	0	+
t͡s	cor	-	-	+	0	0	0	-	-	-	-	0	-
t͡sʰ	cor	-	-	+	0	0	0	-	-	-	-	0	+
t͡ɕ	cor,dor	-	-	+	+	-	-	-	-	+	-	0	-
t͡ɕʰ	cor,dor	-	-	+	+	-	-	-	-	+	-	0	+
n	cor	-	+	0	0	0	0	-	+	-	-	0	-
ŋ	dor	-	+	-	+	-	0	-	+	0	-	0	-
l	cor	+	+	0	0	0	0	-	-	-	-	0	-
ʋ	lab	+	+	0	0	0	0	-	-	0	-	0	-
j	dor	+	+	0	+	-	-	-	-	0	-	+	-
i	dor	+	+	0	+	-	-	+	-	0	-	+	-
e	dor	+	+	0	-	-	-	+	-	0	-	+	-
ɛ	dor	+	+	0	-	-	-	+	-	0	-	-	-
ɑ	dor	+	+	0	-	+	+	+	-	0	-	0	-
o	dor	+	+	0	-	-	+	+	-	0	+	+	-
ɯ	dor	+	+	0	+	-	+	+	-	0	-	+	-
u	dor	+	+	0	+	-	+	+	-	0	+	+	-
ĩ	dor	+	+	0	+	-	-	+	+	0	-	+	-
ẽ	dor	+	+	0	-	-	-	+	+	0	-	+	-
ɛ̃	dor	+	+	0	-	-	-	+	+	0	-	-	-
ɑ̃	dor	+	+	0	-	+	-	+	+	0	-	0	-
õ	dor	+	+	0	-	-	+	+	+	0	+	+	-
ɯ̃	dor	+	+	0	+	-	+	+	+	0	-	+	-
ʊ̃	lab	+	+	0	0	0	0	+	+	0	-	-	-

- Place: the only way to distinguish between /p/, /t/, and /k/.
- Continuant: distinguish between /s/ and /t͡s/, and other fricatives & affricates.
- Voicing: distinguish between /f/ and /v/, and also /x/ and /ɣ/.
- Delayed release: distinguish between /t/ and /t͡s/, and other stops & affricates.
- High: distinguish between /i/ and /e/, and their nasalized counterparts.
- Low: distinguish between /o/ and /ɑ/, and their nasalized counterparts.
- Back: distinguish between /i/ and /ɯ/.
- Syllabic: distinguish between /i/ and /j/.
- Nasal: distinguish between /i/ and /ĩ/, etc.
- Distributed: distinguish between /t͡s/ and /t͡ɕ/.
- Rounding: distinguish between /u/ and /ɯ/.
- Tense: distinguish between /e/ and /ɛ/.
- Spread glottis: distinguish between /p/ and /pʰ/, etc.
- Constricted glottis is not included here because the only two [-place] sounds /h/&/ʔ/ are different in [continuant].

Tones

In Bai, there are eight different tones, and words use tones to distinguish from each other.

Tone name	Tone value	Lax/tense	Representation	Symbol
1	33	lax	-x	˧
2	42	tense	-rt	˥˩
3	31	lax	-t	˧˩
4	55	lax	-l	˥
5	35	lax	-f	˧˥
6	44	tense	-rx	˧˧
7	21	tense	(none)	˩
8	55	tense	-rl	˥

Note:

1. These above “representations” refer to the notation in the Chinese-Bai dictionary, they are neither acoustic nor perceptual. If the representation has an “r”, it means that the preceding vowel should be tense.
2. <u>All the tones in this language sketch are noted by Tone name</u> in the above table.

This lax-tense difference can demonstrate contrasts. Below are three <u>minimal sets</u>, with six tones included because Tone 5 and Tone 7 do not consider lax/tense status. The symbols of the six tones have corresponding height, but one is before the vertical line (lax), the other is after the vertical line (tense).

		Representation	Meaning
mɑ^{1}	lax	mɑx	full
mɑ^{6}	tense	mɑrx	staw

		Representation	Meaning
mɑ^{4}	lax	mɑl	they
mɑ^{8}	tense	mɑrl	curse

		Representation	Meaning
mɑ^{3}	lax	mɑt	carry (on the back)
mɑ^{2}	tense	mɑrt	pull (grass)

The following table demonstrated the minimal set of eight tones of together:

Representation	SR	Meaning
t͡ɕix	t͡ɕi^{1}	pull
t͡ɕirt	t͡ɕi^{2}	chase
t͡ɕit	t͡ɕi^{3}	field
t͡ɕil	t͡ɕi^{4}	many
t͡ɕif	t͡ɕi^{5}	be in a rush
t͡ɕirx	t͡ɕi^{6}	leech
t͡ɕi	t͡ɕi^{7}	owe (money)
t͡ɕirl	t͡ɕi^{8}	lodge

Some Phonological Rules:

- /x/ → [h] / _V[+nasal], using features, the rule is: $\begin{pmatrix} \text{dorsal} \\ \text{-voice} \\ \text{+continuant} \\ \text{-sonorant} \end{pmatrix}$ → [-place] / _V[+nasal]

  Examples:

Underlying Representation	Surface Representation	Meaning
/xɑ̃^{2}xo^{6}/	[hɑ̃^{2}xo^{6}]	Han People
/xũ^{1}/	[hũ^{1}]	recover (from disease)
/xɛ̃^{4}/	[hɛ̃^{4}]	raw
/xẽ^{4}/	[hẽ^{4}]	sky

- 0 → [ʔ] / [$_{w}$_V*
  Examples:

Underlying Representation	Surface Representation	Meaning
/ɯ^{6}/	[ʔɯ^{6}]	curse
/ɯ^{4}/	[ʔɯ^{4}]	yell
/ɑ^{6}/	[ʔɑ^{6}]	duck
/ɑ^{4}sɛ̃^{3}/	[ʔɑ^{4}sɛ̃^{3}]	what

- S^{x} → S^{5} / _mo^{1}, except when x = 1,2,3,5,6,7; and S stands for a syllable
  (mo^{1} is typically at the end of sentence when asking questions.)

  Examples:

Lexicon (UR)	Meaning	UR	SR	Meaning
/pe^{6}/	to go	/pe^{6} mo^{1}/	[pe^{5} mo^{1}]	Shall we go?
/t͡sʰɯ^{6}/	to bind	/t͡sʰɯ^{6} mo^{1}/	[t͡sʰɯ^{5} mo^{1}]	Shall we bind (an object)?
/pi͡ɛ^{2}/	bland	/pi͡ɛ^{2} mo^{1}/	[pi͡ɛ^{5} mo^{1}]	Is it bland?
/t͡sʰo^{3}/	salty	/t͡sʰo^{3} mo^{1}/	[t͡sʰo^{5} mo^{1}]	Is it salty?

Since all the syllables in Jianchuan dialect of Bai do not have codas and follow the structure of CV or V, we have this rule: (The consonant is in parentheses because it may not appear.)

- 0 → u / (C*)o_^{x} $_{\text{syllable}}$] , when x≠7, i.e. x = 1 or 2 or 3 or 4 or 5 or 6 or 8
- o → ɔ / (C*)_^{7} $_{\text{syllable}}$] , using features, it is:

  (The tone is 7 here)

  V $\begin{pmatrix} \text{-high} \\ \text{-low} \\ \text{+back} \\ \text{+round} \\ \text{+tense} \end{pmatrix}$ → [-tense] / (C*) _^{7} $_{\text{syllable}}$]

  Examples:

Underlying Representation	Surface Representation	Meaning
/lo^{3}/	[lou^{3}]	fall back
/lo^{4}/	[lou^{4}]	bamboo shoot leave
/pʰo^{6}/	[pʰou^{6}]	cucumber
/no^{1}/	[nou^{1}]	brain
/ko^{7}/	[kɔ^{7}]	lake
/lo^{7}/	[lɔ^{7}]	tiger

- Plural change:
  /lɯ^{3}/→ ‘this’ ; /mɯ^{3}/ → ‘that’ ; /kõ^{7}/ → ‘two’
  [lɯ^{6} kõ^{7}] → ‘these two’ ; [mɯ^{6} kõ^{7}] → ‘those two’
  Cannot tell whether [kõ^{7}] causes this phonological (tonal) change or the change is morphological.

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